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Liquor outlet concentrations and alcohol-related neighbourhood problems

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This bulletin presents the results of research investigating the relationship between the concentration of licensed premises in a given area and perceptions of alcohol-related problems in that locale. For this purpose, a secondary analysis of the National Crime and Safety Survey (2002) was conducted using data from survey participants who resided in NSW. This investigation examined three outcomes: (1) reported problems with drunkenness in the neighbourhood, (2) reported problems with property damage in the neighbourhood and (3) assault victimisation in the home. Two measures of alcohol outlet concentration were constructed for this analysis and included as independent variables: (1) liquor outlet accessibility and (2) liquor outlet density. Multilevel modelling of these data showed that respondents who lived closer to liquor outlets were more likely to report problems in their neighbourhood from drunkenness and property damage, controlling for socio-demographic factors. The analysis also showed that respondents who lived in areas with a higher density of licensed premises were more likely to report problems in their neighbourhood from drunkenness, again controlling for socio-demographic factors. It was not possible to apply multilevel modelling to assess the relationship between domestic assault victimisation and either of the alcohol outlet concentration measures due to the relatively low number of assaults in the sample which were reported as having occurred at home. The implications of these findings for liquor licensing policy in NSW are discussed.

INTRODUCTION

A recurring issue for liquor licensing policy makers is the extent to which restrictions should be placed on the availability of alcohol in order to minimise alcohol-related harms in the community. In most Australian jurisdictions, including New South Wales (NSW), the liquor licensing laws allow for a range of liquor licensing restrictions to be applied, which in effect limit the availability of alcohol. Examples include placing restrictions on the hours during which licensed premises can trade, the type of locations where alcohol can or cannot be sold (e.g. not in petrol stations or supermarkets) or limiting the number of sellers who are permitted into the alcohol retail market. The need for this latter approach is the subject of current policy debate in Australia between those who argue that restricting the number of liquor outlets is necessary in order to reduce alcohol-related problems (Australian Drug Foundation 2005; Stockwell 2004) and those who argue that such restrictions are inherently anti-competitive in nature because they deny other potential retailers the opportunity to compete in that market (National Competition Council 2002).

There is a substantial amount of evidence in the scientific literature showing a cross-sectional relationship between alcohol outlet density and a range of alcohol-related harms. For example, a number of studies in the United States (US) have found a relationship between levels of outlet density and the incidence of violent assault. Scribner, Mackinnon and Dwyer (1995) analysed assault rates across 74 cities in Los Angeles County and found that both off- and on-premises outlet density was positively associated with the rate of assault over and above a range of socio-demographic variables. On the basis of their statistical modelling, these authors estimated that one liquor outlet was associated with an extra 3.4 incidents of assault per year. Another investigation (Gorman et al. 2001) analysed rates of violent crimes, including assault, in 97 geographical 'blocks' in

the city of Camden, New Jersey. This analysis found that outlet density in each of the blocks accounted for one-fifth of the variability in the violent crime rate after controlling for socioeconomic factors.

Similar investigations in the US have also found strong relationships between outlet density and a number of other adverse outcomes, including alcohol-related hospital admissions (Tatlow, Clapp & Hohman 2000), child abuse and neglect (Freisthler, Midanik & Gruenewald 2004), motor vehicle accidents (Jewell & Brown 1995), pedestrian injuries (LaScala, Gerber & Gruenewald 2000), drink driving (Gruenewald, Johnson & Treno 2002) and a range of mortality outcomes (Escobedo & Ortiz 2002).

There is also evidence to show that the effect of outlet density varies by licence type. A recent study distinguished between outlet densities in terms of bars, off-licences and restaurants across 766 postcodes in three areas of California, when examining rates of violence (Lipton & Gruenewald 2002). This analysis confirmed that increased density of bars was positively associated with rates of hospitalisation for violence. It was also found that increased density of licensed restaurants was associated with reduced rates of hospitalisation. On the other hand, Scribner, Mackinnon and Dwyer (1994) found in their analysis of 72 cities in Los Angeles County that increased density of restaurants and off-licences was independently predictive of motor vehicle accidents, while the density of bars was not.

There have been fewer investigations in Australia into the effects of alcohol outlet density, though where conducted, such studies have confirmed the findings from the US. In an investigation undertaken in NSW, Stevenson, Lind and Weatherburn (1999) conducted analyses at the Local Government Area (LGA) level, using recorded crime data, wholesale alcohol sales data and liquor licensing data. For LGAs in Sydney, a very strong positive correlation was found between outlet density and alcohol sales respectively and both were found to predict rates of assault. This effect held up even after statistically controlling for various sociodemographic factors. In rural NSW, by contrast, outlet density was not predictive of assaults, however the volume of alcohol sales was still found to be predictive.

The potential impact of higher concentrations of liquor outlets on general well-being in the community is an important issue given that the Australian National Competition Council (NCC) has required all State jurisdictions to review their liquor laws in the context of National Competition Policy (NCP). The NCC have drawn a distinction between restrictions which have a 'public benefit' rationale (e.g. restrictions on legal drinking age, trading hours, sale of alcohol to intoxicated persons) and those which are based on the assumption that the existing retail need in the alcohol market is currently being met; the so called 'public needs test' (National Competition Council 2002). The NSW liquor laws formerly contained provisions which enabled members of the public (including existing alcohol retailers) to object to the grant of a new liquor licence on the basis that the market need for alcohol in a local community was already being met by existing sellers. Such restrictions were deemed by the NCC to be anti-competitive in nature and, faced with substantial fines, the NSW Government amended the liquor licensing laws in 2004 to remove such restrictions (*National Competition Policy Amendments (Commonwealth Financial Penalties) Bill* 2004).

While the NSW Government removed the 'needs test' barrier to entry into the alcohol retail market, it still maintains a regulatory approach whereby new liquor licence applicants are required to negotiate a 'social impact assessment' process overseen by the liquor licensing authority (Department of Gaming & Racing 2003). Information relating to the likelihood of adverse effects from higher concentrations of liquor outlets has the potential to inform this social impact assessment process. However, given the limited number of Australian investigations into outlet density to date, further investigations, particularly in NSW, are necessary to provide this process with more recent and relevant data to draw upon when considering new licence applications.

The current investigation was therefore undertaken to provide timely information about the relationship between liquor outlet concentrations and alcohol-related problems in local neighbourhoods. This study utilises a sample of over 9,300 NSW residents included in the 2002 National Crime and Safety Survey conducted by the Australian Bureau of Statistics (ABS). It uses spatial methods to construct a range of outlet density/accessibility measures from liquor licensing data and examines the extent to which increased levels of liquor outlet concentration are predictive of neighbourhood problems such as drunkenness, property damage and assault victimisation in the home.

METHOD

IDENTIFICATION AND GEOCODING OF NSW LICENSED PREMISES

The first phase of this analysis involved geocoding all relevant licensed premises in NSW for the calendar year 2002. The aim of geocoding these data was to derive a longitude and latitude (X & Y coordinates) denoting the spatial location of each premises. Data were provided by the NSW Department of Gaming and Racing (DGR) which included the name, address and licence type details

for all licensed premises in NSW. As the National Crime and Safety Survey was conducted during 2002, only those licences issued before the 2003 calendar year were included in the analysis. The following licence types were not included in the construction of the accessibility/density measures because their function relates to the production and/or wholesaling of alcohol beverages rather than retailing to the general consumer: auction licences, brewers, vignerons, and wholesalers. Catering, special events, aircraft and vessel licences were also excluded, given that their location of alcohol sales was not fixed to a particular locality.

The geocoding of relevant licensed premises was undertaken by a commercial organisation (MapData Sciences Pty Ltd) consulting to the Bureau of Crime Statistics and Research (BOCSAR) and was based on information contained in the DGR licensed premises database. In the initial geocoding phase, almost one in five premises (approximately 2,000 premises) had no address details or address details that were incorrect, and for this reason had been geocoded to the spatial centroid of the suburb in which they were located. In order to improve this geocoding rate, the address details of these 2,000 premises were manually verified using information from maps and telephone directories and, wherever possible, were corrected. This verified address information was then used in a second phase of geocoding. This reduced the percentage of premises that were geocoded to the centre of the suburb to just 10 per cent of all licensed premises examined.

CONSTRUCTION OF THE OUTLET ACCESSIBILITY AND DENSITY MEASURES

The investigation used two distinct measures of alcohol availability: liquor outlet accessibility and liquor outlet density. Both of these measures were constructed using spatial software developed by the National Centre for Social Applications of Geographic Information Systems (GISCA) at the University of Adelaide.

Liquor Outlet Accessibility

Using the geocoded licensed premises database, GISCA calculated a set of liquor outlet accessibility measures for every census collection district (CD) in NSW. CDs are the smallest geographic areas used by the Australian Bureau of Statistics (ABS). They also serve as the Primary Sampling Units (PSUs) in the Crime and Safety Survey. For every CD in NSW, GISCA calculated the average distance from the spatial centroid of each CD to the five closest licensed premises.

These average distances were also calculated for the following specific liquor licence types: all hotels, hotels with extended trading beyond midnight, registered clubs, off-licences (bottleshops), licensed restaurants and all other licence types. Unfortunately the accessibility measures for specific licence types were found to be much less stable than the total premises accessibility measure. This was because, in many instances, the fifth closest premises of a particular licence type was a lot further away than the other four, thereby substantially inflating the average distance. Given this, it was decided to use only the accessibility measure that included all licensed premises.

Liquor Outlet Density

It had been anticipated at the outset of this investigation that, consistent with previous research in this area, the outlet density measures constructed for the analysis would be based on postcodes. However this approach could not be adopted because CDs, which comprise the primary sampling unit in the Crime and Safety Survey, do not concord directly with postal areas in NSW. There are also a number of postal areas in NSW that are not spatially contiguous. Given this, outlet densities were constructed within defined Statistical Local Areas (SLAs), as SLAs are an exact match to CDs. It is worth noting, however, that SLAs tend to be similar in size to Local Government Areas (or councils) and, particularly in rural areas, are often considerably larger than postal areas. For each SLA in NSW, outlet densities per 10,000 population were calculated by GISCA using the geocoded licensed premises data. In addition to the density of all licensed premises types, densities for each of the categories of licences documented above were also constructed.[1]

ABS NATIONAL CRIME AND SAFETY SURVEY DATA

The most recent National Crime and Safety Survey (available for data analysis) was undertaken by the ABS in 2002 and consisted of supplementary questions incorporated into the monthly Labour Force survey. A multistage area sampling design was employed in the survey, whereby CDs comprised the primary sampling units and SLAs served as strata from which CDs were drawn. Blocks, dwellings and households within CDs comprised the other stages of the sampling process. All persons over the age of 15 years within each selected household were asked to participate in the survey by self-completing and mailing back the questionnaire. The survey was carried out between April and July 2002 and the response rate achieved was 76 per cent (Australian Bureau of Statistics 2004).

While the Crime and Safety Survey contains questions relating to a wide range of crime-related outcomes, there were three specific questions of relevance to the current investigation. Respondents were asked about the '*problems from crime or people creating a public nuisance*

in their neighbourhood'. They were then presented with a number of categories of different crime types including (1) drunkenness and (2) vandalism/graffiti/damage to property. These two items comprised the major outcomes in the current study. Respondents were also asked whether during the past 12 months '*anyone (including people you know well) used force or violence against you'*. Assaults that reportedly occurred at home were the third outcome used in this investigation. Assault victimisation was restricted to those occurring at home because a substantial proportion of non-domestic assaults may have occurred outside the area in which the respondent lived and therefore would not directly relate to local liquor outlet concentrations.

MERGING OF LIQUOR OUTLET ACCESSIBILITY/DENSITY DATA WITH THE CRIME & SAFETY SURVEY DATA

Due to privacy provisions under the Commonwealth's *Census and Statistics Act* 1905, it was not possible for BOCSAR staff to directly view the unit record Crime and Safety Survey data file. This meant that all data manipulations, including the merging of datasets, had to be performed by ABS staff. For this purpose, a file was provided to the ABS, which contained the liquor outlet accessibility and density measures for every CD (and SLA) in NSW. As the Crime and Safety Survey included respondents from a sample of CDs, only those densities/accessibilities from relevant CDs were merged with the NSW sub-sample.

STATISTICAL ANALYSIS

Multilevel models were applied using MLwiN software (Version 2.0). These models take account of the hierarchical structure of the data (respondents located within households, within CDs, within SLAs) and potentially allow for effects at each of these different levels to be taken into account in the analysis. A four-level data structure was therefore specified in the modelling.[2] The three outcomes of interest were: (1) reported neighbourhood problems with drunkenness, (2) reported neighbourhood problems with property damage and (3) assault victimisation in the home. As each of these measures is dichotomous in nature (i.e. yes/no), binomial multilevel models were developed which are similar in nature to logistic regression models.[3]

Separate models were developed for each of the liquor outlet accessibility and density measures. The accessibility and density measures were broken into quintiles and modelled as a set of four dummy explanatory variables in each case. While statistically more conservative in terms of power, this approach has the advantage of allowing an assessment to be made as to whether a potential relationship between outlet accessibility/density is linear in nature, or follows some other function. The accessibility measures were modelled as Level 3 terms (CDs), while the density measures were modelled as Level 4 terms (SLAs).

Data on a number of socio-demographic factors measured in the Crime and Safety Survey were used in the multilevel modelling in order to minimise the possibility that any apparent outlet accessibility/density effects were spuriously confounded by other factors. These included each respondent's age group, gender, marital status, country of birth, labour force status and occupational group.

As a control for socio-economic status, the ABS SEIFA Index of Social Disadvantage for the CD in which the respondent resided was also included in the modelling. This variable was categorised into quintiles and modelled as a set of four dummy terms, with the most disadvantaged quintile serving as the referent category. This measure was specified as a Level 3 term (CD level).

The ARIA index, developed by GISCA, was used to classify respondents as either residing in urban or non-urban areas (GISCA – The National Centre for Social Applications in GIS 2004).

The following modelling strategy was adopted. For each of the three outcomes of interest, initial bivariate models were fit for the respective liquor outlet accessibility/density measures as well as for the control (potential confounder) variables. Next, all significant bivariate variables were included in the same multilevel model. A manual backward elimination approach was then applied, removing either non-significant or unimportant terms until the most parsimonious model had been identified. As stated previously, outlet accessibility and outlet density were treated as separate constructs and applied in separate families of models. For the density models, an attempt was made to assess whether any differentiation could be made in terms of the relative densities of particular licence types. These included the following: all hotels, extended trading hotels, registered clubs, off licences, licensed restaurants and a general 'other' category.

RESULTS

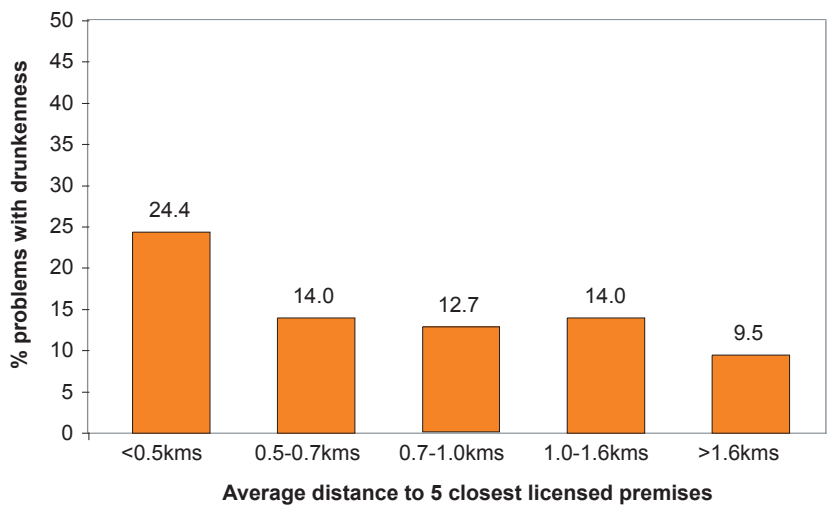
SAMPLE CHARACTERISTICS

Over 9,300 respondents were surveyed in NSW as part of the ABS 2002 National Crime and Safety Survey. Table 1 shows the unweighted socio-demographic profile of this sample. Just over half the sample were female, over one-fifth were 60 years or older, two-thirds were married or in a defacto relationship, and just under one-fifth were born in a non-English speaking country. Sixty per cent of the sample were employed and three per cent were unemployed. Just over 60 per cent resided in urban areas. Sample weights were not applied in any

Table 1: Socio-demographic characteristics of the NSW Crime and Safety Survey sample (unweighted) N=9,309

Variable	*N*	*%*
Gender		
Male	4,488	48.2
Female	4,821	51.8
Age group		
15-19 years	777	8.4
20-29 years	1,418	15.2
30-39 years	1,736	18.7
40-49 years	1,801	19.4
50-59 years	1,543	16.6
60+ years	2,034	21.9
Marital status		
Married / Defacto	5,868	63.0
Not married	3,441	37.0
Country of birth		
Australia	6,624	71.2
Overseas, English speaking	859	9.2
Overseas, Non-English speaking	1,826	19.6
Labour force status		
Employed	5,600	60.2
Unemployed	311	3.3
Not in workforce	3,398	36.5
Occupational group		
Managers / Professionals	2,212	23.8
Tradespersons	674	7.2
Skilled clerical	1,257	13.5
Unskilled	1,471	15.8
Not in workforce / not applicable	3,695	39.7
Location		
Urban	5,723	61.5
Non-Urban	3,586	38.5

Figure 1: Liquor outlet accessibility and reported neighbourhood problems with drunkenness



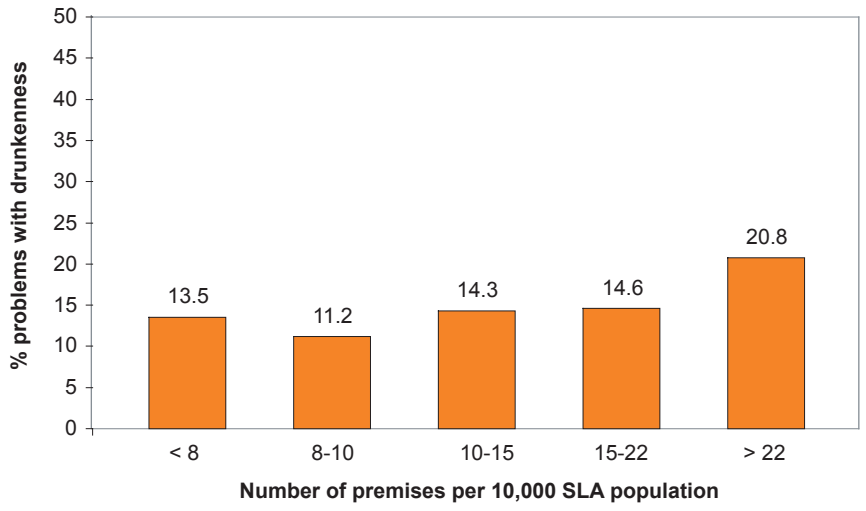
of the analyses as the objective was to examine outlet accessibility/density effects using covariate adjustment in regression analyses, rather than to obtain prevalence estimates for the general population.

OUTLET ACCESSIBILITY/ DENSITY AND NEIGHBOURHOOD PROBLEMS WITH DRUNKENNESS

Figure 1 shows the bivariate relationship between relative accessibility of licensed premises and reported problems with drunkenness in each respondent's neighbourhood.[4] Almost one-quarter of the respondents who lived within half a kilometre (km) of the five closest licensed premises reported problems with drunkenness in their neighbourhood. This was much higher than for those respondents who lived further away from licensed premises. Between 12 and 14 per cent of those who lived 0.5-1.6 kms from the five closest premises reported problems with drunkenness, while less than 10 per cent of those who lived further than 1.6 kms away reported such problems. The unadjusted bivariate relationship between relative accessibility to licensed premises and reported neighbourhood problems with drunkenness was statistically significant ($\chi^2_4 = 77.1$, $p<0.001$).

Figure 2 shows the relationship between the density of licensed premises per 10,000 population in the SLA in which each respondent resided and reported neighbourhood problems with drunkenness.[5] Reported neighbourhood problems with drunkenness were most apparent for those respondents in the most 'dense' quintile of the survey sample, with the other four quintiles being relatively similar in magnitude on this outcome measure. Almost 21 per cent of the respondents who lived in SLAs with more than 22 licensed premises per 10,000 population

Figure 2: Liquor outlet density (SLAs) and reported neighbourhood problems with drunkenness



reported neighbourhood problems with drunkenness. By contrast, between 11 and 15 per cent of respondents who lived in SLAs with fewer licensed premises reported such problems. The unadjusted bivariate relationship between liquor outlet density and neighbourhood problems with drunkenness was statistically significant (χ^2_4 = 18.6, p<0.001).

Unadjusted bivariate associations between relative liquor outlet accessibility and density could potentially be confounded by other factors associated with neighbourhood drunkenness. Therefore a number of other potential risk factors for these problems were also examined for this analysis. Table 2 shows the bivariate associations between these additional factors and neighbourhood problems with drunkenness. Bivariate relationships were apparent for all of the potential confounder variables examined, except for gender and occupational group.

Younger respondents were more likely than older respondents to report problems with drunkenness in their neighbourhood. For example, while between 18 and 21 per cent of those aged 15 to 29 years reported neighbourhood problems with drunkenness, only around 13 per cent of those aged 50 to 59 years and 10 per cent of those aged 60 years or older reported such problems. Respondents were also more likely to report neighbourhood problems with drunkenness if they resided in non-urban areas (17% v. 14%), were unmarried (18% v. 13%), were born in Australia (16% v. 12%) or were unemployed (20% v. 14-15%). There was also a significant relationship between social disadvantage and perceptions of neighbourhood drunkenness. This relationship was such that almost one quarter of the respondents in the most disadvantaged quintile reported neighbourhood problems with drunkenness, but only 10 per cent of those in the least disadvantaged quintile reported such problems. Finally, respondents in the most populated CD quintile were less likely to report neighbourhood problems with drunkenness than the remainder of the sample (9% v. 15-17%).

Given the significant bivariate associations described above, it was necessary to conduct regression analyses to assess whether there was a significant relationship between neighbourhood drunkenness, liquor outlet accessibility (Figure 1) and outlet density (Figure 2) controlling for these other factors. Table 3 (on page 8) presents the findings from this analysis for liquor outlet accessibility. The control variables in the final model included: age group, country of birth, location (urban/non-urban), SEIFA Index of Social Disadvantage and CD population size. It is worth noting that both marital and labour force status were predictive at the bivariate level (as shown in Table 2) but neither of these factors were predictive once other covariates had been controlled for. These two measures were therefore excluded from the final model.

As shown in Table 3, the relationship between relative liquor outlet accessibility and neighbourhood problems with drunkenness remained statistically significant after controlling for potential confounder variables. The effects are expressed in the logit scale. A negative sign on a significant coefficient indicates that the first category listed is less likely to have the outcome of interest than is the second category (or what is known as the referent category). The most proximal accessibility category (<0.5kms) serves as the referent for each of the other distance categories. The negative coefficients for each of the relative accessibility categories show that they are less likely to experience problems with drunkenness in their neighbourhoods than the most proximal referent category. The overall Chi-square test for the liquor outlet accessibility measure was found to be statistically significant, after controlling for the other confounder variables (χ^2_4 = 86.1, p<0.001).

Table 4 (on page 9) shows the findings from the multilevel modelling of neighbourhood problems with drunkenness and liquor outlet density. This model contains the same control covariates as the model shown in

Table 2: Bivariate associations between potential confounder variables and reported neighbourhood problems with drunkenness

Variable	*% neighbourhood problems with drunkenness*	*Significance*[i]
Gender		
Males	15.2	*p*=0.439
Females	14.6	
Age group		
15-19 years	18.0	*p*<0.001*
20-29 years	20.9	
30-39 years	15.3	
40-49 years	15.7	
50-59 years	13.2	
60+ years	9.7	
Marital status		
Married	13.3	*p*<0.001*
Not married	17.5	
Country of birth		
Australia	16.0	*p*=0.009*
Overseas, English speaking	12.3	
Overseas, Non-English speaking	12.1	
Labour force status		
Employed	15.1	*p*=0.045*
Unemployed	19.9	
Not in workforce	14.1	
Occupational group		
Managers / Professionals	14.0	*p*=0.367
Tradespersons	16.0	
Skilled clerical	14.2	
Unskilled	17.0	
Not in workforce / not applicable	14.6	
Location		
Urban	13.8	*p*=0.043*
Non-Urban	16.6	
SEIFA Index of Social Disadvantage		
Most disadvantaged quintile	23.5	*p*<0.001*
Quintile 2	16.1	
Quintile 3	11.4	
Quintile 4	13.1	
Least disadvantaged quintile	10.4	
CD population size		
<450	17.4	*p*<0.001*
450–580	15.7	
580–700	17.3	
700–850	14.8	
>850	9.3	

* *Significant at the 0.05 level*

(i) See note 6

Table 3, with the exception of CD population size. It was not necessary to include CD population size in this model because the density measure is expressed as a rate per 10,000 population in the SLA in which each respondent resided.

In this multilevel model, the most dense outlet density quintile (>22 premises per 10,000 SLA population) served as the referent category for each of the other four less dense quintiles. As shown in Table 4, there is a statistically significant association between outlet density and neighbourhood problems with drunkenness. The negative coefficients indicate that each of the less dense quintiles is less likely to experience problems with drunkenness than the most dense referent category. The overall Chi-square test for the liquor outlet density measure was found to be statistically significant after controlling for the other confounder variables (χ^2_4 = 18.6, *p*<0.001).

OUTLET ACCESSIBILITY/ DENSITY AND PERCEPTIONS OF NEIGHBOURHOOD PROBLEMS WITH PROPERTY DAMAGE

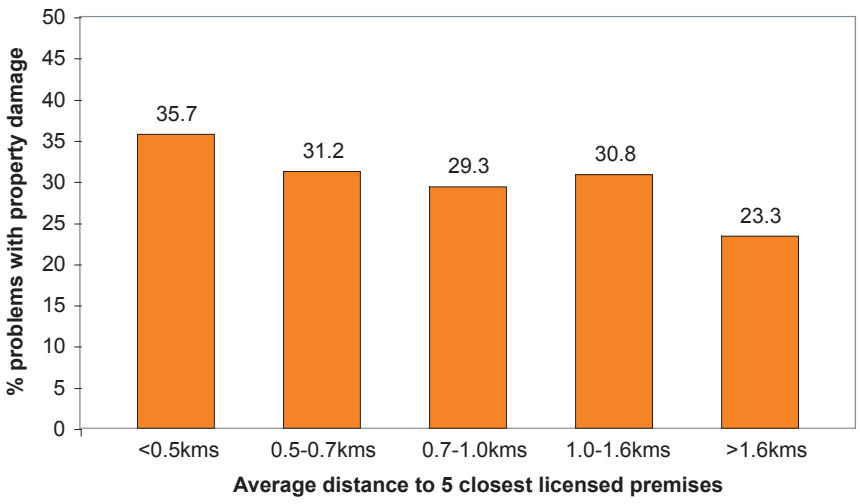
Figure 3 shows the bivariate relationship between the relative accessibility of licensed premises and perceived neighbourhood problems with property damage. It would appear from this figure that as distance from licensed premises increases, neighbourhood problems with property damage decreases. Almost 36 per cent of respondents who lived within half a kilometre of the five closest liquor outlets reported that there were problems with property damage in their neighbourhood. However, only about 30 per cent of those who lived 0.5-1.6 kms from the five closest premises reported problems with property damage, while just 23 per cent of those who lived further than 1.6 kms away reported such problems. The unadjusted bivariate

Table 3: Final multilevel model (3 levels) assessing the relationship between relative liquor outlet accessibility and neighbourhood problems with drunkenness

Variable	*Parameter estimate*	*Standard error*	*Significance*
Liquor outlet accessibility (kms)			
0.5-0.7 v. <0.5	-0.842	0.148	*p*<0.001*
0.7-1.0 v. <0.5	-1.074	0.157	*p*<0.001*
1.0-1.6 v. <0.5	-0.871	0.159	*p*<0.001*
>1.6 v. <0.5	-1.493	0.178	*p*<0.001*
Age group (yrs)			
15-19 v. 60+	0.872	0.154	*p*<0.001*
20-29 v. 60+	0.925	0.130	*p*<0.001*
30-39 v. 60+	0.669	0.127	*p*<0.001*
40-49 v. 60+	0.764	0.126	*p*<0.001*
50-59 v. 60+	0.534	0.133	*p*<0.001*
Country of birth			
O/S Eng speaking v. Australia	-0.160	0.139	*p*=0.250
O/S Non-Eng speaking v. Australia	-0.281	0.113	*p*=0.012*
Location			
Non-urban v. Urban	0.428	0.123	*p*<0.001*
SEIFA Index of Social Disadvantage			
Quintile 2 v. Quintile 1	-0.485	0.146	*p*=0.001*
Quintile 3 v. Quintile 1	-0.876	0.154	*p*<0.001*
Quintile 4 v. Quintile 1	-0.701	0.154	*p*<0.001*
Quintile 5 v. Quintile 1	-0.972	0.164	*p*<0.001*
CD population size			
450-580 v. <450	-0.125	0.152	*p*=0.411
580-700 v. <450	0.035	0.153	*p*=0.820
700-850 v. <450	-0.063	0.157	*p*=0.688
<850 v. <450	-0.412	0.176	*p*=0.019*

** Significant at the 0.05 level*

Figure 3: Liquor outlet accessibility and reported neighbourhood problems with property damage



relationship between relative accessibility to licensed premises and reported neighbourhood problems with property damage was statistically significant (χ^2_4 = 37.9, *p*<0.001).

Figure 4 shows the relationship between the density of licensed premises per 10,000 population in the respondent's SLA and reported neighbourhood problems with property damage. In contrast to the relative accessibility measure, there does not appear to be any positive relationship between outlet density and the percentage of respondents reporting neighbourhood problems with property damage. Indeed, fewer respondents in the most dense quintile (>22 premises per 10,000 population) reported problems with property damage (27%) than did those in any of the other quintiles (30 – 32%). Significance testing showed that the bivariate association between relative outlet density and neighbourhood property damage was not statistically significant (χ^2_4 = 3.2, *p*=0.525). This means that the apparent differences shown in Figure 4 are likely to represent random variation only. Given the absence of a bivariate association between liquor outlet density and neighbourhood problems with property damage, adjusted analyses using multilevel modelling are not reported. This result will however be discussed in greater detail in a later section of this bulletin.

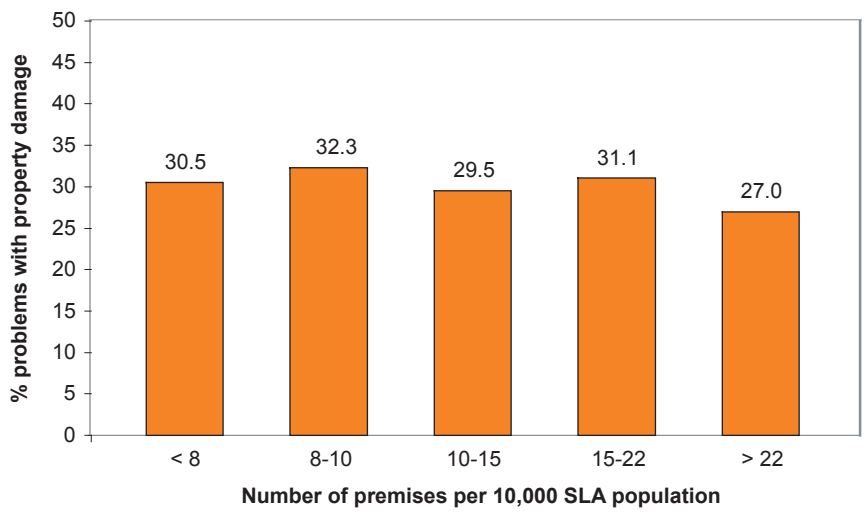
Once again, it was necessary to consider other potential risk factors that could account for the significant bivariate relationship between liquor outlet accessibility and neighbourhood problems with property damage. For this reason, the bivariate relationships between the available set of potential confounders and problems with property damage were examined. The outcome of this analysis is shown in Table 5 (on page 10).

Table 4: Final multilevel model (4 levels) assessing the relationship between relative liquor outlet density and neighbourhood problems with drunkenness

Variable	*Parameter estimate*	*Standard error*	*Significance*
Liquor outlet density (premises per 10,000 persons)			
< 8 v. >22	-0.743	0.276	*p*=0.007*
8-10 v. >22	-1.081	0.266	*p*<0.001*
10-15 v. >22	-0.527	0.237	*p*=0.026*
15-22 v. >22	-0.506	0.207	*p*=0.014*
Age group (yrs)			
15-19 v. 60+	0.882	0.154	*p*<0.001*
20-29 v. 60+	0.957	0.130	*p*<0.001*
30-39 v. 60+	0.650	0.128	*p*<0.001*
40-49 v. 60+	0.748	0.126	*p*<0.001*
50-59 v. 60+	0.527	0.133	*p*<0.001*
Country of birth			
O/S Eng speaking v. Australia	-0.154	0.139	*p*=0.267
O/S Non-Eng speaking v. Australia	-0.191	0.114	*p*=0.094
Location			
Non-urban v. Urban	-0.198	0.169	*p*=0.242
SEIFA Index of Social Disadvantage			
Quintile 2 v. Quintile 1	-0.614	0.148	*p*<0.001*
Quintile 3 v. Quintile 1	-1.059	0.157	*p*<0.001*
Quintile 4 v. Quintile 1	-0.995	0.165	*p*<0.001*
Quintile 5 v. Quintile 1	-1.409	0.188	*p*<0.001*

** Significant at the 0.05 level*

Figure 4: Liquor outlet density (SLAs) and reported neighbourhood problems with property damage



As seen in Table 5, there is a significant effect for country of birth, with respondents born in non-English speaking countries being less likely to report neighbourhood problems with property damage than those from English speaking backgrounds (21% v. 32%). There is also a significant effect for location, which is in the opposite direction to that found for the drunkenness outcome. Respondents from urban areas were more likely to report problems with property damage than those from non-urban areas (33% v. 25%). The effect with respect to the SEIFA Index of Social Disadvantage also differed from that found for the drunkenness outcome. Respondents in the two least disadvantaged quintiles were more, rather than less, likely to report neighbourhood problems with property damage compared with those in the other quintiles (32-33% v. 27-29%). A significant effect is also evident for age group, however the relationship is not linear. No statistically significant effects were apparent for gender, marital status, labour force status, occupation or CD population size. These variables were therefore excluded from the final model.

Table 6 (on page 11) shows the results from the multilevel modelling of the effect of outlet accessibility on reported problems with property damage in the local neighbourhood. Once again, the most proximal accessibility category (<0.5kms) served as the referent for each of the other distance categories. The control variables in this final model are age group, country of birth, location (urban/non-urban) and the SEIFA Index of Social Disadvantage. As seen in Table 6, the relationship between relative liquor outlet accessibility and neighbourhood problems with property damage remained statistically significant after controlling for confounders. Negative coefficients are apparent for each of the other relative accessibility categories, indicating a

Table 5: Bivariate associations between potential confounder variables and reported neighbourhood problems with property damage

Variable	*% neighbourhood problems with property damage*	*Significance*[i]
Gender		
Males	30.1	*p*=0.888
Females	30.0	
Age group (yrs)		
15-19	33.1	*p*=0.015*
20-29	27.9	
30-39	31.3	
40-49	33.0	
50-59	29.6	
60+	27.1	
Marital status		
Married	30.0	*p*=0.862
Not married	30.1	
Country of birth		
Australia	32.3	*p*<0.001*
Overseas, English speaking	31.7	
Overseas, Non-English speaking	21.1	
Labour force status		
Employed	30.6	*p*=0.333
Unemployed	33.1	
Not in workforce	28.8	
Occupational group		
Managers / Professionals	30.8	*p*=0.525
Tradespersons	31.5	
Skilled clerical	32.1	
Unskilled	29.0	
Not in workforce / not applicable	29.0	
Location		
Urban	33.0	*p*<0.001*
Non-Urban	25.4	
SEIFA Index of Social Disadvantage		
Most disadvantaged quintile	29.5	*p*=0.004*
Quintile 2	27.6	
Quintile 3	27.4	
Quintile 4	32.3	
Least disadvantaged quintile	33.4	
CD population size		
<450	28.7	*p*=0.754
450–580	30.0	
580–700	30.6	
700–850	31.7	
>850	29.0	

* *Significant at the 0.05 level*

(i) See note 7

lower risk of respondents experiencing problems with property damage in their neighbourhoods compared with the most proximal referent category. The overall Chi-square test for the relationship between the liquor outlet accessibility measure and neighbourhood problems with property damage was found to be statistically significant after controlling for confounder variables (χ^2_4 = 24.2, p<0.001).

ASSAULT VICTIMISATION AT HOME

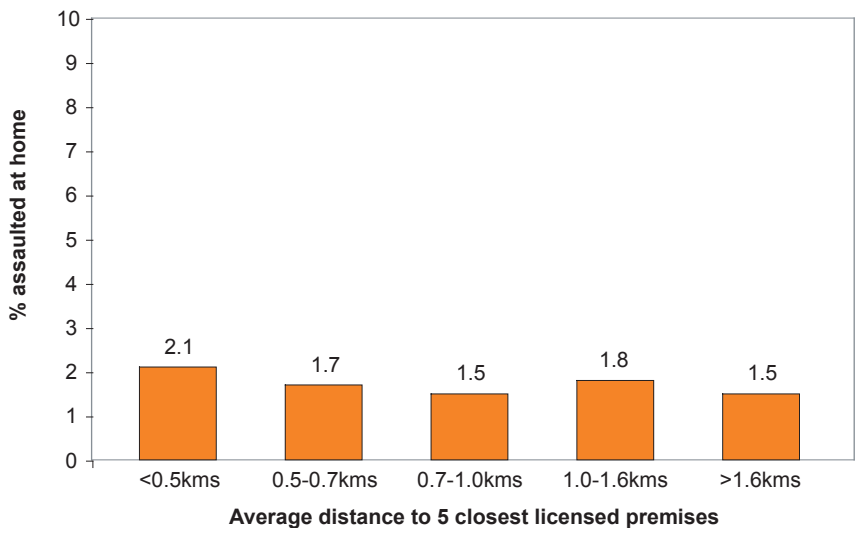
Figures 5 and 6 show the bivariate relationships between liquor outlet accessibility, liquor outlet density and the percentage of respondents who reported having been assaulted at home during the previous 12 months. No clear pattern can be discerned from either of these figures. Although the most accessible (Figure 5) and dense (Figure 6) quintiles have the highest percentages of reported assault victimisation at home, these differences were not found to be statistically significant. It should be noted, however, that the number of respondents in this sample who reported having been a victim of an assault in their home was relatively small (158 persons or 1.7% of the sample). This would have substantially reduced our ability to adequately assess the relationship between liquor outlet accessibility/ density and domestic assault. The small number of assault victims in this sample also created problems for the multilevel modelling (even a model containing only an intercept term was unable to reach convergence). Furthermore, the low frequency of reported assaults in the home raises statistical power issues, particularly when modelling accessibility and density as categorical predictor variables.

Table 6: Final multilevel model (3 levels) assessing the relationship between relative liquor outlet accessibility and neighbourhood problems with property damage

Variable	*Parameter estimate*	*Standard Error*	*Significance*
Liquor outlet accessibility (kms)			
0.5-0.7 v. <0.5	-0.254	0.113	*p*=0.025*
0.7-1.0 v. <0.5	-0.331	0.114	*p*=0.004*
1.0-1.6 v. <0.5	-0.290	0.115	*p*=0.012*
>1.6 v. <0.5	-0.623	0.129	*p*<0.001*
Age group (yrs)			
15-19 v. 60+	0.188	0.121	*p*=0.121
20-29 v. 60+	-0.065	0.103	*p*=0.527
30-39 v. 60+	0.167	0.096	*p*=0.082
40-49 v. 60+	0.316	0.094	*p*<0.001*
50-59 v. 60+	0.171	0.098	*p*=0.081
Country of birth			
O/S Eng speaking v. Australia	-0.114	0.104	*p*=0.273
O/S Non-Eng speaking v. Australia	-0.765	0.089	*p*<0.001*
Location			
Non-urban v. Urban	-0.390	0.091	*p*<0.001*
SEIFA Index of Social Disadvantage			
Quintile 2 v. Quintile 1	-0.140	0.116	*p*=0.227
Quintile 3 v. Quintile 1	-0.150	0.117	*p*=0.200
Quintile 4 v. Quintile 1	0.056	0.117	*p*=0.632
Quintile 5 v. Quintile 1	0.002	0.121	*p*=0.986

** Significant at the 0.05 level*

Figure 5: Liquor outlet accessibility and assault victimisation at home within previous 12 months

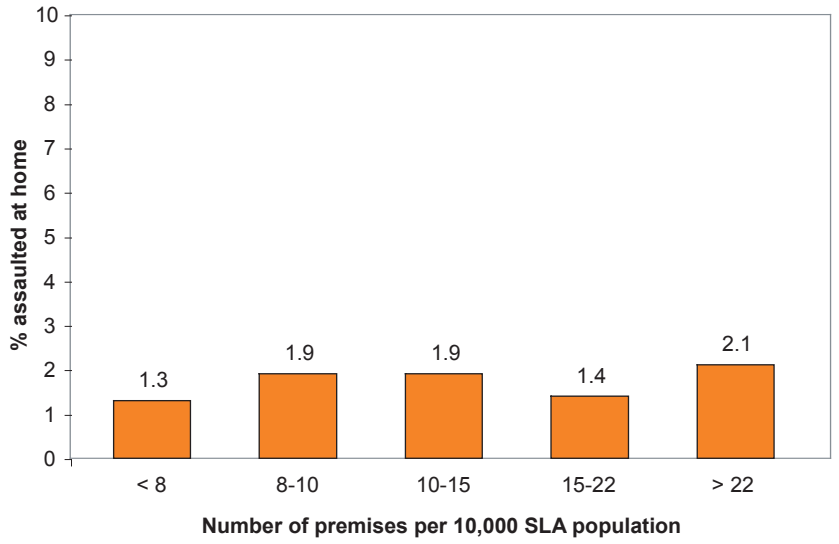


LIQUOR LICENCE TYPE AND DIFFERENTIAL DENSITY EFFECTS FOR NEIGHBOURHOOD DRUNKENNESS

As discussed previously, there is some evidence showing that the effect of outlet density can vary by liquor licence type. To test this using the current data set, an attempt was made to fit models with density terms across a range of different licence types for the neighbourhood drunkenness outcome. As a first step, separate multilevel models were fit for each licence type while also controlling for the other covariates shown in Table 4. Significant positive outlet density effects were found for the following licence types: hotels ($p<0.05$), extended trading hotels ($p=0.02$), off licences ($p=0.01$), licensed restaurants ($p=0.01$) and the 'other' category ($p<0.05$). There was no apparent effect for registered clubs ($p=0.2$).[8]

When an attempt was made to fit a model containing the densities for each of these licence types simultaneously (with a view to identifying the most important licence type or types), the findings were inconclusive. This was because the high correlations between the densities of different outlet types at the SLA level meant that the estimated effects for each licence type were markedly attenuated, with no single licence type remaining consistently predictive. Given this, it was concluded that the current investigation was not able to differentiate the effects of different licence types with respect to outlet density. It is worth noting, however, that the effect sizes for the total density measure were generally greater in magnitude than were those for each of the individual licence type density measures. This suggests that there may be a cumulative effect of outlet density across the different licence types (i.e. greater availability per se) with respect to the neighbourhood drunkenness outcome.

Figure 6: Liquor outlet density (SLAs) and assault victimisation at home within previous 12 months



DISCUSSION

This investigation was undertaken to provide information about the effect of the concentration of liquor outlets on neighbourhood amenity in NSW. The results showed that respondents who live closer to liquor outlets (relative accessibility) were more likely to report problems in their neighbourhood with both drunkenness and property damage. These relationships were evident after adjusting for a range of socio-demographic factors. The results also showed that respondents living in areas with a higher density of liquor outlets per 10,000 (SLA) population were more likely to report neighbourhood problems with drunkenness. Again this effect was shown to be independent of socio-demographic factors.

Like any research, this investigation has a number of limitations. Firstly, the study was not able to assess the impact of liquor outlet accessibility/density on the incidence of domestic assault victimisation. This was because there were too few incidents of this type reported by respondents in the survey sample to enable multilevel modelling to be undertaken. While using all reported assaults as an alternative outcome may have solved this problem, such an approach would be open to the criticism that a substantial number of the assaults may have occurred at locations away from the area in which the respondent resides. Further research utilising recorded crime data could be undertaken to improve our understanding of the relationship between liquor outlet accessibility/density and domestic assault. Accurately geocoding the precise location of these recorded assaults would, however, be a significant challenge for such an investigation.

A second limitation is that the outlet density analyses were not able to isolate the impact of different licence types. Licence type has been shown to be predictive of alcohol-related problems in studies conducted in Australia (Stockwell, Somerford & Lang 1992) and US research has suggested that the effect of outlet density varies by licence type (Lipton & Gruenewald 2002; Scribner, Mackinnon & Dwyer 1994). While this issue warrants further investigation, the key policy question, from a National Competition Policy perspective, is whether it is necessary to place restrictions on the total number of premises (regardless of type) in a given area. The current study, in showing a relationship between liquor outlet concentrations and reported neighbourhood problems with drunkenness and property damage, strongly suggests that there is a need for such restrictions.

Another limitation is that in constructing the liquor outlet density measures, it was necessary to use SLAs rather than postcodes as the unit of aggregation. This was because the primary sampling unit in the Crime and Safety Survey was the CD, and CDs do not match exactly to postcodes. The larger size of SLAs, particularly in non-urban areas, may have resulted in some of the density measures being relatively insensitive. It is notable in this regard that the relative accessibility indicator was sensitive to neighbourhood problems with property damage, while the density measure was not. This suggests that the relative accessibility measure was a better indicator of proximal influences than the density measure.

The final limitation that needs to be acknowledged is that, due to errors in the geocoding of some licensed premises (e.g. 10% geocoded to the centre of the suburb), the accessibility measure constitutes a relative rather than an absolute measure of exposure to liquor outlets. The statistical approach used in this study reflected this limitation. Rather than modelling accessibility as an interval scaled variable, a categorical approach had to be adopted. This more conservative approach is likely to minimise the impact of any differential measurement error inherent in the geocoding. However it also makes it impossible to identify the precise form of the relationship we tested. Improvements in the recording of the addresses of licensed premises (in the liquor licensing authority's database) would go some way to resolving this problem.

Despite these limitations, this study is consistent with other investigations in demonstrating significant relationships between higher concentrations of liquor outlets and a range of alcohol-related problems. These findings have direct relevance for the current policy debate on liquor licensing deregulation in the context of the National Competition Policy (NCP) reviews. In their NCP review conducted in 2001, the NCC argued as follows:

> *'regulations that prevent responsible sellers from entering the industry, discriminate between sellers …and impose arbitrary restrictions on seller behaviour are irrelevant to harm minimisation'* (National Competition Council 2001, p.21.7).

There are two problems with this argument. Firstly, this study, in conjunction with the large body of research evidence from the US, has shown that the concentration of liquor outlets is predictive of alcohol-related problems. Any statement that implies that limiting the number alcohol retailers is irrelevant to harm minimisation must therefore be open to serious question.[9] Secondly, previous BOCSAR research has shown that the responsible provision of alcohol by suppliers appears to be the exception rather than the rule in NSW. In a recent survey, only 10 per cent of 18-39 year olds who were showing signs of intoxication whilst drinking at licensed premises reported receiving responsible service interventions by bar staff. In fact, the survey showed that the most frequent response of licensed premises staff to intoxication was to continue serving alcohol (Donnelly & Briscoe 2003). Evidence such as this clearly supports the need for the continued regulation of the alcohol retail market in order to minimise the harms associated with alcohol misuse.

There is no question that the previous 'needs test', which allowed existing licensees to object to new licences being granted on the basis of the public's demand for alcohol already being met, was inherently anti-competitive in nature. This 'needs test' is, however, only one of a possible range of strategies that can be put in place to limit the number of alcohol suppliers. The social impact assessment process, which has replaced this needs test in NSW, certainly has the potential to ensure that the harms caused by alcohol misuse are minimised. This process would be assisted by taking into account data relating to current levels of alcohol-related harm in specific local areas, including harms associated with such things as the degree of extended trading, or even the overall number of alcohol outlets. The critical issue here is that the central focus should be on harm minimisation (which is the primary objective of the liquor laws in NSW) rather than on an appraisal of the extent to which a market need for a given commodity is being met.

The issue of outlet density would appear to be a critical one in terms of minimising alcohol-related harm in the community. There is, however, still a need to conduct more specific research which can better inform policy makers about the specific thresholds above which problems in a particular local area will manifest (Stockwell & Gruenewald 2001).[10] This type of research is likely to be a complex undertaking and it is possible that such thresholds would vary across different local areas. Further investigations should also be considered to examine other outcomes, such as drink driving, hospitalisation rates and recorded assaults (both domestic and non-domestic). Such investigations would hopefully also improve our understanding of the relationship between the concentration of specific licence types (e.g. extended trading hotels) and a range of alcohol-related harms. Even in the absence of such data, the current evidence base strongly suggests that a public benefit case can be mounted in favour of restricting the number of liquor outlets in order to minimise the harms associated with alcohol consumption.

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NOTES

1. For each target SLA, the average outlet densities of all spatially contiguous SLAs were also calculated. This method was based on an approach used by Gruenewald, Johnson and Treno (2002) to take account of the potential effects of spatial autocorrelation. As these 'lagged' terms did not attain statistical significance in any of the multilevel models, only the findings from the models containing the target outlet densities are reported here.

2. In the initial modelling, a three-level structure was specified for the 'accessibility' analyses with the CD-level accessibility measure specified as the highest level. This approach was adopted given that higher order level models (e.g. 4 level) are less parsimonious. These models were subsequently re-fit specifying SLAs as the fourth level even though no SLA-level predictors were included. This made no difference to the conclusions reached with regard to the accessibility measure. The findings from the three-level models are therefore reported here. For the density models, four-level models were specified and are reported here given that the density measure was constructed at the SLA level.

3. When fitting binomial multilevel models, the preferred estimation procedure recommended in the statistical literature is the 2nd order PQL approach (Snijders & Bosker 1999). When conducting these analyses on the full sample, this 2nd order PQL approach was unable to reach convergence. This necessitated

applying a 1st order PQL estimation approach. As this method has been shown to be prone to under-estimating both parameter estimates and their standard errors, it was decided to conduct a sensitivity analysis to check on the robustness of the model findings. The reason for the lack of convergence appeared to be a function of the large number of Level 2 units (households), which in turn only had a small number of Level 1 elements (respondents) within them. Given this, it was decided to randomly select only one person per household and fit three level, rather than four level models (respondents within CDs within SLAs). While this reduced the total sample size by more than half, it was now possible to fit the binomial multilevel models using 2nd order PQL estimation. Importantly, all obtained liquor outlet accessibility and density effects that were previously found using the whole sample, were still statistically significant and the effects sizes were of similar magnitude. Given this, findings from the modelling using the whole sample are reported here, as the regression results were clearly not an artefact of the estimation procedure used.

4. The relative accessibility cut-offs shown in Figures 1 and 3 have been rounded for convenience of expression in this report. The actual categories based on the quintile cut-offs from the survey sample were: <0.45 kms, 0.45-0.71 kms, 0.72-1.01 kms, 1.02-1.56 kms and >1.56kms.

5. The outlet density cut-offs shown in Figures 2 and 4 have also been rounded for convenience of expression in this report. The actual categories based on the quintile cut-offs from the survey sample were: <7.8 premises, 7.8-10.3 premises, 10.4-15.0 premises, 15.1-22.2 premises and >22.2 premises.

6. Gender (χ^2 = 0.6, df = 1), Age Group (χ^2 = 60.0, df = 5), Marital Status (χ^2 = 15.8, df = 1), Country of Birth (χ^2 = 9.4, df = 2), Labour Force Status (χ^2 = 6.2, df = 2), Occupational Group (χ^2 = 4.3, df = 4), Location (χ^2 = 4.1, df = 1), SEIFA Index of Social Disadvantage (χ^2 = 59.2, df = 4), CD population size (χ^2 = 30.5, df = 4).

7. Gender (χ^2 = 0.0 df = 1), Age Group (χ^2 = 14.1, df = 5), Marital Status (χ^2 = 0.0, df = 1), Country of Birth (χ^2 = 48.6, df = 2), Labour Force Status (χ^2 = 2.2, df = 2), Occupational Group (χ^2 = 3.2, df = 4), Location (χ^2 = 31.2,, df = 1), SEIFA Index of Social Disadvantage (χ^2 = 15.1, df = 4), CD population size (χ^2 = 1.9, df = 4).

8. All the licence type models reported here were fit using the 2nd order PQL estimation procedure with one respondent randomly selected per household (as described in Note 3). Given the high correlations between the densities across licence types, it was felt that this estimation procedure would be preferable.

9. While the NCP reviews pay no attention to the considerable scientific literature showing a robust relationship between increased outlet density and increased crime and health problems, they do attempt to justify their argument with the claim that per capita alcohol consumption has decreased in Australia over a long-term period during which the alcohol industry has been consistently de-regulated. There are a number of problems with such an argument. First, it does not take account of a number of major economic recessions that have occurred since the early 1970s, which would have impacted on the expenditure of a range of items including alcohol. Second such an argument ignores the effects of other deterrence-based interventions that have occurred during this period which would have had an impact on alcohol consumption levels (e.g. random breath testing of motorists).

10. It is important to note that the relative accessibility and density categories used in this investigation do not themselves specify the actual thresholds for increased neighbourhood problems. The privacy provisions of the legislation governing the ABS precluded BOCSAR staff from viewing the frequency distributions of the density and accessibility measures in the Crime and Safety survey. Given this, the most feasible analysis approach was to instruct ABS staff to divide the sample into quintiles on each of these measures. Thus, the effects of the accessibility groupings on, for example, neighbourhood drunkenness should not be viewed as a dose response relationship based on distance per se but rather as the relative likelihoods of respondents within each of these groups reporting this neighbourhood problem.

PREVIOUS EDITIONS OF BCSR ALCOHOL STUDIES BULLETINS

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