Using geocoded liquor licensing data in Victoria

Final project report

Using geocoded liquor licensing data in Victoria

The socioeconomic distribution of alcohol availability in Victoria

Final project report
Author: Michael Livingston

Acknowledgements

CONTENTS

1 Introduction

This project was funded by VicHealth to develop a geocoded database of historical liquor licensing data and to use these data to explore the socioeconomic and demographic distribution of alcohol availability in Victoria. The project report will be split into two sections, the first outlining the geocoding process and providing initial results, and the second providing the substantive content of the project.

2 Geocoding of liquor licences in Victoria

2.1 Background

Liquor licensing data in Victoria has traditionally been available only at the level of postcode. In other words, it has been possible for some time to examine the number of alcohol outlets of various types in particular postcodes, but more detailed analysis has generally been unworkable. For example, researchers or policymakers interested in assessing how licences cluster together at a micro level or how harm hotspots relate to outlet locations, have been unable to. The current project has been undertaken to geocode historical liquor licensing data from 1991 to 2008. Geocoding allows for the precise locating of spatial data in geographic information systems and on maps. Geocoded data can then be mapped at any geographic level and analysed in conjunction with other spatial data. Thus, for example, previous work has geocoded cancer mortality data in the USA and ascertained that, using small geographic areas, socioeconomic disadvantage rates are related to rates of cancer mortality [1].

The use of geographical data in the alcohol field has increased over the past decade, following calls for a more spatially aware approach to alcohol research [2]. In Australia, spatial analyses of alcohol data have largely been limited to analyses at broad geographic levels using raw address data provided by a range of agencies – most commonly data at the level of postcode [3, 4] or Local Government Area [5, 6]. These analyses are limited in a number of ways. First, the geographical units used are often large areas, and may misclassify people into categories. For example, analyses of Australian Census data found that basing socioeconomic disadvantage on postcode data was more than 50% more likely to misclassify respondents into incorrect disadvantage groups than data based on small Collection District areas [7]. Second, data collected for non-research purposes is likely to include errors in simple fields like 'postcode'. For example, random checking of a single year of Victoria liquor licensing data from 2006 found that the postcodes recorded for approximately one in twenty outlets did not match the actual postcode of the outlet in question. Finally, data aggregated to specific geographic areas prevent the use of a range of methods designed to make use of point-based data, including hot-spotting and point-pattern analysis [8]. Thus, there is much to be gained by geocoding liquor licensing (and other) Australian data to answer a range of research questions.

2.2 Method

Unit record liquor licensing data for the years 1991 to 2008 inclusive were provided by Responsible Alcohol Victoria. These data included every active liquor licence at 30 June of each year, with full address detail provided. Due to the cost of geocoding, the current work focussed on four main categories of licences: general licences (pubs, hotels, taverns), on-premise licences (restaurants, bars, nightclubs), packaged licences (bottle shops, grocery stores), and club licences (sporting clubs, RSLs etc). These categories made up more than 80% of licences over the study period, with producer-distributor (6%), residential (2%) and limited (11%) excluded.

Data were geocoded by MapData Sciences Australia, a commercial spatial data consulting company with expertise in the area. Geocoding was undertaken based on the address data stored in the liquor licensing data files.

2.3   Results

The initial geocoding run found exact address matches for 73.7%, street-level matches for 20.3% and suburb-level matches for 6.0% of all outlets. To improve precision, the 8,142 addresses that were matched only at the suburb level were manually checked and altered using internet searches and historical phone books. This improved geocoding success rate substantially, resulting in 79.0% of addresses matched exactly, 20.5% at the street level and just 0.5% at the suburb level (Table 1).

Table 2.1 – Geocoding accuracy

Match level	First pass	Second pass
Exact	73.7%	79.0%
Street level	20.3%	20.5%
Suburb level	6.0%	0.5%

Geocoding accuracy varied substantially across licence types (Table 2). In particular club licences were much less likely to be matched exactly, and much more likely to be street-level matches. This largely stems from the licensing of sporting clubs that are often located on short streets at non-numbered addresses (e.g. a football club address may be: 'Turner Oval, Farnsworth Avenue').

Table 2.2 – Geocoding accuracy by licence type

Match level	Club licences	General licences	Packaged licences	On-premise licences
Exact	43.0%	74.4%	86.1%	88.1%
Street level	56.2%	25.1%	13.3%	11.4%
Suburb level	0.8%	0.5%	0.6%	0.5%

Similarly, there was substantial variation in geocoding accuracy by location, with rural licences substantially less likely to be matched at the exact address level (Table 3).

Table 2.3 – Geocoding accuracy by rurality

| Match level	Metropolitan	Regional/rural
Exact	89.1%	61.8%
Street level	10.7%	37.2%
Suburb level	0.2%	1.1%

Overall, the geocoding process undertaken has produced results consistent with many other liquor licensing geocoding studies. For example, work undertaken in New South Wales successfully

geocoded only 90% of outlets at the exact or street-level, with 10% coded at the less precise suburb level [9]. In New Zealand, studies on alcohol availability have successfully geocoded between 73% and 87% of outlets [10, 11], while studies in the US typically reported higher match rates (up to 99%), although these studies were generally done in urban settings [12].

2.4 Discussion

While the main focus of this project is on alcohol availability and socioeconomic disadvantage, the broader utility of the geocoded liquor licensing data is substantial. At its simplest, having access to this data provides a clear and simple way to display and explore alcohol availability in Victoria. For example, the map below presents the number of alcohol outlets at the Statistical Local Area in the Melbourne area.

Figure 2.1 – Number of alcohol outlets per Statistical Local Area, Melbourne and surrounds
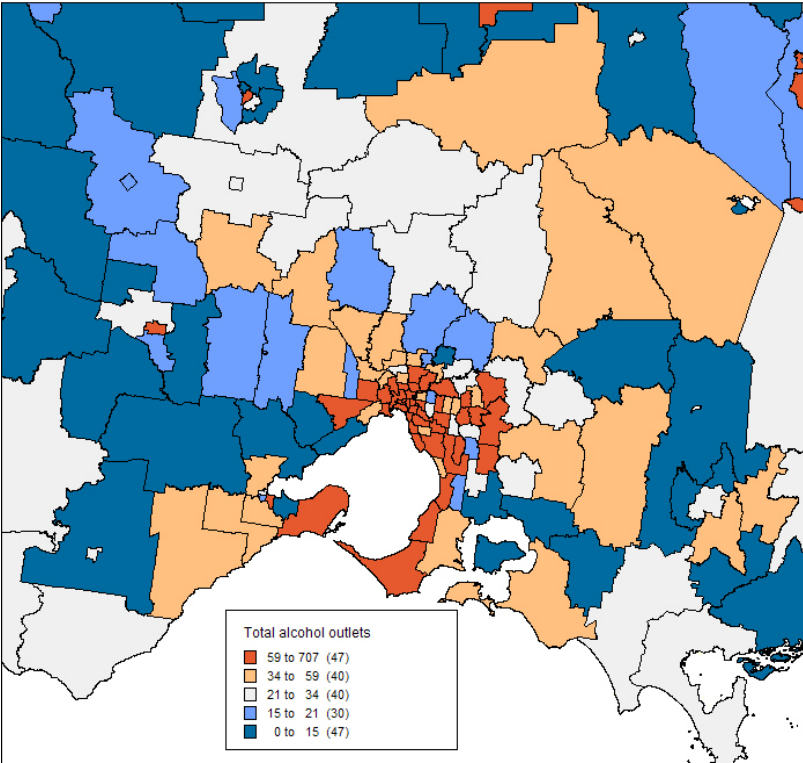
Furthermore, geocoded data provide new ways of presenting changes over time around alcohol availability. For example, below is a visual presentation of how the number and type of alcohol outlets have changed in Fitzroy between 1991 and 2008. This kind of work, while descriptive, is an effective and powerful way to illustrate trends and patterns in the data and provides pointers towards future research questions.

Figure 2.2 – Fitzroy liquor licensing patterns, 1991, 1997, 2003 and 2008
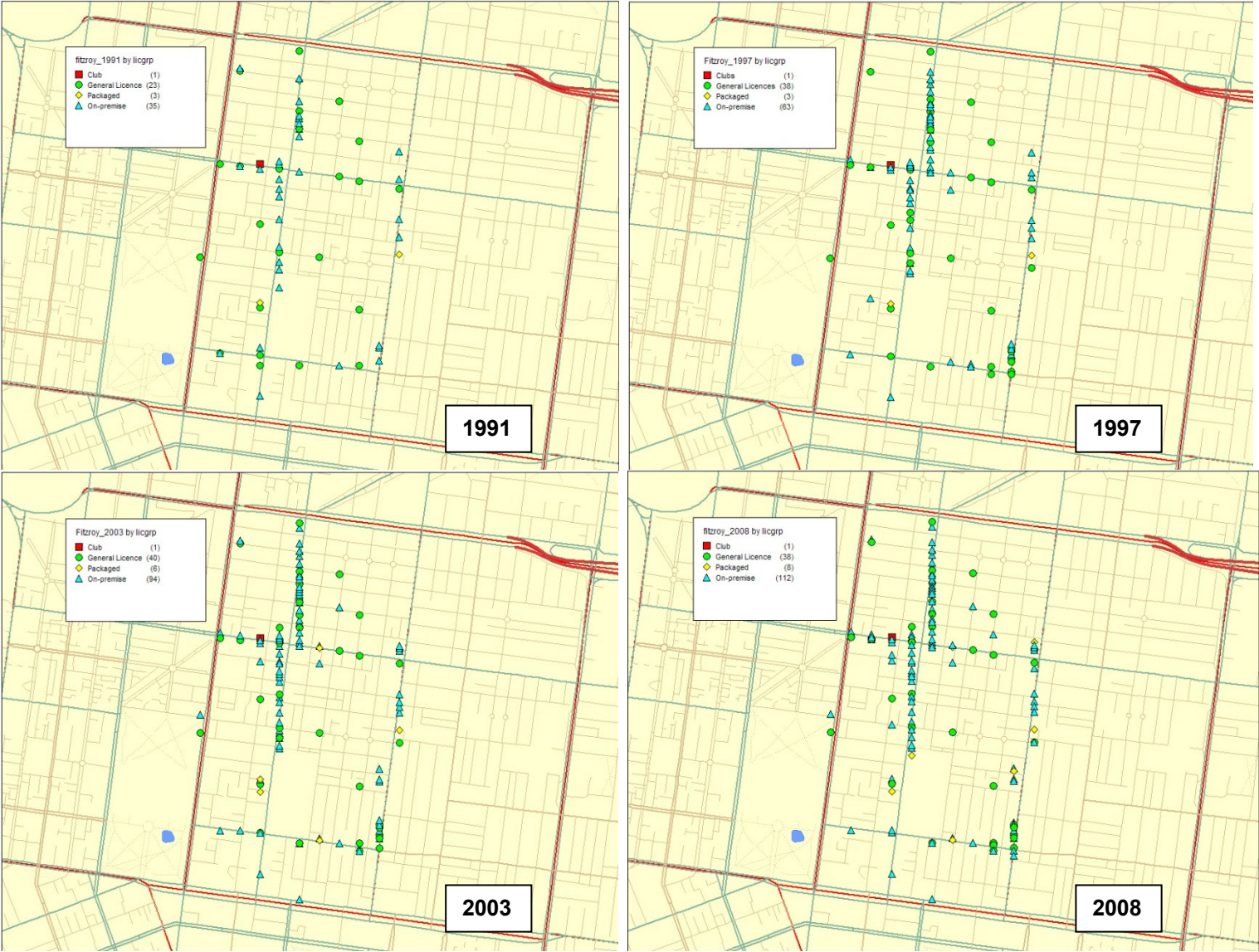
Finally, and most significantly, geocoded liquor licensing data allows for more sophisticated analyses of the associations between alcohol outlets and alcohol-related harms. At this stage, there are no harm data available that can be mapped at individual incident level, but there is significant potential for future analyses examining the geographic relationships between alcohol outlets and a range of outcomes (e.g. assaults, ambulance attendances).

3 The socio-demographic distribution of alcohol outlets in Victoria

3.1 Background

There has been substantial international research highlighting the significant socioeconomic inequalities in health outcomes in developed countries [13]. Within Australia, these inequalities are considerable, with mortality rates significantly higher amongst disadvantaged communities across a range of age groups and causes of death [14]. The causes of these inequalities are varied and complex [15], but it is clear that risky health behaviours contribute to them, with notable socioeconomic gradients found for health risk factors such as obesity and smoking internationally [16, 17] and within Australia [18, 19]. The situation for alcohol is less straightforward. The relationship between socioeconomic disadvantage and drinking pattern varies substantially between countries and sub-populations [20, 21]. In Australia, there is some evidence that males from lower socioeconomic areas are more likely to drink at risky levels [22], although this is not a consistent finding [23]. Despite the varied findings on the relationship between socioeconomic disadvantage and drinking, there is clearer evidence that less advantaged people experience a greater burden of alcohol-related harm. For example, research in Finland found that for a given level of drinking, poorer Finns were around twice as likely to die or be hospitalised due to alcohol [24]. Higher rates of alcohol-related mortality among disadvantaged sections of the population have been found in a number of countries [25-27], and a recent study in Australia suggested blue-collar workers had a cirrhosis mortality rate more than twice that of white-collar workers [28].

Given the disparities in harm experienced, there is clear evidence that alcohol is a substantial contributor to health inequalities in many parts of the world, including Australia.

3.1.1 ENVIRONMENTAL IMPACTS ON INEQUALITIES

Many researchers have looked to environmental factors to explain the disparities in health observed across socioeconomic groups [e.g. 29]. This is particularly true when the focus is on health risk behaviours.

For example, a range of studies have examined the association between socioeconomic deprivation and access to healthy food. In the USA, Walker et al. [30] reviewed 31 studies examining food access. They found that studies generally identified higher densities of fast food outlets and less access to supermarkets in disadvantaged neighbourhoods. The US studies focus particularly on ethnicity, finding that predominantly black neighbourhoods have the least access to healthy food. Similar work in the US has demonstrated lower access to facilities related to physical activity in disadvantaged neighbourhoods [31]. Findings outside of the US have been more mixed [32]. For example, a recent study in New Zealand demonstrated higher densities of fast food outlets in deprived neighbourhoods, but similarly high rates of access to healthy foods in these neighbourhoods [33]. In Australia, a number of studies have found higher access to fast food outlets in socioeconomic disadvantaged neighbourhoods, including three studies from Victoria [34-36].

Similar analyses have been undertaken examining access to attempt to explain socioeconomic disparities in smoking rates. These studies have thus far been limited to the USA, but have found support for the argument that the local environment contributes to health inequalities. Multiple studies have found evidence linking rates of smoking to tobacco outlet densities [37-39] and it has been shown repeatedly that tobacco outlets are more prevalent in poor or minority neighbourhoods [38, 40, 41].

3.1.2 PREVIOUS STUDIES OF ALCOHOL OUTLET DISTRIBUTIONS

In the alcohol field, a number of researchers have examined whether the distribution of alcohol outlets is related to social class to assess whether the alcohol environment may contribute to socioeconomic inequalities in alcohol-related harm. The first study in the field was undertaken by Gorman and Speer using data from a single city in New Jersey [42]. They found that alcohol outlets were generally concentrated in more disadvantaged neighbourhoods, although the area with the highest number of outlets had a low level of poverty. LaVeist and Wallace [43] conducted a similar analysis using data from Baltimore focussing only on liquor stores. As with the New Jersey study, they found substantially higher densities of liquor stores in poor, black neighbourhoods. Two more recent studies examined these relationships across the whole of the USA [44, 45], confirming that in urban areas, poor communities face much higher exposure to liquor stores than advantaged communities. Romley et al. focussed on urban areas of the US, finding that liquor stores in particular clustered in poor, black neighbourhoods, but that bars were also more concentrated in low income areas. This was supported by more recent work by Berke et al. [44], who used data from regional and rural areas as well as cities across the USA. Their results suggested that the relationship between poverty and alcohol availability is strongest in urban areas and much less notable in suburban or regional parts of the USA. Outside of the USA, two national studies in New Zealand identified similar patterns, with bars, clubs and packaged liquor outlets all substantially more likely to be located in more deprived neighbourhoods, [10, 46], while a study in Glasgow produced much less clear results [47]. This work is still in its early stages. Thus far there have been no studies of the distribution of alcohol outlets in Australia, and no studies examining how changes in alcohol availability play out across different kinds of neighbourhoods.

3.1.3 ALCOHOL OUTLET EFFECTS

While the research outlined above is still developing, there is good reason to focus on the equity of how alcohol outlets are distributed, as there is a substantial research literature linking the distribution of outlets to the distribution of alcohol-related harm [48, 49]. A large number of cross-sectional studies have identified associations between alcohol outlet density and harms including violence [50-52], accidents [53], sexually transmitted disease [54], morbidity [55], youth drinking [4, 56], child maltreatment [57, 58] and neighbourhood amenity problems [9]. This link has been further validated by longitudinal studies demonstrating that alcohol-related harms change along with the density of alcohol outlets [e.g. 3, 12, 59, 60]. It is worth noting that the specific effects of alcohol outlets on harm types vary substantially by type of outlet, type of harm and the setting of the study [49]. Studies on Victorian data at the postcode level have found particularly strong effects for general (hotel) outlets and packaged liquor outlets. For example, in a longitudinal study of violence across Greater Melbourne, hotel numbers were linked to rates of assault in inner-city areas, while packaged liquor outlets were associated with assaults in the suburbs. Further work based on a similar design, found significant relationships between packaged liquor and domestic violence over time [61], while a study based on hospital data linked hotel licences to assault-related admissions and packaged outlets to alcohol-use disorders [62]. Thus, data from Victoria demonstrate significant relationships between alcohol outlet distributions and harm rates at the local level. This suggests that research into how these outlets are distributed across socioeconomic areas may provide some useful insights into the role of alcohol availability in perpetuating health inequalities.

3.1.4 THIS STUDY

This study has been undertaken in two parts: first, examining the distribution of alcohol outlets in Victoria at a single point in time (the year 2006); and second, examining how this distribution has changed over time. The work presented here is the first to examine the distribution of alcohol outlets in an Australian context, and the first anywhere to explore how changes in alcohol availability over time affect the socioeconomic distribution of alcohol availability.

3.2 Methods

3.2.1 GEOGRAPHIC UNITS

Initial analyses were based on data from 2006, to allow for matching with data collected in the national Census that year. All data were aggregated to the smallest possible geographical unit, the Census Collection District (CD). In general, CDs contain around 500 residents, varying substantially in geographic size depending on population density.

Geographic units were classified as either metropolitan or regional based on the remoteness classification contained within the Australian Bureau of Statistics Australian Standard Geographical Classification System (ASGC) [63]. Within the ASGC, collection districts are grouped into five categories: major cities, inner regional, outer regional, remote and very remote. For ease of analysis, the 22 'remote' CDs, 688 'outer regional' CDs and 2,135 'inner regional' CDs were combined into a single 'regional/remote' group, with the remaining 6,453 CDs in the 'Major cities' group (basically made up of Melbourne and Geelong).

Subsequent analyses made use of data from four national Censuses, 1991, 1996, 2001 and 2006. Again, analyses were based on CDs. However, CDs vary from Census to Census, so these analyses were limited to comparing aggregations of CDs (into deciles of disadvantage) over time. Unit level longitudinal analysis was undertaken with 2006 Statistical Local Areas, larger geographic units for which ongoing Census data are available. Using 2006 SLA boundaries, Victoria is divided into 210 distinct regions. Due to low populations, nine of these SLAs were excluded from analyses (including offshore islands, ski resorts and migratory areas), leaving 201 units for longitudinal analysis.

3.2.2 DATA

Licensing data were based on unit level data on all active licences as at June of each study year (1991, 1996, 2001 and 2006), provided by Responsible Alcohol Victoria. Individual licences were geocoded as outlined in Part 1 of this report and licence counts for each CD were calculated using the MapInfo geographic information system (GIS) for each of four licence types (as outlined previously). Geocoding success rates were around 99% to at least the street-level.

Outlet densities were calculated for each of the four licence categories in two ways: per capita and per square kilometre. The use of both methods allows some examination of whether any associations found between outlet density and socioeconomic disadvantage were due to the way in which outlet density was calculated.

Four main demographic variables were examined in relation to alcohol availability. Firstly, the ABS produced Socio-economic Index for Areas (SEIFA) index of relative socioeconomic disadvantage was used as a composite measure of local area disadvantage [64]. This index was used rather than

individual markers of disadvantage (e.g. unemployment, income, education levels etc) due to the high correlations between these single measures. Collection Districts were assigned to deciles of socioeconomic disadvantage based on cut-offs produced by the ABS using the total Australian population. SEIFA disadvantage indices have been produced at each of the last four Censuses and, despite different underlying methodologies, comparisons of deciles across time is appropriate [64].

In addition to socioeconomic disadvantage, median age, proportion of residents who were male and the proportion of people counted within the CD on Census night who were visitors from elsewhere were included in more detailed analyses to assess whether alcohol availability was related to the age and sex structure of the population or to tourism in the area. These data were sourced from the Census community profiles [65] and via a specific data request where the data were not freely accessible.

3.2.3 ANALYSIS

As mentioned above, due to substantial differences in the meaning of accessibility between urban and rural areas and to imprecision in geocoding at a regional level (see Table 3 and [10]), all analyses were conducted separately for urban and regional areas.

For the initial analyses, Census collection districts were grouped into ten groups, based on the decile of socioeconomic disadvantage. Thus, the state of Victoria was basically collapsed into 10 areas based on disadvantage, from decile 1 (most disadvantaged) to decile 10 (least disadvantaged). Populations, licence numbers and other descriptive statistics were aggregated for these 10 groups of CDs to provide average outlet densities for people living in each decile. These analyses were undertaken using a combination of MapInfo and Microsoft Excel. Initial analyses using this method focussed on 2006 data, with linear regression used to determine whether socioeconomic gradients were significant.

This data aggregation approach was also taken for each of the four years being examined to allow for a comparison at the aggregate CD level across time. These longitudinal comparisons were undertaken descriptively.

To delve more deeply into the cross-sectional associations between socio-demographics and alcohol availability in 2006, regression models were developed using the 9,095 CDs as the study units, with licence counts as the dependent variables and the population size, area, SEIFA decile, median age, proportion male and proportion of visitors as independent variables. Due to the nature of the outcome variables (counts of outlets), negative binomial regression models were utilised.

To provide more robust models of change over time, fixed effects models using data from 201 Statistical Local Areas were developed. These models assess which of the independent variables were associated with changes in alcohol availability over time, providing an assessment of whether changes in socioeconomic disadvantage affect the number of outlets in an area. Similar control variables to the cross-sectional analyses were used, with the age variable changed from median age to the proportion of the population aged between 15 and 34 due to data availability. As with the cross-sectional models, a negative binomial regression approach was undertaken.

3.3 Results

3.3.1 2006 CROSS-SECTIONAL DATA

Metropolitan areas

Collection district socio-demographic data aggregated to the SEIFA decile-level are presented in Table 3.1. Unsurprisingly, CD-level unemployment rate declines consistently from the most disadvantaged group of CDs (decile 1) to the least disadvantaged CDs (decile 10). Similarly, median income varies in the expected direction, with higher income in less disadvantaged CDs. Notably, population density was substantially higher in disadvantaged CDs compared with those in the less disadvantaged deciles.

Table 3.1 – Socio-demographic information by SEIFA decile of socioeconomic disadvantage, metropolitan areas, Victoria, 2006

SEIFA decile	N	Median age	Unemployment rate	Median income	Population	Area (sq km)	Population per sq. km
1 (most disadvantaged)	622	36.8	12.75	293.2	352,568	201.64	1,748.50
2	498	37.5	8.44	363.2	284,780	172.03	1,655.41
3	496	36.2	6.92	408.9	286,805	208.29	1,376.95
4	556	35.9	6.14	439.4	340,056	248.31	1,369.48
5	576	36.4	5.33	472.6	332,383	359.14	925.50
6	577	36.7	4.85	491.1	338,524	540.31	626.54
7	647	36.4	4.42	524.3	379,403	441.64	859.08
8	712	36.5	3.95	564.2	411,968	508.13	810.75
9	776	36.9	3.66	601.5	454,519	516.78	879.52
10 (least disadvantaged)	842	38.1	3.01	689.0	483,803	660.78	732.17

Data on alcohol outlet density by SEIFA quintile are presented in Table 3.2. Outlet density is measured in two ways: per 1,000 residents and per 10km squared. The relationship between socioeconomic disadvantage and alcohol availability was tested using simple linear regression with decile as the independent variable and the measures of outlet density as dependent variables.

Table 3.2 – Alcohol outlet density by SEIFA decile of socioeconomic disadvantage, metropolitan areas, Victoria, 2006

Decile	Licences per 1,000 residents				Licences per 10 square kilometres			
	General	Packaged	On-premise	Club	General	Packaged	On-premise	Club
1	0.14	0.40	0.60	0.12	2.43	7.04	10.51	2.03
2	0.18	0.45	0.89	0.14	2.96	7.50	14.71	2.27
3	0.28	0.36	1.06	0.10	3.79	4.95	14.55	1.44
4	0.30	0.34	1.17	0.12	4.15	4.67	16.03	1.61
5	0.29	0.34	1.13	0.12	2.70	3.17	10.47	1.11
6	0.36	0.33	1.45	0.19	2.28	2.07	9.07	1.18
7	0.27	0.28	1.03	0.10	2.31	2.45	8.81	0.86
8	0.28	0.27	1.01	0.09	2.28	2.22	8.23	0.77
9	0.31	0.24	1.17	0.09	2.73	2.13	10.26	0.83
10	0.27	0.21	0.97	0.09	2.01	1.57	7.13	0.68
Linear regression coefficient	0.012	-0.023	0.030	-0.004	-0.114	-0.656	-0.704	-0.168
P-value	0.07	<0.01	0.23	0.26	0.14	<0.01	0.03	<0.01

Only packaged liquor availability had a significant socioeconomic gradient across both measures of alcohol outlet density, with substantially higher densities of packaged outlets in more disadvantaged areas regardless of the measure used. Based on per capita outlet density, people living in the most disadvantaged areas were exposed to almost twice as many packaged outlets as those in the least disadvantage. Using an area-based measure, this gradient was even steeper, with 4.5 times as many outlets per square kilometre in the poorest areas as in the richest areas.

To overcome the problem of using two different denominators in the rates presented above, negative binomial models were developed using the absolute number of alcohol outlets as the outcome variable and controlling for both population and CD area. In addition, three further control variables (median age, a measure of tourism and the proportion of the population that were male) were incorporated to ensure that the relationship between socioeconomic disadvantage and alcohol availability was not going confounded by other factors. Thus, the models below (Table 3.3) provide more robust estimates of the relationship between socioeconomic disadvantage and alcohol outlet density.

Table 3.3 – Negative binomial models of the association between alcohol outlet density and socioeconomic disadvantage, metropolitan Victoria, 2006

	General		Packaged		On-premise		Club	
	Coef	P-value	Coef	P-value	Coef	P-value	Coef	P-value
Decile	0.034	0.045	-0.070	<0.001	0.044	0.001	-0.037	0.039
Population (1,000s)	-1.891	<0.001	-0.193	0.24	-1.412	<0.001	0.244	0.329
Area (square kms)	0.032	0.042	0.003	0.779	0.027	0.03	0.053	<0.001
% visitors	0.093	<0.001	0.034	<0.001	0.108	<0.001	0.044	<0.001
% male	-0.002	0.89	-0.017	0.137	-0.027	0.017	0.005	0.760
Median age	-0.458	<0.001	0.013	0.025	-0.01	0.076	0.028	0.001

The results of the models show varying relationships between socioeconomic status and alcohol availability, with general and on-premise licences more common in advantaged areas, while club and packaged licences were more common in disadvantaged areas. The model coefficients represent the percentage increase in the number of outlets likely in an area for a unit increase in the relevant independent variable. For example, an increase in the decile of disadvantage of 1 unit (i.e. to a more advantaged decile) is associated with an increase of 3.4% in general outlets and 4.4% in on-premise outlets and with a decline of 7.0% in packaged outlets and 3.7% in club outlets.

The proportion of the counted population that were visitors from elsewhere (i.e. our measure of tourism) was positively associated with all four types of alcohol outlet, as was the geographical size of the CD. Other measures produced mixed results, with on-premise and general licences more common in CDs with smaller populations, while packaged licences and clubs were more common in high population CDs. Gender had little relationship on alcohol availability, while CDs with younger populations had more general licences and fewer packaged or club licences.

Regional and remote areas

Socio-demographic data for non-metropolitan regions are presented in Table 3.4. The basic patterns are similar to the metropolitan data, with slightly older populations across the board and generally lower incomes.

Table 3.4 – Socio-demographic information by SEIFA decile of socioeconomic disadvantage, regional and remote areas, Victoria, 2006

SEIFA decile	N	Median age	Unemployment rate	Median income	Population	Area (sq km)	Population per sq. km
1 (most disadvantaged)	287	39.5	11.55	321.4	136204	5471.93	24.89
2	412	42.0	7.55	356.8	187806	11221.29	16.74
3	413	40.8	6.12	383.2	187299	16578.48	11.30
4	354	40.6	5.11	411.3	160655	29233.46	5.50
5	333	40.1	4.57	427.8	146517	31835.28	4.60
6	333	39.1	3.80	457.9	135182	44090.95	3.07
7	263	39.7	3.43	469.0	109689	39158.17	2.80
8	197	38.6	3.17	495.5	80760	21128.09	3.82
9	134	37.3	2.92	544.4	64257	10376.09	6.19
10 (least disadvantaged)	67	38.0	2.47	590.3	32878	1987.21	16.54

As with the metropolitan data, regional and remote alcohol availability was examined using both per-capita and per-area measures (Table 3.5).

Table 3.5 – Alcohol outlet density by SEIFA decile of socioeconomic disadvantage, regional and remote areas, Victoria, 2006

Decile	Licences per 1,000 residents				Licences per 10 square kilometres			
	General	Packaged	On-premise	Club	General	Packaged	On-premise	Club
1	0.73	0.57	0.81	0.29	0.18	0.14	0.20	0.07
2	1.25	0.77	1.26	0.40	0.21	0.13	0.21	0.07
3	1.07	0.64	1.58	0.30	0.12	0.07	0.18	0.03
4	0.76	0.37	0.97	0.34	0.04	0.02	0.05	0.02
5	0.73	0.41	0.98	0.22	0.03	0.02	0.04	0.01
6	0.44	0.28	0.96	0.24	0.01	0.01	0.03	0.01
7	0.45	0.32	0.88	0.28	0.01	0.01	0.02	0.01
8	0.28	0.22	0.61	0.19	0.01	0.01	0.02	0.01
9	0.33	0.22	0.79	0.25	0.02	0.01	0.05	0.02
10	0.18	0.09	0.67	0.18	0.03	0.02	0.11	0.03
Linear regression coefficient	-0.100	-0.064	-0.059	-0.064	-0.020	-0.014	-.017	-0.006
P-value	<0.01	<0.01	0.06	<0.01	0.04	<0.01	0.03	0.03

A strong socioeconomic gradient in alcohol availability was evident across all licence types in rural and regional areas, regardless of the density measure utilised. For example, using a per-capita measure, people living in the most disadvantaged decile had more than six times as many packaged liquor outlets and four times as many general outlets in their neighbourhoods than those in the most advantaged decile. These ratios were even higher when using a geography based measure of outlet density.

The most consistent finding across metropolitan and non-metropolitan areas of Victoria is that people living in disadvantaged areas are disproportionately exposed to packaged liquor outlets (see Figure 3.1).

Figure 3.1 – Metropolitan and non-metropolitan packaged outlet density by decile of socioeconomic disadvantage, 2006
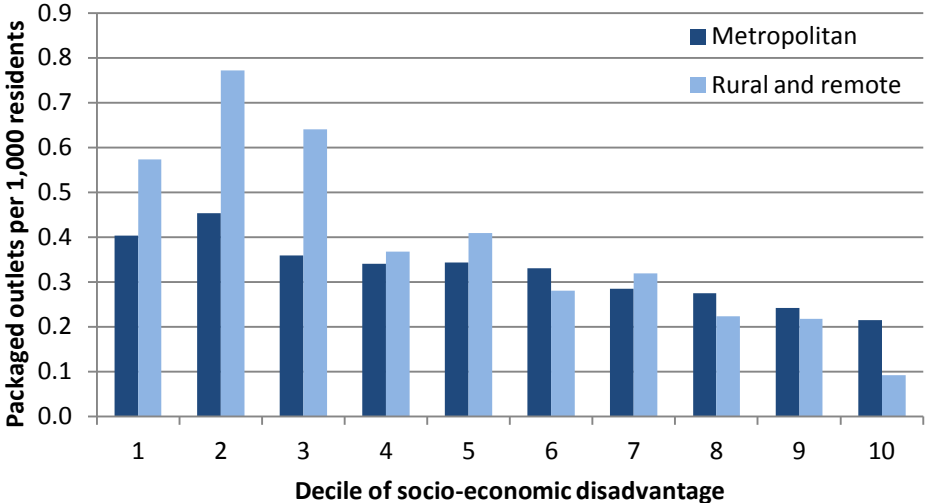
As with the metropolitan data described above, negative binomial models were produced to more robustly assess the relationship between socioeconomic disadvantage and alcohol availability (see Table 3.6)

Table 3.6 - Negative binomial models of the association between alcohol outlet density and socioeconomic disadvantage, regional and remote Victoria, 2006

	General		Packaged		On-premise		Club	
	Coef	**P-value**	**Coef**	**P-value**	**Coef**	**P-value**	**Coef**	**P-value**
Decile	-0.173	<0.001	-0.158	<0.001	-0.015	0.489	-0.046	0.063
Population (1,000s)	0.180	0.396	0.722	0.006	0.518	0.044	1.038	<0.001
Area (square kms)	<0.001	0.994	<0.001	0.219	-0.001	<0.001	<0.001	0.738
% visitors	0.050	<0.001	0.050	<0.001	0.133	<0.001	0.027	<0.001
% male	0.011	0.386	-0.002	0.900	-0.008	0.626	-0.012	0.525
Median age	0.030	<0.001	0.042	<0.001	0.044	<0.001	0.051	<0.001

In regional and remote areas of Victoria, both general outlets and packaged outlets were substantially more likely to be located in disadvantaged CDs. There were non-significant social gradients for on-premise and club licences. Effect sizes were substantially larger than in metropolitan areas with 17.3% and 15.8% decreases in general and packaged outlets with each decile of disadvantage.

As with the metropolitan models, tourism was significantly associated with alcohol availability. Population was generally positively associated with outlet numbers (except for general outlets), while CDs with higher median ages had higher numbers of all outlet types.

3.3.2 LONGITUDINAL DATA

Metropolitan areas

Figure 3.2 presents the broad changes between 1991 and 2006 in the socioeconomic gradient of alcohol availability across the four licence types examined in this study.

With the exception of packaged liquor outlets, inequalities in alcohol availability have substantially reduced over the period of the study. In 1991, all four categories of alcohol outlets were more common in disadvantaged areas, while by 2006, rates of on-premise and club outlets had flattened out across the deciles. The socioeconomic gradient of the density of general licences changed the most, from highly skewed towards disadvantaged neighbourhoods to the reverse.

A more detailed examination of the data found that this substantial change in the socioeconomic distribution of general outlets occurred almost entirely between the 1991 and 1996 Censuses, with the spread of general outlets across SEIFA deciles staying more or less the same between 1996 and 2006. When the specifics of this change were explored visually, it was clear that these results reflected a substantial gentrification of large areas of inner-city Melbourne between 1991 and 1996, rather than a dramatic shift in the location of general outlets within the city. In other words, many suburbs that had been highly disadvantaged in 1991 and had a large number of general outlets had, by 1996, experienced a substantial reduction in socioeconomic disadvantage without a corresponding reduction in general outlets. This is presented visually in Appendix 1.

Figure 3.2: Alcohol outlets per-capita by decile of socioeconomic disadvantage, 1991 and 2006, metropolitan Victoria
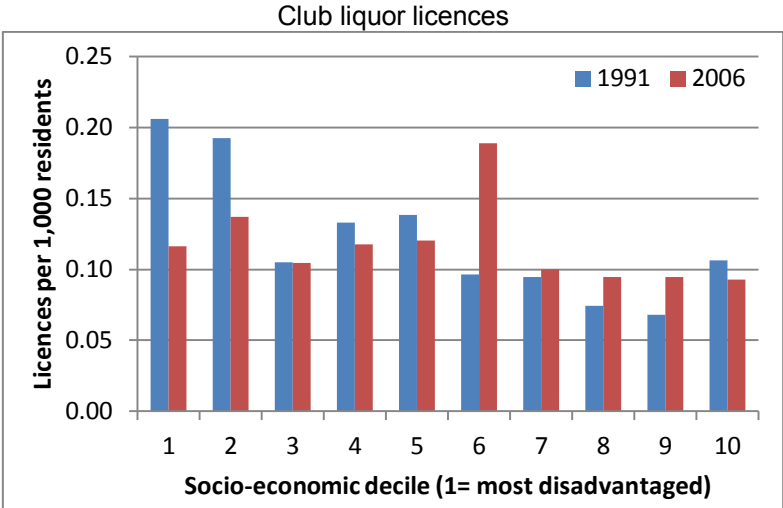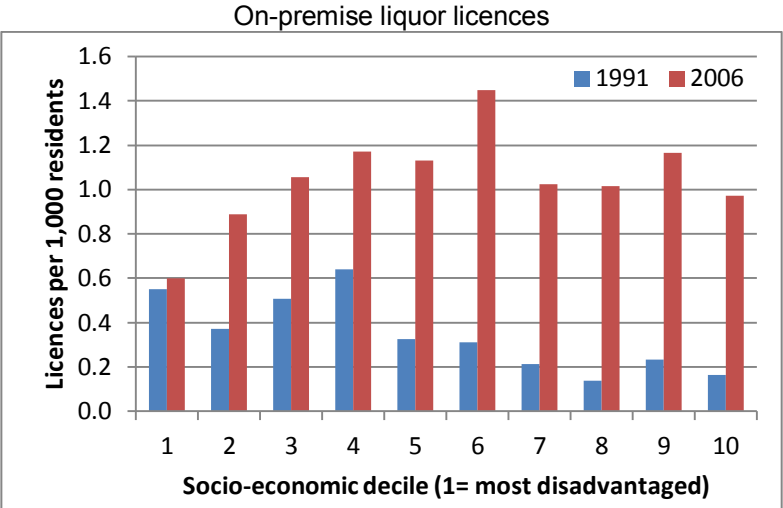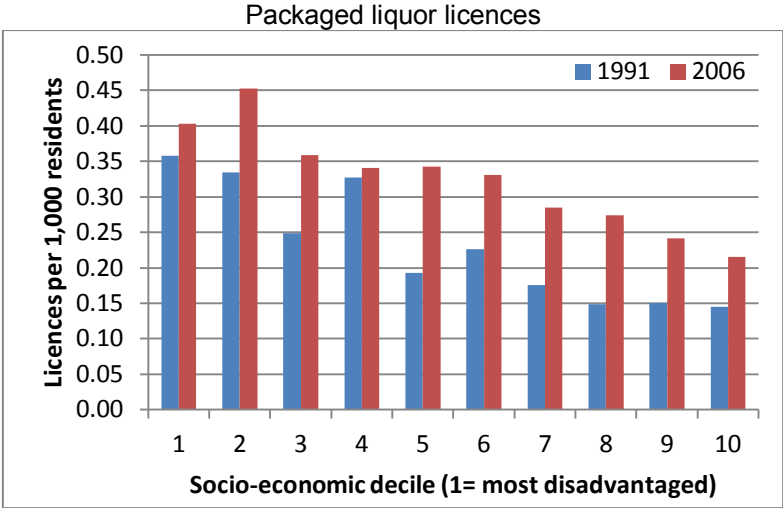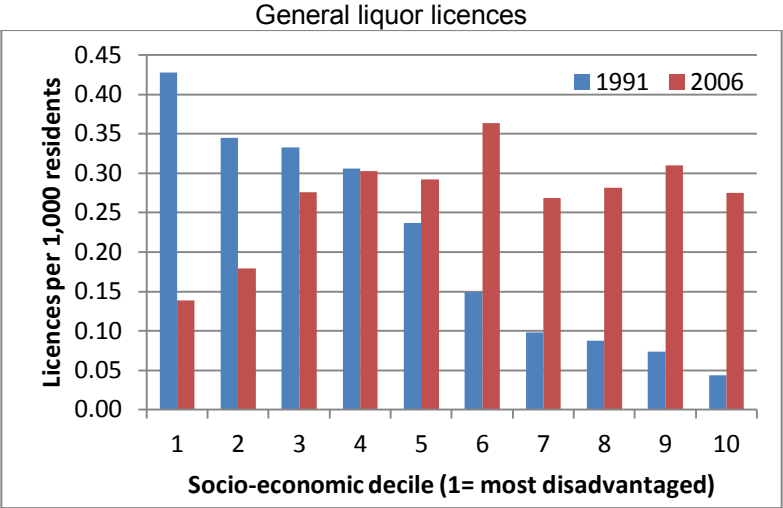
The data presented above reflect the socioeconomic distribution of outlets over time. As noted, this can be altered either by changes to neighbourhoods or to changes in the location of outlets. To explore more specifically how changes at the neighbourhood level altered the distribution of alcohol outlets between 1991 and 2006, a series of fixed-effects models were developed using data from the four Census years. These data were based on consistent geographical units (2006 Statistical Local Areas), with historical Census and licensing data concorded to these fixed boundaries. The areas under analysis in this section (SLAs) are substantially larger than those examined previously (on average, each SLA contains approximately 20 CDs).

The modelling approach used, fixed-effects modelling, maximises the explained variance within units, thus the results of the models reflect how changes in the independent variables across the time period are related to changes in the dependent variables. Thus, the models presented below assess how changes in socioeconomic status, demography and population relate to changes in alcohol outlet density over time. Dummy variables for year are included in the models to control out broad city-wide trends, but are excluded from the table for clarity. Results for the metropolitan SLAs are presented in Table 3.7.

Table 2.7 Negative binomial fixed effects models of the relationship between alcohol outlet density and socioeconomic disadvantage, 1991-2006, metropolitan Victoria

	General		Packaged		On-premise		Club	
	Coef	P-value	Coef	P-value	Coef	P-value	Coef	P-value
Decile	-0.020	0.382	-0.010	0.714	0.034	0.106	0.007	0.841
Population (1,000s)	0.015	0.024	0.023	0.000	0.014	0.001	-0.001	0.956
% male	-0.003	0.944	-0.019	0.667	-0.009	0.757	-0.012	0.849
% visitors	-0.010	0.700	-0.003	0.932	-0.017	0.510	-0.039	0.463
% aged 15-34	0.009	0.228	0.004	0.669	-0.014	0.030	-0.023	0.111

Longitudinally, there was no association between socioeconomic status and outlet density. Only population was associated with alcohol availability, with general, packaged and on-premise outlet numbers increasing along with the resident population. The other demographic factors included in the analysis were also non-significant.

These results appear at odds with the descriptive analyses presented above, which show substantial shifts in the socioeconomic gradient of general licence density. However, as was discussed, this shift has been driven not by a change in the location of general outlets as neighbourhoods get richer or poorer, but by the gentrification of areas that have consistently had large numbers of general outlets across the time period. Thus, these findings are in some sense supported, as the number of outlets in these neighbourhoods was largely unaffected by changes in their socioeconomic status over time. It is also worth noting that the longitudinal analysis presented here uses substantially larger geographical units, which may distort the actual associations between outlet density and disadvantage that exist at lower levels.

However, broadly speaking, the results presented in this section suggest that changes in socioeconomic status have had very little impact on how alcohol outlets are distributed across metropolitan Melbourne. Clearly there have been substantial shifts in the socioeconomic distribution of most licence categories (with the exception of packaged outlets), but these shifts appear to have occurred via the gentrification of neighbourhoods rather than via shifts in the location of licences. This section has thus highlighted that the link between the socioeconomic disadvantage of a neighbourhood and alcohol availability over time is minimal and that any impact of the relaxation of licensing laws in Victoria on the inequalities associated with alcohol availability has been positive, with licence densities in general becoming more evenly distributed across socioeconomic deciles over time.

Regional and rural areas

Figure 3.3 presents the distribution of alcohol outlets by decile of socioeconomic disadvantage for 1991 and 2006 in non-metropolitan areas of Victoria. The socioeconomic gradients of the four types of alcohol outlet density examined here have been largely stable in regional and rural areas. General and packaged liquor outlets were more common in disadvantaged areas in 1991 and this remains the case in 2006. Similarly, the distribution of club and on-premise licences has changed very little over the time period (even as the number of on-premise licences has more than tripled).
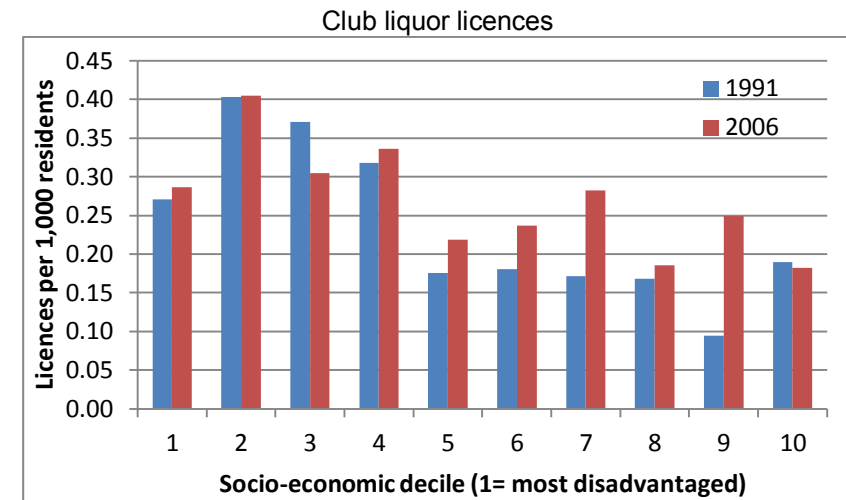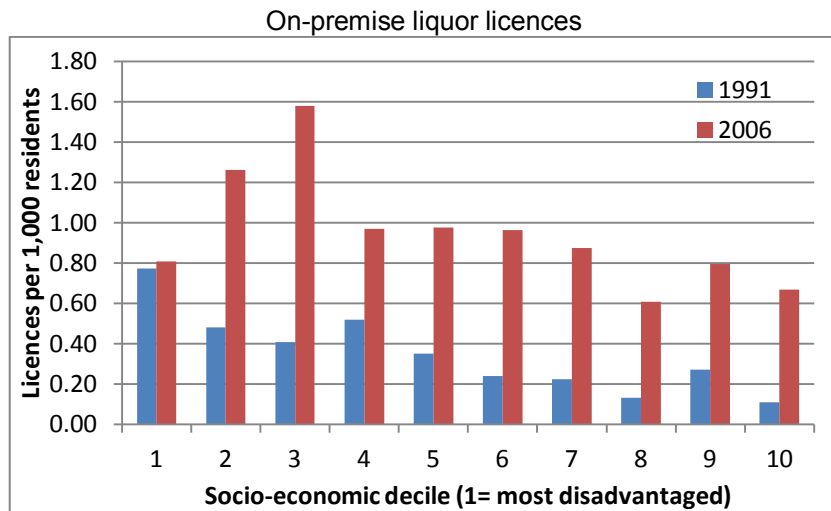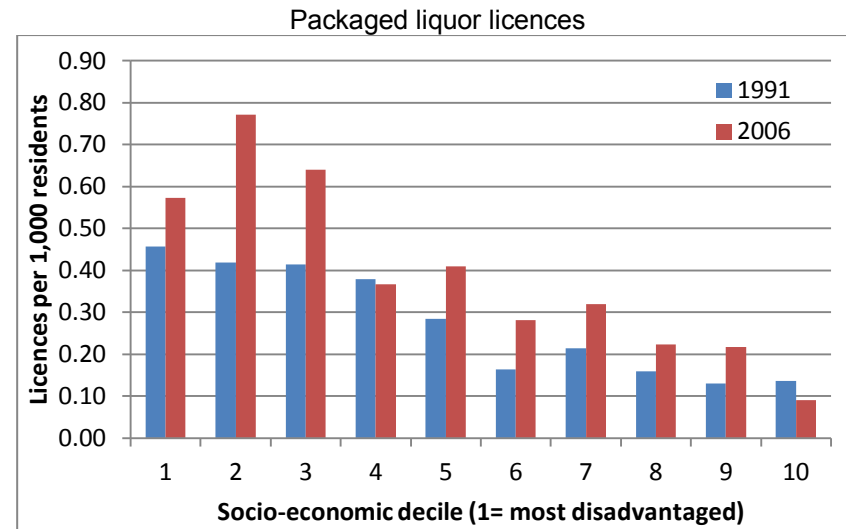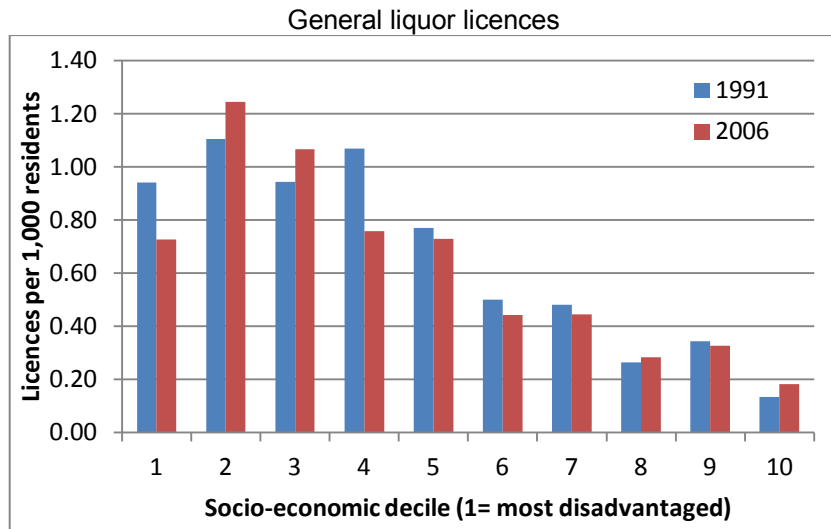
The lack of change in the distribution of alcohol outlets in rural and regional areas is further emphasised by the results of fixed-effects models developed using SLAs as the geographic units (Table 3.8).

Table 3.8 Negative binomial fixed effects models of the relationship between alcohol outlet density and socioeconomic disadvantage, 1991-2006, rural and regional Victoria

	General		Pack		On-premise		Club	
	Coef	P-value	Coef	P-value	Coef	P-value	Coef	P-value
Decile	0.019	0.582	0.052	0.303	0.062	0.115	-0.010	0.871
Population (1,000s)	0.015	0.361	0.025	0.256	0.030	0.076	0.001	0.701
% male	-0.013	0.761	-0.017	0.739	0.027	0.559	0.022	0.760
% visitors	-0.055	0.598	0.071	0.573	0.029	0.790	-0.115	0.547
% aged 15-34	-0.005	0.739	-0.019	0.391	-0.015	0.338	-0.003	0.901

Again, there are no significant relationships between licence numbers and changes in socioeconomic status over time. Thus, in regional areas, access to alcohol was heavily skewed towards more disadvantaged neighbourhoods in 1991, a situation that hasn't changed substantially in the ensuing 15 years.

Figure 3.3: Alcohol outlets per-capita by decile of socioeconomic disadvantage, 1991 and 2006, non-metropolitan Victoria

General liquor licences

Packaged liquor licences

On-premise liquor licences

Club liquor licences

3.4 Discussion

The results of this study highlight substantial socioeconomic variation in exposure to alcohol outlets in Victoria. Using data from 2006, neighbourhoods in metropolitan Melbourne were more likely to have a general or on-premise outlet the more socioeconomically advantaged they were. Contrastingly, packaged liquor outlets were substantially more prevalent in more disadvantaged neighbourhoods. In rural and regional areas general and packaged outlet numbers were higher in socioeconomically disadvantaged areas. When these relationships were examined over time, there were only minor associations between changes in the socioeconomic status of a neighbourhood and changes in alcohol availability. The most marked change between 1991 and 2006 has been the redistribution of general outlets in urban areas such that the socioeconomic gradient has reversed. However, this change has come about largely through the gentrification of neighbourhoods with historically high numbers of general outlets rather than via significant changes in the actual location of general outlets in Melbourne. Given the limited changes observed between 1991 and 2006, the remainder of the discussion will focus on the cross-sectional results using 2006 data.

The distribution of alcohol outlets observed in the metropolitan 2006 data in some ways makes simple economic sense. Outlets where alcohol is typically more expensive (general and on-premise outlets) are more likely to be located in areas of socioeconomic advantage, while outlets where alcohol is sold most cheaply (packaged outlets and clubs) are more prevalent in disadvantaged areas. These results are similar to recent findings in New Zealand [10] of higher densities of restaurants in more advantaged areas and the reverse relationship for packaged liquor outlets. Contrastingly, our findings for rural areas do not match those of Hay et al. [10] in New Zealand, who found higher densities of restaurants in less disadvantaged rural areas and otherwise fairly flat socioeconomic gradients. Contrastingly, the findings of this study suggest uniformly higher alcohol outlet densities in more disadvantaged rural areas.

The higher rates of exposure to packaged alcohol outlets in both urban and rural Victoria is of particular concern with respect to health inequalities in the State. As was discussed earlier, rates of alcohol related harm in Victoria are higher among people who are more socioeconomically disadvantaged [28, 66]. This is particularly the case for rates of chronic harm, such as liver cirrhosis [28]. There is growing evidence that the density of packaged liquor outlets in a community is related to the experience of alcohol-related harm in that community. Internationally, longitudinal studies have demonstrated links between packaged liquor outlets and consumption levels, public and domestic violence and sexual health [60, 67-69], while cross-sectional studies link a range of harms, including rates of chronic disease [55]. Recent studies using data from metropolitan Melbourne provide further evidence that the number of packaged outlets in a neighbourhood is problematic. Longitudinal studies demonstrate significant relationships between packaged liquor density and violence, domestic violence and chronic disease [3, 70, 71], while a cross-sectional study suggests heavy drinking amongst young people is associated with alcohol availability via packaged liquor outlets [4]. Thus, the findings of this study provide an indication that some of the socioeconomic disparities in alcohol-related harm found in Victoria may be related to an inequitable distribution of packaged alcohol outlets by level of disadvantage.

Contrastingly, the positive association between economic advantage and the density of general outlets (pubs) may act to reduce socioeconomic disparities in rates of alcohol-related harm, as densities of these outlets have also been linked to alcohol-related harm (particularly violence) [3]. However, general outlets are more likely to serve patrons from outside their direct neighbourhood, meaning that these effects may be less likely to be experienced only by people living in the more advantaged neighbourhoods with high densities of general outlets.

There has been limited analysis of the relationship between alcohol outlets and alcohol-related harm in rural settings, but the strong associations observed between socioeconomic disadvantage and alcohol outlet densities in non-metropolitan Victoria remain a cause for concern. Rates of alcohol-related harm and risky drinking are already high in rural and regional parts of Victoria, and the findings of this study suggest that rates of alcohol-related harm are likely to be significantly higher again among people living in areas of socioeconomic disadvantage.

The findings of this study are broadly consistent with a wider literature on health inequalities and alcohol availability [e.g. 44], with Victorians living in more disadvantaged communities exposed to substantially higher rates of alcohol outlets (particularly packaged liquor). Thus, alcohol policies that are aimed at reducing health inequalities in Victoria should focus on reducing packaged liquor outlet numbers in disadvantaged neighbourhoods.

4 References

1. Krieger, N., J.T. Chen, P.D. Waterman, M.-J. Soobader, S.V. Subramanian, and R. Carson, Geocoding and Monitoring of US Socioeconomic Inequalities in Mortality and Cancer Incidence: Does the Choice of Area-based Measure and Geographic Level Matter?: The Public Health Disparities Geocoding Project. Am. J. Epidemiol., 2002. 156(5): p. 471-482.

2. Wieczorek, W.F. and C.E. Hanson, Geographic Information Systems and Spatial Analysis. Alcohol Health and Research World, 1997. 21(4): p. 331-339.

3. Livingston, M., A Longitudinal Analysis of Alcohol Outlet Density and Assault. Alcoholism: Clinical and Experimental Research, 2008. 32(6): p. 1074-1079.

4. Livingston, M., A.M. Laslett, and P. Dietze, Individual and community correlates of young people's high-risk drinking in Victoria, Australia. Drug and Alcohol Dependence, 2008. 98(3): p. 241-248.

5. Chikritzhs, T., P. Catalano, R. Pascal, and N. Henrickson, Predicting alcohol-related harms from licensed outlet density: A feasibility study, in Monograph. 2007, National Drug Law Enforcement Research Fund: Hobart: Australia.

6. Stevenson, R.J., B. Lind, and D. Weatherburn, The relationship between alcohol sales and assault in New South Wales, Australia. Addiction, 1999. 94(3): p. 397-410.

7. Hyndman, J.C.G., C.D.A.J. Holman, R.L. Hockey, R.J. Donovan, B. Corti, and J. Rivera, Misclassification of Social Disadvantage Based on Geographical Areas: Comparison of Postcode and Collector's District Analyses. Int. J. Epidemiol., 1995. 24(1): p. 165-176.

8. Stillwell, J., G. Clarke, J. Charles, and H. Stillwell, Applied GIS and spatial analysis. 2003, Chichester, UK: Wiley.

9. Donnelly, N., S. Poynton, D. Weatherburn, E. Bamford, and J. Nottage, Liquor outlet concentrations and alcohol-related neighbourhood problems. Bureau of Crime Statistics and Research: Alcohol Studies Bulletin, 2006(8).

10. Hay, G.C., P.A. Whigham, K. Kypri, and J.D. Langley, Neighbourhood deprivation and access to alcohol outlets: A national study. Health & Place, 2009. 15(4): p. 1086-1093.

11. Kypri, K., M.L. Bell, G.C. Hay, and J. Baxter, Alcohol outlet density and university student drinking: a national study. Addiction, 2008. 103(7): p. 1131.

12. Treno, A.J., F.W. Johnson, L.G. Remer, and P.J. Gruenewald, The impact of outlet densities on alcohol-related crashes: A spatial panel approach. Accident Analysis and Prevention, 007. 39(5): p. 894-901.

13. Marmot, M., Social determinants of health inequalities. The Lancet, 2005. 365(9464): p. 1099-1104.

14. Turrell, G. and C. Mathers, Socioeconomic inequalities in all-cause and specific-cause mortality in Australia: 1985-1987 and 1995-1997. Int. J. Epidemiol., 2001. 30(2): p. 231-239.

15. Marmot, M.G., Understanding social inequalities in health. Perspectives in Biology and Medicine, 2003. 46(3): p. 9.

16. Harper, S. and J. Lynch, Trends in socioeconomic inequalities in adult health behaviors among US states, 1990–2004. Public Health Reports, 2007. 122(2): p. 177.

17. McLaren, L., Socioeconomic Status and Obesity. Epidemiol Rev, 2007: p. mxm001.

18. White, V., D. Hill, M. Siahpush, and I. Bobevski, How has the prevalence of cigarette smoking changed among Australian adults? Trends in smoking prevalence between 1980 and 2001. Tobacco Control, 2003. 12(suppl 2).

19. Wang, Z., C.M. Patterson, and A.P. Hills, Association between overweight or obesity and household income and parental body mass index in Australian youth: analysis of the Australian National Nutrition Survey, 1995. Asia Pacific Journal of Clinical Nutrition, 2002. 11(3): p. 200-205.

20. Bloomfield, K.I.M., U. Grittner, S. Kramer, and G. Gmel, Social inequalities in alcohol consumption and alcohol-related problems in the study countries of the EU concerted action 'Gender, Culture and Alcohol Problems: a Multi-national Study'. Alcohol Alcohol., 2006. 41(suppl_1): p. i26-36.

21. Marmot, M., Inequality, deprivation and alcohol use. Addiction, 1997. 92(3s1): p. 13-20.

22. Glover, J., D. Hetzel, and S. Tennant, The socioeconomic gradient and chronic illness and associated risk factors in Australia. Australia and New Zealand Health Policy, 2004. 1(1): p. 8.

23. Australian Institute of Health and Welfare, 2007 National Drug Strategy Household Survey - Detailed Findings. 2009, Australian Institute of Health and Welfare: Canberra.

24. Makela, P. and T. Paljarvi, Do consequences of a given pattern of drinking vary by socioeconomic status? A mortality and hospitalisation follow-up for alcohol-related causes of the Finnish Drinking Habits Surveys. British Medical Journal, 2008. 62(8): p. 728.

25. Martikainen, P., P. Makela, S. Koskinen, and T. Valkonen, Income differences in mortality: a register-based follow-up study of three million men and women. International Journal of Epidemiology, 2001. 30(6): p. 1397.

26. Hemstrom, O., Alcohol-related deaths contribute to socioeconomic differentials in mortality in Sweden. The European Journal of Public Health, 2002. 12(4): p. 254.

27. Harrison, L. and E. Gardiner, Do the rich really die young? Alcohol-related mortality and social class in Great Britain, 1988-94. Addiction, 1999. 94(12): p. 1871-1880.

28. Najman, J.M., G.M. Williams, and R. Room, Increasing socioeconomic inequalities in male cirrhosis of the liver mortality: Australia 1981-2002. Drug Alcohol Rev, 2007. 26(3): p. 273-8.

29. Mitchell, R. and F. Popham, Effect of exposure to natural environment on health inequalities: an observational population study. The Lancet, 2008. 372(9650): p. 1655-1660.

30. Walker, R.E., C.R. Keane, and J.G. Burke, Disparities and access to healthy food in the United States: A review of food deserts literature. Health & Place.

31. Gordon-Larsen, P., M.C. Nelson, P. Page, and B.M. Popkin, Inequality in the built environment underlies key health disparities in physical activity and obesity. Pediatrics, 2006. 117(2): p. 417.

32. Cummins, S. and S. Macintyre, Food environments and obesity--neighbourhood or nation? Int. J. Epidemiol., 2006. 35(1): p. 100-104.

33. Pearce, J., T. Blakely, K. Witten, and P. Bartie, Neighborhood Deprivation and Access to Fast-Food Retailing:: A National Study. American Journal of Preventive Medicine, 2007. 32(5): p. 375-382.

34. Reidpath, D.D., C. Burns, J. Garrard, M. Mahoney, and M. Townsend, An ecological study of the relationship between social and environmental determinants of obesity. Health & Place, 2002. 8(2): p. 141-145.

35. Burns, C.M. and A.D. Inglis, Measuring food access in Melbourne: Access to healthy and fast foods by car, bus and foot in an urban municipality in Melbourne. Health & Place, 2007. 13(4): p. 877-885.

36. Kavanagh, A., L. Thornton, A. Tatttam, L. Thomas, D. Jolley, and G. Turrell, Place does matter for your health: A report of the Victorian Lifestyle and Neighbourhood Environment Study (VicLANES). 2007, Key Centre for Women's Health in Society, The University of Melbourne.: Melbourne.

37. Henriksen, L., E.C. Feighery, N.C. Schleicher, D.W. Cowling, R.S. Kline, and S.P. Fortmann, Is adolescent smoking related to the density and proximity of tobacco outlets and retail cigarette advertising near schools? Preventive Medicine, 2008. 47(2): p. 210-214.

38. Novak, S.P., S.F. Reardon, S.W. Raudenbush, and S.L. Buka, Retail Tobacco Outlet Density and Youth Cigarette Smoking: A Propensity-Modeling Approach. American Journal of Public Health, 2006. 96(4): p. 670-676.

39. Peterson, N.A., J.B. Lowe, and R.J. Reid, Tobacco Outlet Density, Cigarette Smoking Prevalence, and Demographics at the County Level of Analysis. Substance Use & Misuse, 2005. V40(11): p. 1627-1635.

40. Hyland, A., M.J. Travers, K.M. Cummings, J. Bauer, T. Alford, and W.F. Wieczorek, Tobacco Outlet Density and Demographics in Erie County, New York. American Journal of Public Health, 2003. 93(7): p. 1075-1076.

41. Schneider, J., R. Reid, N. Peterson, J. Lowe, and J. Hughey, Tobacco Outlet Density and Demographics at the Tract Level of Analysis in Iowa: Implications for Environmentally Based Prevention Initiatives. Prevention Science, 2005. 6(4): p. 319-325.

42. Gorman, D.M. and P.W. Speer, The concentration of liquor outlets in an economically disadvantaged city in the northeastern United States. Subst Use Misuse, 1997. 32(14): p. 2033-46.

43. LaVeist, T.A. and J.M. Wallace, Health risk and inequitable distribution of liquor stores in African American neighborhood. Social Science & Medicine, 2000. 51(4): p. 613-617.

44. Berke, E.M., S.E. Tanski, E. Demidenko, J. Alford-Teaster, X. Shi, and J.D. Sargent, Alcohol Retail Density and Demographic Predictors of Health Disparities: A Geographic Analysis. Am J Public Health, 2010: p. AJPH.2009.170464.

45. Romley, J.A., D. Cohen, J. Ringel, and R. Sturm, Alcohol and environmental justice: the density of liquor stores and bars in urban neighborhoods in the United States *. Journal of Studies on Alcohol, 2007. 68(1): p. 48-55.

46. Pearce, J., P. Day, and K. Witten, Neighbourhood Provision of Food and Alcohol Retailing and Social Deprivation in Urban New Zealand. Urban Policy and Research, 2008. 26(2): p. 213 - 227.

47. Ellaway, A., L. Macdonald, A. Forsyth, and S. Macintyre, The socio-spatial distribution of alcohol outlets in Glasgow city. Health & Place, 2010. 16(1): p. 167-172.

48. Popova, S., N. Giesbrecht, D. Bekmuradov, and J. Patra, Hours and Days of Sale and Density of Alcohol Outlets: Impacts on Alcohol Consumption and Damage: A Systematic Review. Alcohol and Alcoholism, 2009. 44(5): p. 500.

49. Livingston, M., T. Chikritzhs, and R. Room, Changing the Density of Alcohol Outlets to Reduce Alcohol-Related Problems. Drug and Alcohol Review, 2007. 26: p. 557-566.

50. Britt, H.R., B.P. Carlin, T.L. Toomey, and A.C. Wagenaar, Neighborhood level spatial analysis of the relationship between alcohol outlet density and criminal violence. Environment and Ecological Statistics, 2005. 12: p. 411-426.

51. Gruenewald, P.J., B. Freisthler, L. Remer, E.A. LaScala, and A. Treno, Ecological models of alcohol outlets and violent assaults: crime potentials and geospatial analysis. Addiction, 2006(101): p. 666-677.

52. Livingston, M., Alcohol outlet density and assault: a spatial analysis. Addiction, 2008. 103(4): p. 619-628.

53. LaScala, E.A., F.W. Johnson, and P.J. Gruenewald, Neighborhood characteristics of alcohol-related pedestrian injury collisions: a geostatistical analysis. Prevention Science, 2001. 2(2): p. 123-134.

54. Scribner, R., D.A. Cohen, and T.A. Farley, A Geographic Relation Between Alcohol Availability and Gonorrhea Rates. Sexually Transmitted Diseases, 1998. 25(10): p. 544-548.

55. Theall, K.P., R. Scribner, D. Cohen, R.N. Bluthenthal, M. Schonlau, S. Lynch, and T.A. Farley, The Neighborhood Alcohol Environment and Alcohol-Related Morbidity. Alcohol Alcohol., 2009. 44(5): p. 491-499.
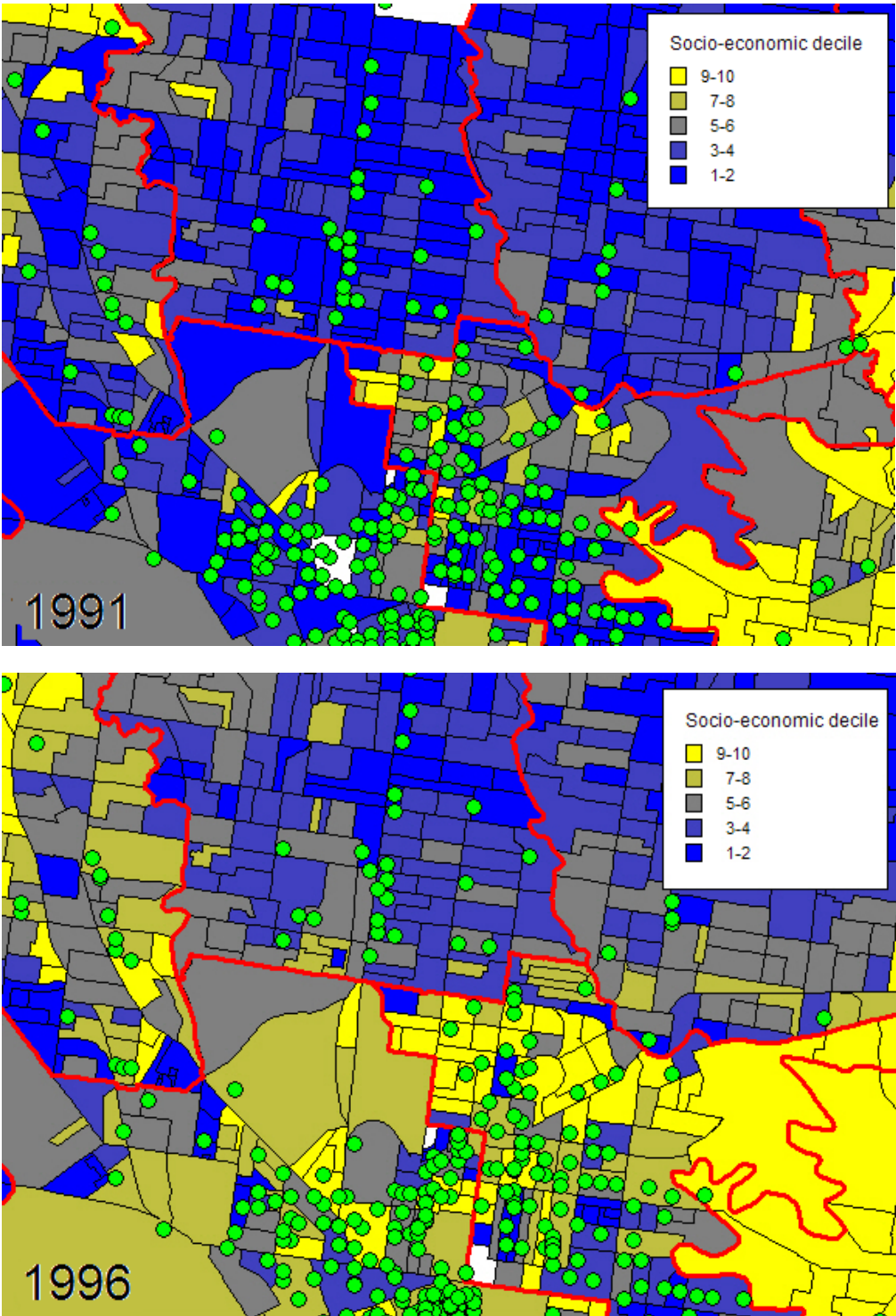
56.   Truong, K.D. and R. Sturm, Alcohol Environments and Disparities in Exposure Associated With Adolescent Drinking in California. American Journal of Public Health, 2009. 99(2): p. 264-270.

57.   Freisthler, B., P.J. Gruenewald, L.G. Remer, B. Lery, and B. Needell, Exploring the Spatial Dynamics of Alcohol Outlets and Child Protective Services Referrals, Substantiations, and Foster Care Entries. Child Maltreatment, 2007. 12(2): p. 114-124.

58.   Freisthler, B., L.T. Midanik, and P.J. Gruenewald, Alcohol outlets and child physical abuse and neglect: applying routine activities theory to the study of child maltreatment. Journal of Studies on Alcohol, 2004. 65(5): p. 586-592.

59.   Freisthler, B. and R.E. Weiss, Using Bayesian Space-Time Models to Understand the Substance Use Environment and Risk for Being Referred to Child Protective Services. Substance Use & Misuse, 2008. 43(2): p. 239 - 251.

60.   Gruenewald, P.J. and L. Remer, Changes in Outlet Densities Affect Violence Rates. Alcoholism: Clinical and Experimental Research, 2006. 30(7): p. 1184-1193.

61.   Livingston, M., How domestic violence rates change with changes in outlet density in Kettil Bruun Society Alcohol Epidemiology Symposium. 2009: Copenhagen, Denmark.

62.   Livingston, M., Alcohol outlet density and harm: comparing the impacts on violence and chronic harms in Kettil Bruun Society Thematic Meeting on Alcohol and Violence. 2010: Melbourne, Victoria.

63.   Australian Bureau of Statistics, Australian Standard Geographical Classification (ASGC). 2009, ABS: Canberra.

64.   Australian Bureau of Statistics, Information Paper: Census of Population and Housing - Socio-Economic Indexes for Areas, Australia, 2006. 2008, Australian Bureau of Statistics: Canberra.

65.   Australian Bureau of Statistics, Basic Community Profiles, Census 2006. 2006, Australian Bureau of Statistics: Canberra.

66.   Jonas, H., P. Dietze, G. Rumbold, K. Hanlin, S. Cvetkovski, and A. Laslett, Associations between alcohol related hospital admissions and alcohol consumption in Victoria: Influence of socio-demographic factors. Australian and New Zealand Journal of Public Health, 1999. 23(3): p. 272-279.

67.   Cohen, D.A., B. Ghosh-Dastidar, R.A. Scribner, A. Miu, M. Scott, P. Robinson, T.A. Farley, R.N. Blumenthal, and D. Brown-Taylor, Alcohol outlets, gonorrhea, and the Los Angeles civil unrest: A longitudianl analysis. Social Science & Medicine, 2006. 62: p. 3062-3071.

68.   Yu, Q., R. Scribner, B.P. Carlin, K. Theall, N. Simonsen, B. Ghosh-Dastidar, D.A. Cohen, and K. Mason, Multilevel spatio-temporal dual changepoint models for relating alcohol outlet destruction and changes in neighbourhood rates of assaultive violence. Geospatial Health, 2008. 2(2): p. 161-172.

69.   Stockwell, T., J. Zhao, S. Macdonald, B. Pakula, P.J. Gruenewald, and H.D. Holder, Changes in per capita alcohol sales during the partial privatization of British Columbia's retail alcohol monopoly: a multi-level local area analysis. Addiction, 2009. 104(11): p. 1827-1836.

70.   Livingston, M., The ecology of domestic violence - the role of alcohol outlet density. Geospatial Health, In Press.

71.   Livingston, M., Alcohol outlet density and harm: comparing the impacts on violence and chronic harms. Drug and Alcohol Review, In press.

APPENDIX 1   Changes in socio-economic distribution of general outlets between 1991 and 1996

The influence of gentrification on the shift in the socioeconomic distribution of general liquor licences in metropolitan Melbourne is demonstrated below in Figure X. While the distribution of general outlets (the green spots) remained fairly stable over the time period, the socioeconomic status of large sections of the inner-city shifted from highly disadvantaged (dark blue) to advantaged (yellow).

Figure A.1 – Distribution of general alcohol outlets by socioeconomic decile, 1991 and 1996

State Government
Victoria