A longitudinal analysis of alcohol outlet density and domestic violence

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A longitudinal analysis of alcohol outlet density and domestic violence

Michael Livingston

Aims: A small number of studies have identified a positive relationship between alcohol outlet density and domestic violence. These studies have all been based on cross-sectional data and have been limited to assess ecological correlations between outlet density and domestic violence rates. This study provides the first longitudinal examination of this relationship.

Design: The study uses data for 186 postcodes from within the metropolitan area of Melbourne, Australia for the years 1996 to 2005. Alcohol outlet density measures for three different types of outlets (hotel/pub, packaged liquor, on-premise) were derived from liquor licensing records and domestic violence rates were calculated from police recorded crime data, based on postcode of the victim. The relationships between these three types of alcohol outlet density and domestic violence were assessed over time using a fixed-effects model. Controls for the spatial autocorrelation of the data were included in the model.

Findings: Alcohol outlet density was significantly associated with rates of domestic violence, over time. In particular, the density of hotel (pub) licences and the density of packaged liquor licences were positively related to domestic violence rates and the density of on-premise licences was negatively related to domestic violence.

Conclusions: In Melbourne, changes in density of hotel (pub) licenses and packaged liquor licenses have been positively associated with changes in rates of domestic violence whereas the rates of on-site liquor licenses have been negatively associated with domestic violence.

Keywords: Alcohol availability, outlet density, domestic violence, panel methods

Introduction

Domestic violence is a significant problem in Australia, with the 2005 Personal Safety
Survey estimating that 15% of women aged 15 or older had experienced violence by a current
or previous partner (1), and research suggesting domestic violence is a precursor of more than
a quarter of homicides in Australia (2). In 2003, Begg et al. (3) estimated that intimate-
partner violence was responsible for 1.1% of the burden of disease and injury amongst
Australian women. While there remain debates about the causal role of alcohol in domestic
violence (4), there is a substantial body of evidence relating alcohol consumption to domestic
violence with, for example, Leonard (5) finding that alcohol is involved in between 25% and
50% of domestic violence incidents. Leonard also discusses the role of general alcohol
policy approaches in reducing rates of domestic violence, suggesting that measures focussing
on alcohol availability are likely to reduce violence rates. This is given support by one study
finding a negative effect of the price of alcohol on domestic violence (6) and some studies in
remote Australian towns which are suggestive of reductions in domestic violence following
restrictions in trading hours (7, 8).

The main theoretical reasons to expect the density of alcohol outlets in an area to be related to
domestic violence derive from simple availability theory (9), which, at its most
straightforward suggests that alcohol consumption will increase as alcohol becomes more
available. Thus, increases in off-premise alcohol outlets in an area may lead to increased
overall consumption (through more convenient access, lower prices due to competition or
increasingly visible advertising), which in turn will lead to increased heavy drinking
occasions and intoxication, thus increasing the risk of domestic violence. Contrastingly,
increases in outlets with a focus on on-premise alcohol consumption may alter drinking

practices such that more alcohol is consumed at these venues, which are typically the location of heavier drinking occasions (10), again increasing intoxication and risk of domestic violence taking place.

Similarly, there is a small body of evidence which suggests a significant link between the density of alcohol outlets in an area and the area's rate of domestic violence. This link is an intuitive extension of the previously discussed role of alcohol in domestic violence and the repeated studies demonstrating clear relationships between community-level factors (predominantly measures of disadvantage or social disorganisation) and domestic violence (11-15). An early study in New Jersey (16) found a positive relationship between total alcohol outlet density and police-recorded rates of domestic violence, but this relationship was no longer evident once socio-demographic control variables (e.g. social disadvantage, population movement etc) were controlled for. These findings suggest that the geographical relationship between alcohol outlet density and domestic violence is due to a common relationship with other socio-demographic factors. However, two recent studies have found a persistent relationship between alcohol outlet density and domestic violence, even with socio-demographic factors controlled for. In particular, a recent study by McKinney et al. (17) combined data from a national (U.S.) population survey and administrative data sources to assess whether self-reported experiences of intimate partner violence were related to alcohol availability, finding a positive link between alcohol outlet density and male-to-female partner violence. McKinney et al. also examined whether particular outlet types were problematic, finding that on-premise outlet density was significantly related to partner violence, but not off-premise. McKinney et al. (17) adjusted for a wider range of socio-economic and demographic characteristics, across individual, couple and community levels, finding that the relationship between outlet density and partner violence persisted with these factors

controlled for. Similarly, recent work by Livingston (18) in Melbourne, Australia found that while socio-demographic factors reduced the size of the relationship between outlet density and domestic violence, a significant effect remained. This study found a positive relationship between general (pub or hotel) licences and domestic violence and a negative link between on-premise (restaurant, bar, cafe) licences and domestic violence, suggesting very different roles for different types of alcohol outlets.

The development of this literature follows a substantial number of studies demonstrating that alcohol outlet density and rates of assaultive violence in general are related (see 19, 20, 21 for reviews). This link has been particularly strengthened by a series of studies which have examined the relationship between alcohol outlet density and violence over time, finding that changes in outlet density are related to changes in violence rates (22-25). These longitudinal findings provide stronger evidence that the relationship between outlets and violence is causal, and not related to other underlying factors not controlled for in cross-sectional analyses. Thus, while there are a growing number of cross-sectional studies suggesting that alcohol outlet density is related to domestic violence, there remains a need for an assessment of this relationship over time.

This study involves the first longitudinal analysis of the relationship between alcohol outlet densities and rates of domestic violence. The study uses data at the postcode level from Melbourne, Australia from 1996 to 2005 and uses spatial panel data methods. This time period and setting provide a particularly interesting frame for the study, with significant increases in alcohol availability taking place in Melbourne across the late 1990s and early 2000s (26).

Methods

This study is a population level analysis of domestic violence, focussing particularly on the longitudinal relationship between alcohol availability and domestic violence rates at a neighbourhood level.

Geographical units

Postcode level aggregate data on alcohol outlets and domestic violence were used to assess whether annual changes in alcohol outlet density were related to annual changes in rates of domestic violence. The study uses data from the 186 postcodes from the greater Melbourne region that have not had boundary changes over the ten years of the study (1996 to 2005). While some postcodes within the greater Melbourne area were excluded due to boundary changes (n = 37), the postcodes used in the study included approximately 85% of the population of Melbourne at the 2001 Census. In 2005, the average postcode was 14.7 kilometres square, with a resident population of 15,600 people. These are approximately half the size of US zip codes, but much larger than postal areas in the United Kingdom. Postcodes are the best administrative approximation of local suburbs or communities available, although in some of the outer areas of the city some include large non-residential areas such as state parks or industrial areas.

Licensing data

Data on active liquor licences for the 30th of June for each year of the study were provided by the Licensing Branch of the Victorian Department of Consumer Affairs. These data included the postcode in which each premise was located, and this field was used to assign outlets to postcodes. A check on the addresses of 200 random records across the study time-period found that the postcode data were accurate in 98% of cases. This study focussed on three

categories of liquor outlets: those with general licences, those with on-premise licence and those with packaged licences. These licences made up 67% of all licences in Victoria over the study period, with the rest made up of club licences, wholesalers and wineries. General licences (793 in the study area in 2005) allow the sale of alcohol for both on- and off-premise consumption and apply to hotels, pubs and taverns. On-premise licences (3,502 in the study area in 2005) allow for on-premise sales only and apply to a diverse range of outlets, including cafes, restaurants, bars and nightclubs. Packaged licences (974 in the study area in 2005) are for outlets that sell alcohol for off-premise consumption only, including retail liquor stores and some small grocery stores. Because this study was concerned with an outcome occurring in domestic settings, alcohol outlet density was calculated for each of these categories as the number of outlets per 1,000 residents.

Domestic violence data

Domestic violence incident data were provided by the Victorian Police Service from their Law Enforcement Assistance Program (LEAP) database. The data used are counts of 'family incidents' (incidents of domestic violence) recorded by the police for each postcode in the study area for the period 1996 to 2005. These incidents fall somewhere between calls and arrests – they are incidents where the police deem that an offence has taken place and will thus not include all calls, but will include offences that do not result in an arrest. It should be noted that using a policing driven measure of domestic violence creates the potential for biases in the analyses (e.g. reporting rates may be higher in some areas and thus higher rates recorded in those areas). In addition, many incidents of domestic violence are likely to be excluded from police-based statistics with, for example, the Australian 2005 Personal Safety Survey (27) finding that just 36 per cent of female victims of physical assault reported the

incident to the police. This represents a significant source of potential bias to the study, particularly if reporting rates vary along with the availability of alcohol. There is little published research on which factors influence the reporting of domestic violence in Australia, although there is research from the US indicating, for example, that non-white victims are more likely to report domestic violence, so the risk of bias from this measure is not negligible. However, police data is often used in these kinds of analyses (e.g. 11, 28-30), and the use of a range of control variables related to police reporting rates (e.g. socio-economic disadvantage) will ameliorate this bias somewhat. While some previous studies have used counts or rates based on geographic measures (e.g. 23, 24), the fact that these offences took place in residential settings meant that it made the most sense to use rate per 1,000 residents per year.

Population data

Population data for each postcode came from Census data for 1996 and 2001 and Estimated Residential Population data for 2005 (31, 32). For the remaining years (1997-2000, 2002-2004) population estimates were estimated using linear interpolation. While these population figures were thus estimates, they provided a reasonable approximation of population change over the study period.

Socio-economic data

Data on the socio-economic disadvantage of each postcode were derived from the Australian Bureau of Statistics Socio-Economic Index for Areas (SEIFA) index of relative disadvantage (33). This index is based on a range of variables collected during the five-yearly national

Census and provides a composite measure of socio-economic disadvantage in a neighbourhood. SEIFA scores range from a low of around 700 (most disadvantaged) up to a high of around 1200 (least disadvantaged) SEIFA data were available for 1996, 2001 and 2006 and data were linearly interpolated for the intervening years.

Analysis

The dependent variable for the regression analyses undertaken in this study was the annual rate of police-recorded domestic violence incidents across each of the 186 postcodes in the study area. The independent variables were the alcohol outlet density rates (both the overall rate and the rates of individual licence categories) along with the residential postcode of the population and the SEIFA index of relative disadvantage. The main aim of the study was to assess how changes in postcode-level outlet density related to changes in domestic violence rates over a ten year period (1996-2005). As the time-period under analysis is too short to develop reliable time-series models, it was necessary to make use of panel data analysis methods. These methods make up for the small number of time points in the study by replicating the analyses across the geographical units. This study uses fixed-effects models, which are asymptotically consistent, and appropriate for situations such as this where the units are not part of a random sample from a larger population. In addition, fixed-effects models focus on maximising the explained variance within units, reducing the possibility that cross-sectional differences between units will bias the results. To ensure that city-wide trends did not influence the results, the model included time-period fixed-effects as well as postcode-level fixed effects. Thus, this is a very conservative modeling strategy, ignoring cross-sectional differences between postcodes and overall trends, and instead only making use of variation within postcodes. The first model developed examines the relationship

between total licence density and domestic violence. This is followed by three models examining each type of licence in turn. Finally, all three licence categories were included in a single model to try to determine which were the most important in explaining rates of domestic violence.

Using spatially-based data such as those used in this study can result in a violation of the independence of the study's units, a key assumption of regression modeling. This is due to the presence of spatial autocorrelation in the data. This occurs when data for one region are related in some non-random way to data for nearby regions. If spatial autocorrelation is present in the data but not controlled for in analyses, the regression results can be substantially biased. Thus, this study used a spatial fixed-effects modeling procedure based on maximum likelihood estimators to ensure that non-biased regression results were produced. Conditional Auto-Regressive (CAR) models were developed, using simple Queen's contiguity weights, whereby the influence of all directly neighbouring postcodes is considered, but not any influence of non-neighbouring postcodes. These models were developed using the Matlab spatial econometrics toolbox developed by Paul Elhorst (34).

Results

Descriptive statistics for each of the measures used in the study are presented in Table 1. There is clearly sufficient variation over time within the postcode units to be able to assess the temporal relationship between outlet density and domestic violence. Even for on-premise outlet density, which has doubled in the study area over the time-frame studied, enough postcodes (10%) have experienced reductions in on-premise density to provide sufficient variance for the fixed-effects modeling.

The results of the fixed-effects regression models are presented in Table 2. For the sake of clarity, the year dummy variables (which control for overall trends) are not presented. These dummies were generally significant and positive in all models, indicating the city-wide increasing trend in domestic violence rates over the time-period.

The overall model found a small but significant positive effect for total licence density, with an increase in the overall rate of alcohol outlet density of 1 outlet per 1,000 residents resulting in an increase in the domestic violence rate of 0.08 per 1,000 residents. When the separate outlet categories were analysed, there were significant positive effects for each of the categories examined. The positive effects for general and on-premise licences were relatively small – an increase of one general outlet per 1,000 residents in a postcode was associated with an increase of 0.28 domestic violence incidents per 1,000, while an increase of one on-premise outlet per 1,000 residents was associated with an increase in the domestic violence rate of 0.11. The most substantial effect was found for packaged liquor outlets, with an increase of one packaged outlet per 1,000 related to an increase of 1.36 in the domestic violence rate. To provide some context, these effect sizes represent increases of 5.9%, 2.3% and 28.6% respectively from the overall mean of the domestic violence rate (4.76/1,000 residents).

When all three outlet categories were entered into the same model (Table 3), only packaged outlets remained significant, with an increase of 0.66 incidents of domestic violence per 1,000 residents for each additional packaged outlet. It is worth noting that the changes in availability across the three types of outlet are correlated over time. The correlation between the changes in packaged liquor density and general licence density are the highest (0.67, $p<0.01$), while the remaining correlations were non-significant.

Across all five models, the effect of the SEIFA index of relative disadvantage was significant and negative, highlighting the relationship between increased levels of disadvantage and increased rates of recorded domestic violence. The results also indicated significant positive spatial autocorrelation in the data across all the models. The spatial autocorrelation coefficients reported are substantial (~0.6), suggesting that rates of domestic violence are highly correlated between neighbouring postcodes and highlighting the risks of modeling these data with non-spatial methods.

Conclusions

This study adds to the small body of literature examining the connections between alcohol availability and domestic violence, providing the first longitudinal evidence of a relationship between alcohol outlet density and domestic violence. The study's findings contrast with previous cross-sectional work in this jurisdiction (18), which found that only general licences were positively linked to domestic violence, while on-premise licences were negatively linked. This highlights the possibility of misleading results in cross-sectional analyses, with the results of this longitudinal study providing a more intuitive set of relationships. In particular, the longitudinal analyses highlighted the substantial role of packaged liquor outlets in domestic violence, a relationship that was not detected in previous cross-sectional work.

The relationships found by this study suggest that all three types of alcohol outlets are related to increased levels of domestic violence, with general (or pub) licences and on-premise licences having a relatively small effect and packaged (off-premise) licences having a more substantial impact. These findings fit with theoretical justifications of the link between

alcohol outlet-density and domestic violence. Firstly, the strongest link is found for the type of outlet that sells alcohol for off-premise consumption. If the density of alcohol outlets is related to consumption levels (as suggested by some previous studies (35)), then it is plausible that increasing density of these particular outlets will result in increasing consumption of off-premise alcohol. This consumption is likely to take place within the home, increasing the risk of domestic violence. It is worth noting that, while general licences allow off-premise sales, they also sell a significant amount of alcohol for drinking on premises. These licences have been linked previously to general levels of assault (23, 36), and are often venues in which alcohol consumption is the main activity. There is some evidence that these types of premises are the site of particularly heavy drinking (37), and increasing densities of these kinds of outlets may result in higher frequencies of intoxication, and then to higher risks of domestic violence.

Both of these rationales rely on a link between outlet density and consumption, which remains somewhat contested (e.g. 38). This contrasts with studies focusing on outlet density and public violence, where a variety of theoretical justifications have been put forward to explain the link without requiring changes in consumption (19, 21, 39). While it is hard to imagine alcohol outlets affecting rates of domestic violence without affecting consumption in some way (e.g. by changing the amount, pattern or location of drinking), it is possible that the relationships found in this study reflect changes in socio-demographic factors which are correlated with both alcohol outlet density and domestic violence, although the incorporation of a broad measure of socio-economic disadvantage in the current study reduces the likelihood of this happening. The positive relationship between on-premise licences and domestic violence rates is harder to interpret, with these outlets selling all of their alcohol for consumption on-premises. It is possible that increases in restaurants and bars in an area may

change the way in which residents drink (e.g. encouraging heavier on-premise drinking), although, consistent with this study's results, this would be likely to have only a small effect.

The major limitation of the study is its use of a single composite measure of socio-economic disadvantage, due to the limitations of data available between Censuses in Australia. However, given the utility of this measure for assessing overall disadvantage and the conservative modeling design, this limitation is not likely to have influenced the alcohol effects observed.

The results of this study are consistent with a growing number of studies linking alcohol outlet density and domestic violence (17, 18, 40), adding to the evidence that alcohol availability is risk factor for domestic violence. In particular, the study finds longitudinal relationships between outlet densities and domestic violence rates, while utilising a very conservative study design, with cross-sectional variation, overall trends and spatial auto-correlation controlled, providing the strongest evidence yet for a direct effect of outlet density on domestic violence. The study particularly implicates hotel packaged liquor licences which, along with previous analyses linking these outlets to general rates of violence (23), suggests the need for changes to liquor licensing policy in Victoria that will stem the proliferation of these outlets.

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Table 1 – Descriptive statistics of study measures

	Mean	S.D.	Min	Max	Total change	Proportion postcodes decreasing
Domestic violence rate (per 1,000)	4.76	0.06	0	19.81	18.30%	33.9%
General licence rate (per 1,000)	0.39	1.29	0	18.52	-1.00%	63.4%
On-premise licence rate (per 1,000)	0.28	0.21	0	2.06	100.70%	10.2%
Packaged licence rate (per 1,000)	1.15	3.35	0	49.35	41.60%	20.3%
SEIFA index of disadvantage	1032.55	78.30	706.96	1162.48	-0.4%	66.7%
Population (x 1,000)	15.61	10.02	0.39	55.92	11.90%	18.9%

Table 2 – Fixed-effects model results – total licence density and separate models for each licence category

Model 1 – Total licences				Model 2 – General licences				Model 3 – Packaged licences				Model 4 – On-premise licences			
Variable	B	t-value	p	Variable	B	t-value	p	Variable	B	t-value	p	Variable	B	t-value	p
Residential population (1000s)	-0.01	-1.18	0.24	Residential population (1000s)	-0.01	-1.23	0.22	Residential population (1000s)	-0.01	-0.94	0.35	Residential population (1000s)	-0.01	-1.26	0.21
SEIFA	-0.02	-28.25	<0.01	SEIFA	-0.02	-27.99	<0.01	SEIFA	-0.02	-27.51	<0.01	SEIFA	-0.02	-28.32	<0.01
Total licence density	0.08	7.32	<0.01	General licences	0.28	6.93	<0.01	Packaged licences	1.36	5.45	<0.01	On-premise licences	0.11	7.21	<0.01
Spatial autocorrelation	0.60	26.11	<0.01	Spatial autocorrelation	0.59	25.33	<0.01	Spatial autocorrelation	0.59	25.50	<0.01	Spatial autocorrelation	0.60	26.37	<0.01

Table 3 – Fixed-effects model results – licence categories in multivariate model

Variable	B	t-value	p
Residential population (1000s)	-0.01	-0.86	0.39
SEIFA	-0.02	-27.67	<0.01
General licence density	0.05	0.46	0.64
Packaged licence density	0.66	2.35	0.02
On-premise licence density	0.07	1.66	0.10
Spatial autocorrelation	0.60	25.67	<0.01