The Locally-Specific Impacts of Alcohol Outlet Density in the North Island, New Zealand

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Acknowledgements

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• Commissioned and funded by: HPA (originally ALAC)

• Research Advisory Group: Mariska Wouters, Murray Clearwater, Eva McLaren and Giselle Baretta

Background

• The Sale and Supply of Alcohol Act 2012 gives local bodies the opportunity to develop Local Alcohol Plans

• More information on the locally-specific impacts of liquor outlets is needed

• This research goes some way towards addressing that need

• It follows earlier work conducted by Cameron et al. in Manukau City
The existing evidence base

- Inconsistent associations between outlet density and alcohol-related effect
  - ‘Availability theory’, on which most research is based, is contested because of the inconsistent evidence
  - Proximity and amenity effects may be a better characterisation
- Generally, outlet density is positively associated with alcohol-related harms (violent and other crime, motor vehicle accidents, hospitalisations, etc.), BUT
  - Varies with type of outcome, outlet type and context
- Growing body of NZ research
  - Similar to general findings
  - Social deprivation is important
The North Island outlet density project

- Commissioned by HPA (originally ALAC) in March 2012
- Aims to extend the previous research on relationships between outlet density and police events and motor vehicle accidents conducted in Manukau City
  - Spatially: The whole of the North Island is included
  - Temporally: Annual average effects over the period 2006-2011 are considered
- Makes use of a relatively new spatial estimation technique, geographically weighted regression (GWR)
  - Allows the relationship between outlet density (by type) and dependent variables to vary spatially
  - Allows locally-specific relationships to be estimated
Data

- Licensing data 2006-2011 for the whole of the North Island (from Ministry of Justice)
  - Geo-coded to CAU
  - Classified by type:
    1. Licensed clubs
    2. Bars and nightclubs
    3. Other on-licence
    4. Supermarkets and grocery stores
    5. Other off-licence
- Converted to outlet density (number of outlets per 10,000 usually resident population) for each CAU
Data

- Police incidents (from NZ Police CARD database), separated into seven categories:
  - Anti-social behaviour
  - Dishonesty
  - Drug and alcohol
  - Property abuse
  - Property damage
  - Sexual
  - Violence
- Motor vehicle crashes (from the NZTA CAS database)
- Converted to density (number of events per 10,000 usually resident population) for each CAU
Data

• Two control variables:
  • Population density (persons per sq kilometre) per CAU
  • New Zealand Deprivation Index for each CAU

• Some adjustments were made to the CAU map, to ensure adequate population size for calculating densities
  • 132 CAUs amalgamated (small population size)
  • 12 excluded (marinas, ports, harbours, etc.)
  • Final spatial model includes 1172 CAUs (including amalgamations)
Methods

• Geographically weighted regression
  • Uses a distance-weighted sub-sample of observations to produce an estimate for each target CAU
  • The sub-sample we employed was the 30 nearest neighbours
  • Each neighbour weighted by distance to target CAU
  • Balancing observed ‘local’ differences, estimate precision and weak data

• Two outputs
  1. A global model (based on OLS) which summarises the ‘average effect’, but doesn’t take account of any locally-specific effects
  2. A locally-specific model (GWR) where the coefficient estimates vary spatially, suitable for mapping

• All coefficients can be interpreted as marginal effects, i.e. the additional number of events associated with one additional outlet of the given type
## Results – Global Model

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Club density</td>
<td>3.197***</td>
<td>2.183**</td>
<td>0.026</td>
<td>0.672***</td>
</tr>
<tr>
<td>Bar and nightclub density</td>
<td>14.73***</td>
<td>13.43***</td>
<td>1.335***</td>
<td>2.395***</td>
</tr>
<tr>
<td>Other on-licence density</td>
<td>3.357***</td>
<td>4.324***</td>
<td>0.0004</td>
<td>0.779***</td>
</tr>
<tr>
<td>Supermarket and grocery store density</td>
<td>5.710***</td>
<td>9.816***</td>
<td>-0.170*</td>
<td>2.536***</td>
</tr>
<tr>
<td>Other off-licence density</td>
<td>-7.817***</td>
<td>6.994***</td>
<td>-0.040</td>
<td>-1.610***</td>
</tr>
<tr>
<td>NZ Deprivation Index</td>
<td>1.030***</td>
<td>0.642***</td>
<td>0.035***</td>
<td>0.250***</td>
</tr>
<tr>
<td>Population density</td>
<td>2.175***</td>
<td>4.655***</td>
<td>0.109***</td>
<td>0.076</td>
</tr>
<tr>
<td>Global Adjusted $R^2$</td>
<td>0.7927</td>
<td>0.6331</td>
<td>0.7133</td>
<td>0.6926</td>
</tr>
<tr>
<td>GWR Adjusted $R^2$</td>
<td>0.9455</td>
<td>0.8953</td>
<td>0.8806</td>
<td>0.9343</td>
</tr>
</tbody>
</table>

* Significant at 10%  ** Significant at 5%  ***Significant at 1%
## Results – Global Model

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<tbody>
<tr>
<td>Club density</td>
<td>1.267***</td>
<td>-0.031</td>
<td>0.853***</td>
<td>0.129</td>
</tr>
<tr>
<td>Bar and nightclub density</td>
<td>2.871***</td>
<td>0.321***</td>
<td>5.311***</td>
<td>0.511***</td>
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<tr>
<td>Other on-licence density</td>
<td>0.666***</td>
<td>0.004</td>
<td>0.557***</td>
<td>0.266***</td>
</tr>
<tr>
<td>Supermarket and grocery store density</td>
<td>3.698***</td>
<td>0.270***</td>
<td>2.901***</td>
<td>-1.124***</td>
</tr>
<tr>
<td>Other off-licence density</td>
<td>-0.816***</td>
<td>0.008</td>
<td>-0.758*</td>
<td>0.460***</td>
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<tr>
<td>NZ Deprivation Index</td>
<td>0.268***</td>
<td>0.015***</td>
<td>0.539***</td>
<td>-0.023**</td>
</tr>
<tr>
<td>Population density</td>
<td>0.308*</td>
<td>0.097***</td>
<td>0.482**</td>
<td>-0.781***</td>
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<tr>
<td>Global Adjusted R²</td>
<td>0.6496</td>
<td>0.5199</td>
<td>0.7335</td>
<td>0.3412</td>
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<tr>
<td>GWR Adjusted R²</td>
<td>0.8923</td>
<td>0.7893</td>
<td>0.9270</td>
<td>0.5040</td>
</tr>
</tbody>
</table>

* Significant at 10%  
** Significant at 5%  
***Significant at 1%
Results – Spatial variability in effects
Results – GWR

Bar and night club density vs. violent offences

- 9.00 - 13.00 (n=106)
- 6.00 - 9.00 (n=185)
- 5.00 - 6.00 (n=190)
- 4.75 - 5.00 (n=195)
- 4.00 - 4.75 (n=174)
- 3.00 - 4.00 (n=185)
- 0.00 - 3.00 (n=98)
- Stat. Insignificant (n=39)
Results – GWR

Bar and night club density vs. violent offences

<table>
<thead>
<tr>
<th>Density Range</th>
<th>Number (n)</th>
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<tbody>
<tr>
<td>9.00 - 13.00</td>
<td>106</td>
</tr>
<tr>
<td>6.00 - 9.00</td>
<td>185</td>
</tr>
<tr>
<td>5.00 - 6.00</td>
<td>190</td>
</tr>
<tr>
<td>4.75 - 5.00</td>
<td>195</td>
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<tr>
<td>4.00 - 4.75</td>
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<td>98</td>
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<tr>
<td>Stat. Insignificant</td>
<td>39</td>
</tr>
</tbody>
</table>
Results – GWR

Other off-licence density vs. violent offences

- 10.50 - 14.00 (n=53)
- 8.00 - 10.50 (n=49)
- 3.30 - 8.00 (n=50)
- 2.70 - 3.30 (n=50)
- 2.30 - 2.70 (n=47)
- 0.00 - 2.30 (n=51)
- Negative (n=270)
- Stat. Insignificant (n=802)
Results – GWR

Other off-licence density vs. violent offences

- 10.50 - 14.00 (n=53)
- 8.00 - 10.50 (n=49)
- 3.30 - 8.00 (n=50)
- 2.70 - 3.30 (n=50)
- 2.30 - 2.70 (n=47)
- 0.00 - 2.30 (n=51)
- Negative (n=270)
- Stat. Insignificant (n=602)
Results – GWR

Licensed club density vs. motor vehicle accidents

- 2.00 - 3.00 (n=48)
- 1.60 - 2.00 (n=49)
- 1.20 - 1.60 (n=45)
- 1.10 - 1.20 (n=43)
- 0.90 - 1.10 (n=58)
- 0.00 - 0.90 (n=59)
- Negative (n=12)
- Stat. Insignificant (n=858)
Results – GWR

Licensed club density vs. motor vehicle accidents

Legend:
- 2.00 - 3.00 (n=48)
- 1.60 - 2.00 (n=49)
- 1.20 - 1.60 (n=45)
- 1.10 - 1.20 (n=43)
- 0.90 - 1.10 (n=58)
- 0.00 - 0.90 (n=59)
- Negative (n=12)
- Stat. Insignificant (n=858)
Conclusions

• Different outlet types appear to have different effects
  • May be related to amenity effects
  • Diffusion bias

• Global models may mask substantial ‘local’ differences

• Some areas show no statistically significant associations

• The degree of observed spatial variation provides support for local alcohol policies
Further thoughts

• Does not show cause

• Quiet on interpretation i.e. What is behind the results? Why? Local knowledge is important

• Uses average effects – doesn’t consider changes over time

• GWR model is quite sensitive to weighting decision, inclusion/exclusion of variables, and the presence of outliers

• What about the South Island?