

# Post-earthquake analysis of crime and alcohol outlets in Christchurch

March 2018

Breetzke, G., Elley, B., & Gilbert, J.

A report commissioned by the Health Promotion Agency

## COMMENTS

The Health Promotion Agency (HPA) commissioned Independent Research Solutions to undertake this research as part of a HPA alcohol research investment round. The lead researchers are Greg Breetzke, Benjamin Elley and Jarrod Gilbert. This research examines the impacts on and relationships between alcohol outlets and crime patterns in post-quake Christchurch between 2009 and 2014. The analysis looks at the changing spatial distribution of alcohol outlets, changes in crime patterns, and six case studies looking at local areas.

HPA would like to acknowledge Cathy Bruce and Rhiannon Newcombe for the contribution to this project. The HPA commission was managed by Craig Gordon, Senior Researcher, HPA.

The report has undergone external peer review by Dr Michael Cameron, University of Waikato.

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ISBN: 978-1-927303-90-0

Authors: Greg Breetzke, Benjamin Elley and Jarrod Gilbert (Independent Research Solutions)

Citation: Breetzke, G., Elley, B., & Gilbert, J. (2018). *Post-earthquake analysis of crime and alcohol in Christchurch*. Wellington: Health Promotion Agency.

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March 2018

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## ACKNOWLEDGMENTS

I would like to thank Craig Gordon of the Health Promotion Agency for his assistance and support throughout this project. His patience, in the face of delays beyond the research team's control, was based on his belief in getting accurate results above all else.

Many thanks too to the primary members of the research team Greg Breetzke and Ben Elley whose expertise were the principal drivers of this study. The work of Marcus King, who worked under Dr Breetzke, also needs to also be acknowledged as it contributed greatly to this project.

Great thanks must also go to the Christchurch City Council's Martin Fergusson and our team of telephone interviewers who allowed us to create the most up-to-date licencing database in Christchurch.

Thanks too, to the current and former Alcohol Harm Reduction Managers of the Christchurch Police Gordon Spite and Al Lawn.

This area of research is extremely important, and we hope this contribution is valuable on its own, as a point for comparative analysis, and as a springboard for future studies.

Dr Jarrod Gilbert  
*Project Leader*

March 2018

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# Contents

Acknowledgments .....	2
List of Figures .....	5
List of Tables .....	6
Executive Summary .....	7
Method .....	7
Alcohol outlets .....	7
Local licence clusters .....	8
Introduction .....	9
Structure of report .....	9
Methodology .....	10
Data .....	10
Crime data – New Zealand Police .....	10
Alcohol licence data .....	11
Data analysis .....	12
Interviews .....	12
Survey and qualitative analysis .....	12
Preface: the context of alcohol and crime in Christchurch .....	13
The Canterbury Earthquakes .....	13
Alcohol outlets .....	15
Crime .....	17
Alcohol licences and crime .....	18
Relevant legislation .....	19
Part I. The Changing Spatial Distribution of Alcohol Outlets in Pre- and Post-Quake Christchurch .....	20
Introduction .....	20
Method .....	21
Statistical analyses .....	22
Results .....	23
Discussion .....	25
Policy implications .....	25

Part II. Assessment of “clusters of interest” crime-alcohol	
neighbourhoods in Christchurch .....	27
Introduction .....	27
Method .....	27
Identification of ‘cluster of interest’ neighbourhoods .....	27
Quantifying harms .....	28
The demographics of ‘cluster of interest’ neighbourhoods .....	28
Results .....	31
Comparison with the city overall .....	31
The central city .....	33
Riccarton .....	37
Merivale .....	41
Hornby .....	44
Papanui .....	47
Church Corner .....	50
Discussion .....	53
Conclusion .....	56
Looking ahead – future research .....	57
List of references .....	58

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# List of Figures

Figure 1: Crime data by offence category .....	11
Figure 2: Temporal sequence of seismic events in the Canterbury Earthquakes (Bannister & Gledhill, 2012) .....	13
Figure 3: Open and trading alcohol outlet numbers by year .....	15
Figure 4: Open and closed licences across Christchurch .....	16
Figure 5: Total offences (all categories) in Christchurch and nationwide by year .....	17
Figure 6: Licences and crime in Christchurch .....	18
Figure 7: A comparison of alcohol outlet density (per kilometre squared) before and after the Canterbury earthquakes .....	23
Figure 8: The central city buffer zone .....	34
Figure 9: Licences and offending in the CBD, compared with the city-wide offending rates .....	34
Figure 10: Number of offences in the central city .....	36
Figure 11: Crime by time of day in the CBD .....	37
Figure 12: The Riccarton buffer zone .....	38
Figure 13: Alcohol licences in the Riccarton area compared with offending, and with offending city-wide .....	39
Figure 14: Crime by time of day in Riccarton .....	39
Figure 15: The Merivale buffer zone .....	42
Figure 16: Alcohol licence and crime in Merivale .....	42
Figure 17: Crime by time of day in Merivale .....	43
Figure 18: The Hornby buffer zone .....	44
Figure 19: Licence and crime in Hornby compared with city-wide crime .....	45
Figure 20: Crime in Hornby by time of day .....	47
Figure 21: The Papanui buffer zone .....	48
Figure 22: Licence and crime in Papanui compared with city-wide crime .....	48
Figure 23: Crime in Papanui by time of day, sorted by year .....	49
Figure 24: The Church Corner buffer zone .....	51
Figure 25: Licence and crime in Church Corner compared with city-wide crime .....	51
Figure 26: Crime by time of day in Church Corner .....	52

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# List of tables

Table 1: Opening and closing licence numbers in Christchurch by year .....	16
Table 2: Descriptive statistics of alcohol outlets densities per CAU pre- and post-earthquake .....	24
Table 3: Neighbourhood characteristics of CAU with increased, decreased or no change in alcohol outlet density over the earthquake period .....	24
Table 4: Results of linear regression models for changes in densities of alcohol outlets per kilometre squared .....	25
Table 5: Descriptive statistics of clusters of interest .....	29
Table 6: ANOVAs .....	31
Table 7: Percentage change in number of offences by year in each area of interest relative to the offending rates city-wide .....	32
Table 8: Crime by period .....	32
Table 9: Crime by period, relative to Christchurch-wide changes ...	33
Table 10: Offences by year and by category in CBD .....	35
Table 11: Offences by year and by category in Riccarton .....	40
Table 12: Breaches of alcohol ban in Riccarton .....	40
Table 13: Offences by year and by category in Merivale .....	41
Table 14: Offences by year and by category in Hornby .....	46
Table 15: Offences by year and by category in Papanui .....	49
Table 16: Offences in Papanui by year and by category .....	52



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# Executive summary

- This study examines changes in the spatial distribution of alcohol outlets and crime in Christchurch, New Zealand between 2009 and 2014, covering the periods before and after the Canterbury Earthquakes of 2010/2011.
- The report is divided into two distinct but connected avenues of inquiry: Part I examines the changing spatial distribution of outlets in post-earthquake Christchurch, and Part II investigates how these changes relate to crime at a local level.
- Both can be read separately, but together they create a broader understanding of alcohol licensing and harm in post-earthquake Christchurch.
- The results of this study are specific to Christchurch and the unique circumstances of the earthquakes that occurred there, and do not necessarily transfer to other locations.

## METHOD

- The report draws on three sources of data:
  - 2013 census data
  - Crime data from the Police
  - Alcohol licence data adapted from the Christchurch City Council dataset that was built specifically for this project and is the finest grained available in New Zealand.
- These data allowed for the establishment of the first accurate picture of exactly how alcohol licensing changed in the pre and post-quake environment.
- Geographic information systems (GIS) was employed at both a global and localised level.
- The spatial distribution of alcohol outlets before and after the earthquakes was examined, looking at how the clustering of alcohol outlets changed and how these changes are related to socio-demographic factors in each neighbourhood.
- Six neighbourhoods with a high concentration of alcohol licences were identified as 'clusters of interest'. The relationship between alcohol outlet numbers and crime patterns over time was examined in each area individually.

## ALCOHOL OUTLETS

- Alcohol outlets in Christchurch experienced significant upheaval in the aftermath of the Canterbury Earthquakes. Of the outlets operating in Christchurch before the earthquake only 56 percent were operating by the end of 2014. Many closed down permanently and others eventually re-located.
- The city had a pre-quake peak of 845 actively trading licences in August 2010 which plunged to a low of 477 in February 2011 before slowly climbing to 769 in December 2014.
- The dense clustering of licensed premises in the central business district (CBD) was replaced by smaller clusters in the suburbs.
- Neighbourhoods that experienced an increase in alcohol outlet density were, on average, younger; had more foreign-born residents; more likely to be unpartnered and had a more mobile population than other neighbourhoods.

## LOCAL LICENCE CLUSTERS AND CRIME

- Across the four categories of crime under study (i.e., violence; drugs and antisocial; property damage; dishonesty), levels of crime have fallen substantially in Christchurch over the period in question, dropping by 28 percent (14,971 fewer offences) between 2009 and 2014. However, note that nationwide there was a 23 percent drop in these categories of crime over the same period.
- The majority of this fall in crime in Christchurch comes after the 2011 earthquake, with a drop of 22 percent (11,579 fewer offences) between 2010 and 2011 (Statistics New Zealand, 2014), after which crime rates have remained consistently low.
- Analysis of six neighbourhood 'clusters of interest' with high alcohol outlet density found that in the post-quake period crime trends in these areas deviated considerably from trends in the city as a whole.
- All of these areas (excluding the CBD) experienced spikes in offending post-quake that correlated with increased patronage. These spikes were often short-lived, lasting only one or two years. Despite this, some lingering concerns around crime in these areas remained.
- In the longer term, raw crime increased in only one of these areas. In relative terms, however, crime in these areas had not fallen to the same extent as they had fallen in Christchurch as a whole, with the exception of one.
- The reason for this cannot be definitively explained, and will require further research to assess the impact of certain licence types and/or premises, but it appears likely that the increases in patronage (much short term, some lasting) in these areas are an important contributor to offending.
- Although crime was higher in these areas than we might have expected, no relationship was apparent between crime in these clusters and the rising numbers of alcohol outlets. Spikes in offending did not correlate with new licences opening, and some areas showed decreases in offending as licence numbers grew.
- This disparity appears to be related to the types of licences opening: the majority of newly opened premises in all areas were restaurants rather than bars or pubs.
- This study was conducted during a transitional period, when the city had not yet fully rebuilt, and it is possible that a relationship between crime and alcohol outlet density may present itself later, once the city's outlet numbers stabilise and the CBD is redeveloped.

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# Introduction

This report was commissioned by the Health Promotion Agency in late 2014. It examines changes in the spatial distribution of alcohol outlets and crime in Christchurch, New Zealand between 2009 and 2014, covering the periods before and after the Canterbury Earthquakes of 2010/2011.

This period offers a unique backdrop because of the significant disruption caused to the urban structure of the city by the earthquakes. Christchurch at this time offers an opportunity to examine shifts in the physical locations in which people interact, work and socialise.

The aim of this research is twofold: first, we aim to investigate changes in the spatial distribution of alcohol outlets in Christchurch and second, to highlight certain neighbourhoods in the city which experienced an increase in outlets and to determine whether these increases in outlets in these areas were associated with a concomitant increase in crime. We do this using geographic information systems to analyse rich datasets of alcohol licences and offending at a neighbourhood and city-wide level.

## STRUCTURE OF REPORT

The report is broken into two separate and equally important parts. Both parts are self-contained but together they provide insight into the nature of the relationship between alcohol and crime in post-quake Christchurch. In the first part of the report we examine the changing spatial distribution of alcohol outlets in the aftermath of the Canterbury Earthquakes. We map the spatial location of alcohol outlets pre- (December 2009) and post-earthquake (December 2014) using a geographic information system. Using linear regression models, we identified socio-demographic factors which are associated with a change in alcohol outlets in neighbourhoods post-earthquake, controlling for a number of other factors. In the second part of the report we identify six local neighbourhoods in Christchurch that experienced significant increases in alcohol outlets post-quake and investigate the relationship between these increases and crime.

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# Methodology

## DATA

Data for this project are drawn from three primary sources: New Zealand Police crime data, an alcohol licence dataset obtained from the Christchurch City Council and expanded through direct contact with licence holders, and 2013 New Zealand Census data. These datasets are supported by interviews with key stakeholders (such as police and licence holders), and by the results of a brief survey of 340 licence holders and duty managers that was undertaken alongside the collection of alcohol licence data.

## CRIME DATA – NEW ZEALAND POLICE

This research uses crime data from Christchurch between the calendar years of 2009 and 2014. These data were drawn from the Police INCOFF database and the SAS Datamart. The data were matched using the unique occurrence identifier for each offence to get the location coordinates provided to us by the Statistics Manager of New Zealand Police.

These data record crimes individually, so can show cases where more than one crime was committed in a location by a single person. In order to highlight crimes that are likely to have a relationship with alcohol, four categories of crime were selected:

- Violence (includes homicide, assault, robbery, intimidation...)
- Drugs and antisocial (includes disorderly behaviour, alcohol and drugs...)
- Property damage (includes destruction of property...)
- Dishonesty (includes burglary, vehicle conversion, theft, receiving, fraud)

These crime types were selected for examination in this report because prior international research has shown a positive and statistically significant relationship with these types of crime and the availability and accessibility of alcohol outlets (see Brit et al., 2005; Freisthler et al., 2004; Freisthler et al., 2005; Gruenewald et al., 2002; Gyimah-Brempong 2001; Gyimah-Brempong & Racine, 2006; Lipton & Gruenewald, 2002; Livingstone, 2008). These four categories all display sharp increases in offending late at night that correlate with peaks in alcohol use.

These offence data were provided with the following information:

- The date of the offence
- The hour in which it was recorded (e.g. 2200-2300)
- The offence category (e.g. Violence, or Dishonesty)
- The offence code
- The offence description (e.g. Wilful Damage, or Theft Ex Dwelling over \$1000)
- Location of the offence (easting and northing)

Miscoded data and offences outside of Christchurch were removed, resulting in a total of 181,993 offences. The majority of these offences (60%) were in the dishonesty category (see Figure 1 below).

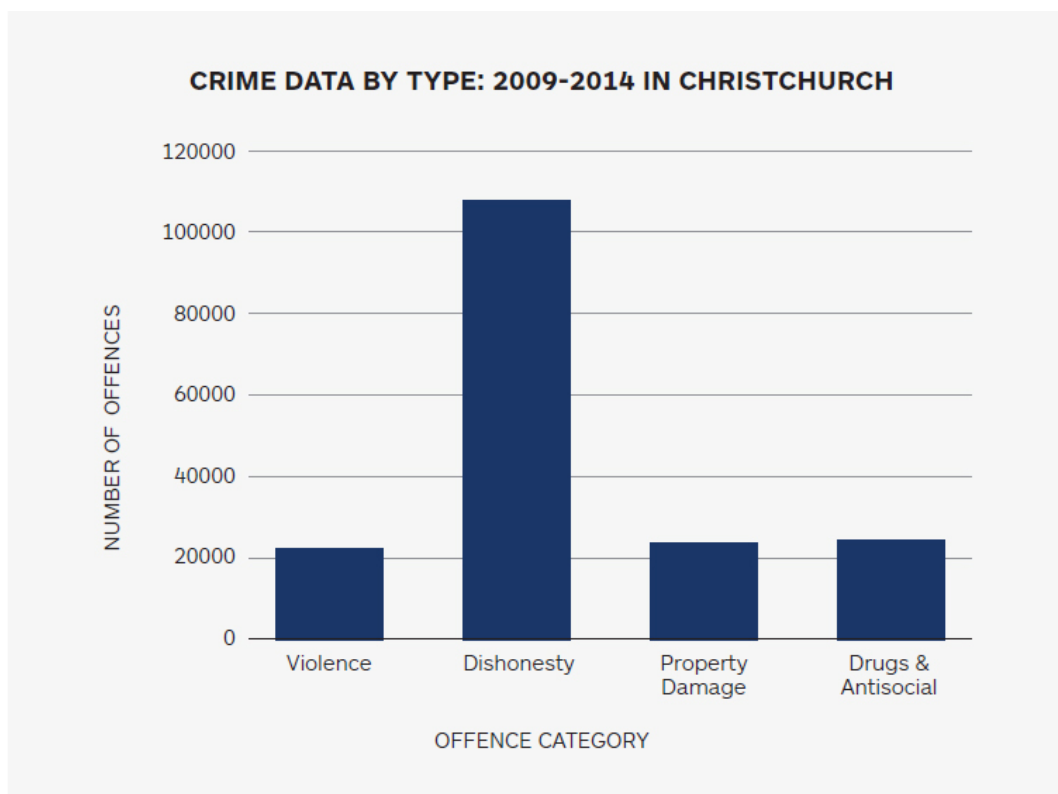


Figure 1: Crime data by offence category

## ALCOHOL LICENCE DATA

The alcohol licence database used in this research was created specifically for the project. This was necessary because the alcohol licence databases held by territorial authorities in New Zealand are not required to record which licensed premises are actively trading at any given time. This meant that although a large number of premises in Christchurch were permanently closed by the February 2011 earthquake, they were not recorded as closed until their alcohol licence expired, which in many cases was years after the premises in question were demolished and even replaced, giving a false impression of the number of licences in an area. In the centre of town, for example, in 2011 and 2012 there were hundreds of alcohol licences still recorded as potentially operating, whereas the number that were actually able to do business was zero.

Although previous research in the area has used the databases held by the Alcohol Regulatory and Licensing Authority (which are provided by local councils) and accepted that the level of error this creates was tolerable (Day et al, 2012), these data were found to be unsuitable in this case because of the finer-grained single-city focus and because the large numbers of earthquake-related closures substantially exacerbated the issue.

An alternative database was built by contacting all current or former licence holders that might have had open premises during the calendar years 2009-2014, based on contact information gained from the Christchurch City Council. Additional data such as opening dates (and closing dates where appropriate), the dates of temporary earthquake closures, and geocoding of each location were added in order to produce a high-quality database that was fit for finer-grained study of alcohol outlets. This database is the most accurate and specific of its kind in New Zealand, and was crucial for a study examining a period of unique disruption.

## DATA ANALYSIS

Data were analysed using two types of GIS software: ArcGIS and GeoDa. Specific techniques are noted in relevant parts of the report.

## INTERVIEWS

A number of in-depth interviews were also undertaken with key people around specific issues and findings stemming from the research process. These included the current as well as the former head of Alcohol Harm Prevention at the Christchurch police, eight key licence holders and a member of the Christchurch City Council alcohol licensing staff.

These interviews were used to provide context to the data, and also served as a means of verifying preliminary findings and identifying the causes of irregularities in the data.

## SURVEY AND QUALITATIVE ANALYSIS

As part of building the unique alcohol licence database, a survey of licence holders (or a suitable proxy such as a duty manager) was undertaken. The surveys were conducted between April and May 2015.

Ten people were employed as part of a call centre using Voice Over Internet Protocol (VOIP) established at the University of Canterbury. Each call operator worked from an introduction template and a 24-question survey that was designed to be completed in less than ten minutes. Probing of answers was minimal and the information received was 'top of mind' responses. Analysis was undertaken using SPSS software.

A total of 362 surveys were completed, 340 of which were usable. These recorded a number of measures around the effects the earthquakes had on businesses using Likert scales and yes/no questions. A number of open and closed-ended questions were asked about the *Sale and Supply of Alcohol Act 2012* and other issues of note.

Data drawn from this survey (such as which areas reported experiencing increases in patronage) were referenced in the process of choosing 'clusters of interest' in Part II of this report.

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# Preface:

## The context of alcohol and crime in Christchurch

### THE CANTERBURY EARTHQUAKES

The Canterbury Earthquakes comprised a series of large seismic events in the Canterbury Region of the South Island of New Zealand beginning in September 2010. **The two most significant events were the first earthquake of the sequence, a moment magnitude ( $M_w$ ) 7.1 earthquake that struck on the 4th September 2010 (Darfield Earthquake), and a  $M_w$  6.3 earthquake that struck on the 22nd February 2011 (Christchurch Earthquake).** Whilst the Christchurch Earthquake was notably smaller in magnitude than the Darfield event, it was responsible for a greater amount of damage as a result of the higher peak ground acceleration observed during the latter event (Bannister & Gledhill, 2012). Figure 2 below provides a graphical summary of the seismic events that occurred in the Canterbury Region between September 2010 and the start of 2012. The temporal distribution of the earthquakes contains four primary peaks followed by aftershocks decreasing in intensity and number.

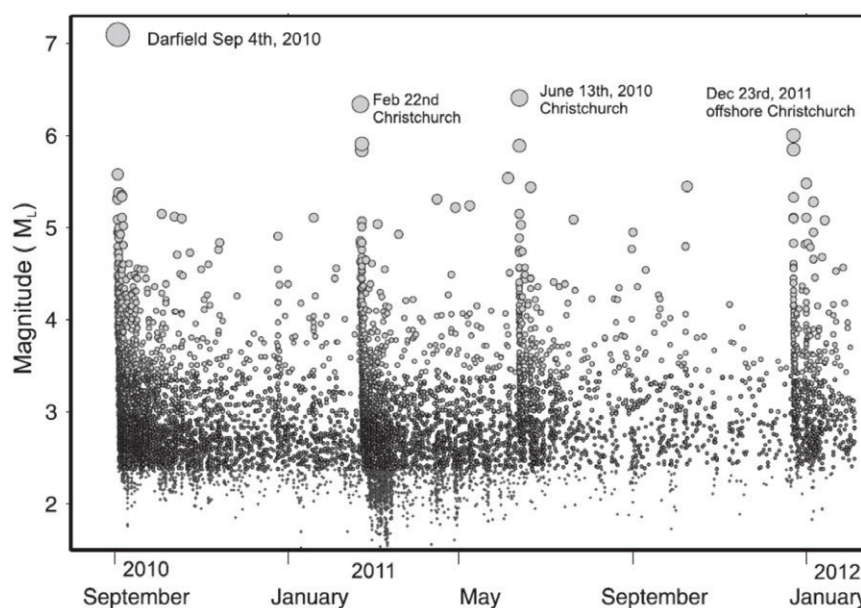


Figure 2: Temporal sequence of seismic events in the Canterbury Earthquakes (Bannister & Gledhill, 2012)

The effects of the Canterbury Earthquakes on the Canterbury Region were significant. From a social perspective, the **earthquakes resulted in 185 fatalities and more than five thousand injuries (including injuries in the aftermath)**, mostly caused by falling debris and actions during shaking (such as tripping whilst running). It was the country's second deadliest earthquake. Johnston et al. (2014) relates the disparity in deaths between the two earthquakes to the timing of each event. The Darfield Earthquake occurred at 0435am on a Saturday morning, minimising the population exposed to falling debris and building collapse (limited to the Central Business District (CBD)), whilst



the Christchurch Earthquake occurred near midday on a working day (Tuesday), maximising the exposed population. In the immediate aftermath of the Christchurch Earthquake, an estimated 55,000 residents fled the city (Nissen and Potter, 2011). Intra-city movement also took place as residents whose homes had been severely damaged were forced to stay with friends and family, or move to other temporary accommodation in the city. In the longer term, the population exodus from Christchurch has continued, driven largely by dissatisfaction over post-earthquake living conditions, fear of further earthquake events, and demolition work on residences. **The population of Christchurch has decreased by 2 percent compared to pre-earthquake levels which contrast starkly with the national population levels which have increased by 5.3 percent over the same time period (CERA, 2015).** In the immediate aftermath of these events, a cordon was placed around the central business district (CBD) of Christchurch and extensive structural assessments undertaken within the cordoned off area as well as across the city as a whole to ascertain the level of damage sustained. Within the CBD, 47 percent of buildings were assessed to be unsafe or required restricted access (Kam et al., 2011) while across the city over 150,000 houses (around three quarters of Christchurch's housing stock) sustained some damage from the earthquakes, and of these around a fifth exceeded NZ\$100,000 in estimated damage (Parker and Steenkamp, 2012). **Over 60 percent of the roughly 6000 businesses located in the Christchurch CBD – employing almost 30 percent of the Christchurch workforce – were forced to close at least temporarily (Stevenson et al., 2011). This included a total of 297 alcohol outlets, or approximately 37 percent of all alcohol outlets located in Christchurch.**

The Canterbury Earthquakes also had a substantial impact on the mental and physical health and wellbeing of residents. Increased stress, anxiety, and depression have all been observed in residents (see Gawith, 2013; Osman, Hornblow, Macleod, & Coope, 2012; Renouf, 2012; Sullivan & Wong, 2011) with females, the elderly, and families married with children the most susceptible (see Osman et al., 2011). **Residents in neighbourhoods which experienced greater earthquake damage have also been found to be at an increased risk of mental health problems (see Renouf, 2012).** In terms of physical health, Pearson, Kingham, Mitchell, and Apparicio (2013) found a positive relationship between the presence of dust resulting from liquefaction and pneumococcal pneumonia while an increase in heart attacks were also reported immediately after the Darfield Earthquake (CERA, 2013). Other social effects related to education; community cohesiveness (Osborne & Sibley, 2013; Thornley, Ball, Signal, Lawson-Te Aho, & Rawson, 2013) and Māori and other populations (Osman et al., 2012) have been noted by researchers but are not discussed in greater detail here. From a physical perspective, the lateral and vertical movement of the Canterbury Earthquakes resulted in significant building damage throughout the Canterbury Region. Damage varied considerably, from the superficial cracking of paint to extreme structural damage, and in rare cases, the collapse of buildings. The spatial distribution of damage was also uneven with the most severe damage occurring in the CBD and in neighbourhoods immediately surrounding the CBD and along the Avon River. Liquefaction and lateral spreading severely affected the city's infrastructure disrupting telecommunications, power supply, water, and sewerage services. Since February 2011, Christchurch has been in a constant and ever-changing state of rebuild and recovery. Over 1200 buildings have been demolished, mostly in the CBD and in a region of Christchurch known as the Residential Red Zone (CERA, 2015). This is a non-continuous zone of land defined throughout residential areas in Christchurch where earthquake damage was most severe, and where substantial numbers of properties were deemed unsafe for future habitation. **The New Zealand Treasury estimates the total repair and rebuild costs of the Canterbury Earthquake sequence to be roughly NZ\$40 billion,** or approximately 20 percent of New Zealand's Gross Domestic Product (GDP) (New Zealand Treasury, 2013).



## ALCOHOL OUTLETS

In the period following the Canterbury earthquakes there were dramatic changes in the number of Christchurch's licensed businesses. The city had a pre-quake peak of 845 licences in August 2010 which plunged to a low of 599 in February 2011 (only 477 of which were actively trading) before slowly climbing up to 768 in December 2014. As shown in Figure 3 below, the two earthquakes caused comparable numbers of closures.

A further 147 licences reported temporarily closing for at least one month after the Canterbury earthquakes. While some reopened quickly, many of these closures lasted for long periods of time: of the 116 who were able to recall the full dates of their closures, the length of those closures ranged from 28 to 1611 days (4.4 years), with an average of 543 days (1.48 years). Three licences had yet to reopen, two of which stated that they had reopening dates in 2016.

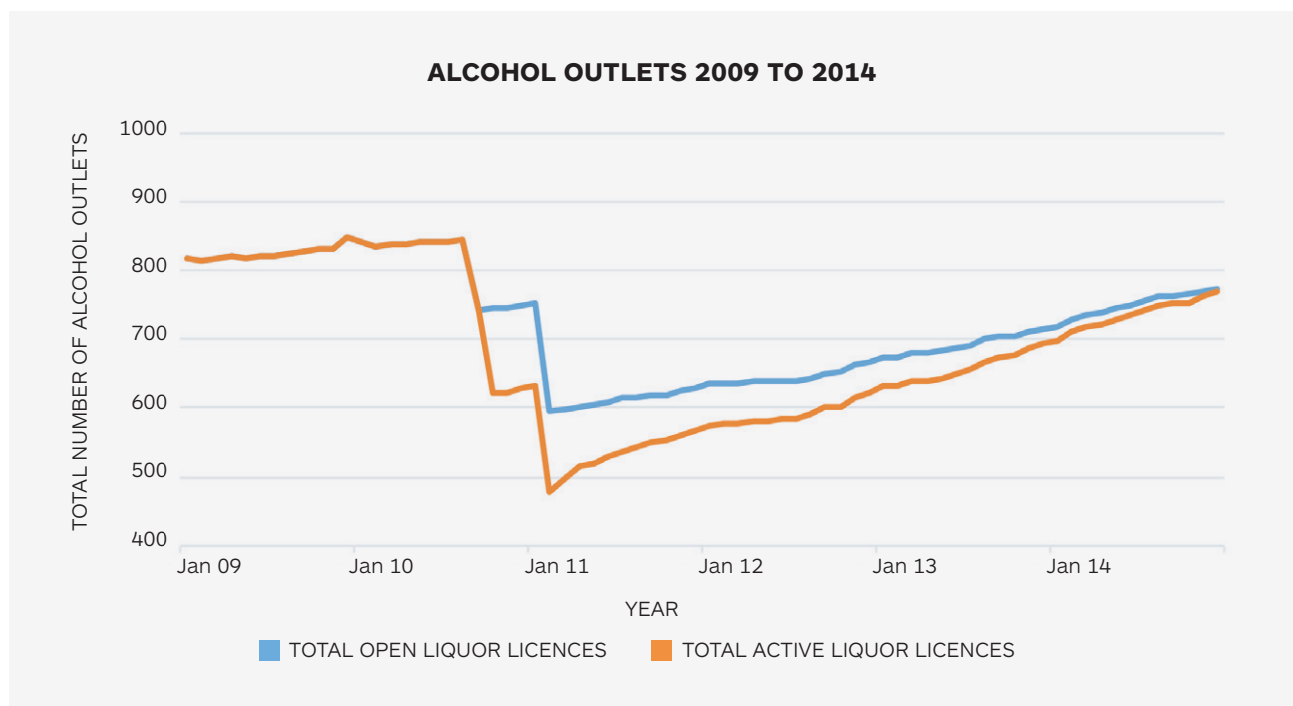


Figure 3: Open and trading alcohol outlet numbers by year

This graph plots the number of alcohol licences that were open but not necessarily trading ('open licences', in blue) and the number of licences that were actually trading ('active licences', in orange).

Some 247 new licensed premises have opened in Christchurch in the time between the February earthquake and December 2014, 77 percent (190) of which were on-licences and 13 percent (32) were off-licences, with the remaining 10 percent comprised of less common licences such as club licences and BYOs. As shown in Table 1 below, this is generally proportional to the existing licences, with a slightly higher number of on-licences.

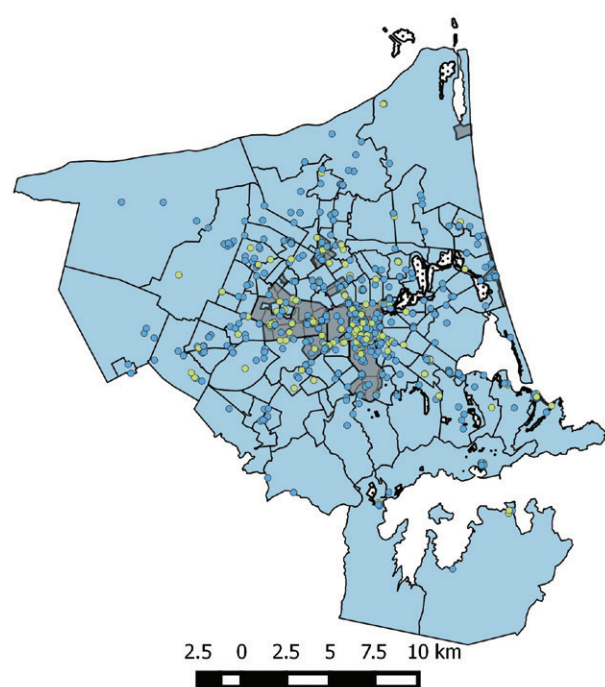
As shown in Table 1, the number of licences ceasing to do business each year in Christchurch has remained fairly consistent, aside from the sudden deviations caused by the earthquakes in 2010 and 2011. Growth in licences remained steady through the earthquakes, and was increasing at a greater rate toward the end of the period under study. Interestingly, of the 111 alcohol licences opened in 2012 and 2013, only 9 have closed in the following 1-3 years, indicating that post-quake Christchurch is a relatively forgiving environment for new licensed businesses.

The percentage of all active licences that were off-licences remained relatively steady throughout the period under study, rising slightly after the earthquakes, from 16.9 in 2010 to 20.4 in 2012, but declining to 18.3 in 2014 (Table 1).

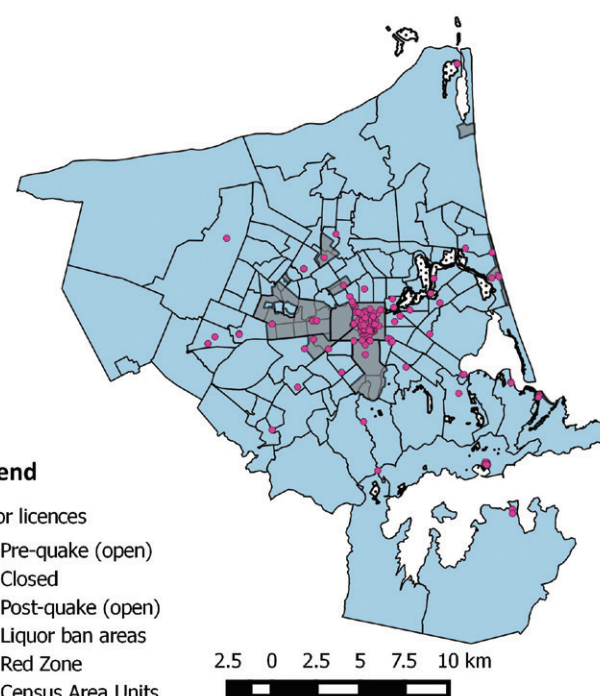
Table 1: Opening and closing licence numbers in Christchurch by year

	2009	2010	2011	2012	2013	2014
Average new licences per month	3.8	3.6	4.3	4.2	5.1	6
Total new licences per year	45	43	51	50	61	72
Average closing licences per month	1.3	11	14.3	0.9	1.1	1.3
Total closing licences per year	15	132	172	11	13	15
Percentage of off-licences (as of January)	17.2	16.9	18.6	20.4	20.4	18.3

#### OPEN LICENCES IN CHRISTCHURCH 2014



#### CLOSED LICENCES IN CHRISTCHURCH 2014



#### Legend

- Liquor licences
  - Pre-quake (open)
  - Closed
  - Post-quake (open)
- Liquor ban areas
- Red Zone
- Census Area Units

Figure 4: Open and closed licences across Christchurch.

New (post-quake) licences are shown on the left in green, while licences that existed pre-earthquake are rendered in blue. Licences that closed in 2010 or 2011 (most likely as a result of the earthquakes) are shown on the right in pink. Note the concentration of closed licences in the central city, but sparse distribution elsewhere.

As we can see in Figure 4, closures of outlets are clustered primarily in the central city area, but smaller numbers are scattered throughout the city. **The CBD accounts for the majority of all closures, with 77 percent ( $n = 234$ ) of the 304 reported closures in 2010 and 2011 located inside the Central City buffer zone** (see Part II).

This leaves only 70 closures throughout the rest of the city, which indicates that **few areas outside the CBD had major decreases in numbers of licensed premises**. Although permanent closures were lower outside of the CBD, only 20 of the 147 licences that reported closing temporarily after the earthquake were within the Central City buffer zone, indicating that **some areas experienced significant numbers of temporary closures instead of permanent ones**. Because the average length of temporary closures was more than one and a half years, however, this may mean that many areas still experienced significant decreases in alcohol outlets for long periods.

After the earthquakes, new licences began appearing in small numbers throughout the city. In figure 4 clusters of new licences are visible to the south of the central city and along Riccarton road (heading west of the CBD) around Westfield Riccarton and Church Corner. **As we can see by comparing the two maps, new licences are not directly replacing closed ones, but are moving into areas that have experienced few closures**. Although the CBD experienced the majority of closures, 61 percent of new licences have opened outside of the CBD area. **This means that for many areas (such as those targeted in Part II), there was an increase in the raw number of licensed premises relatively soon after the earthquake.**

## CRIME

Across the four categories under study (i.e., violence; drugs and antisocial; property damage; dishonesty), levels of crime have fallen substantially in Christchurch over the period in question, dropping by 28 percent (n = 14,971 fewer offences) between 2009 and 2014. The majority of this fall comes after the 2011 earthquake, with a drop of 22 percent (n = 11,579 fewer offences) between 2010 and 2011 (Statistics New Zealand, 2014), after which crime has remained relatively consistent in Christchurch.

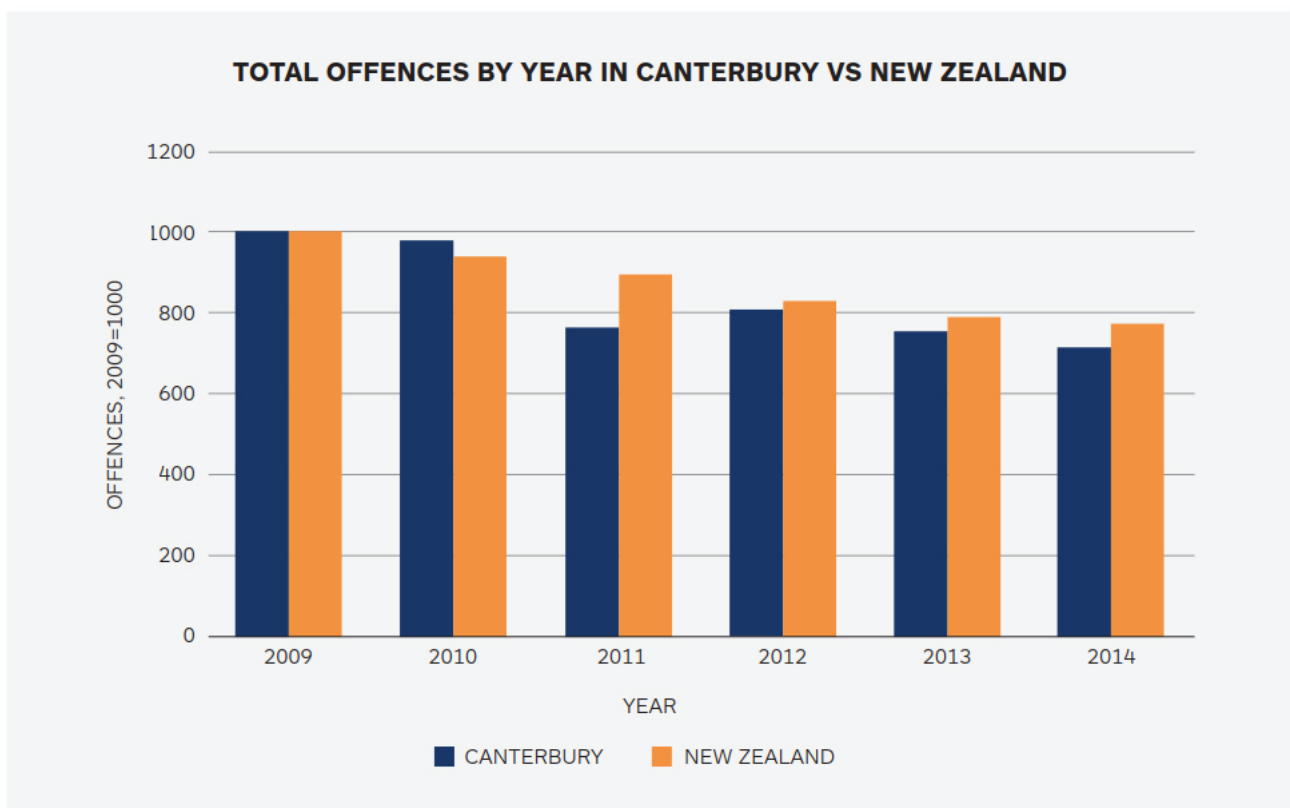


Figure 5: Total offences (all four categories) in Canterbury and nationwide by year. Plotted with base of 2009=1000 for comparison (Statistics New Zealand 2016).

Although the 2011 fall is a considerable deviation from nationwide trends, crime across the country has fallen considerably during this period as well, decreasing by 23 percent ( $n = 101,016$  fewer offences) between 2009 and 2014 (ibid). As we can see in Figure 5, although the two rates of offending are not perfectly comparable, there is reason to believe that declining crime in Christchurch is being motivated not only by Christchurch-specific factors, but also by the factors that are driving the decrease nationwide.

This nationwide decrease, while certainly influenced by falling offending in Christchurch, is too significant to be explained by the effect of the earthquakes. When offending fluctuates in Christchurch (such as the large drop of offending in 2011 and then the rise in 2012) we see no such fluctuations in national offending, which continues to decline steadily.

## ALCOHOL LICENCES AND CRIME

Although alcohol licence and offending numbers in Christchurch were both clearly affected by the earthquakes and the ensuing disruption, their development in the years after the earthquakes has been significantly different.

Figure 6 below indicates that the number of active alcohol licences in the city falls immediately after the 2011 earthquake, as does the rate of offending in our four categories. Although there is some visually apparent correlation as both decline after the earthquakes, as the number of licences begin to grow, the crime rate does not follow it. **While crime in the four selected categories remains relatively consistent, the number of alcohol outlets in Christchurch continues to grow.**

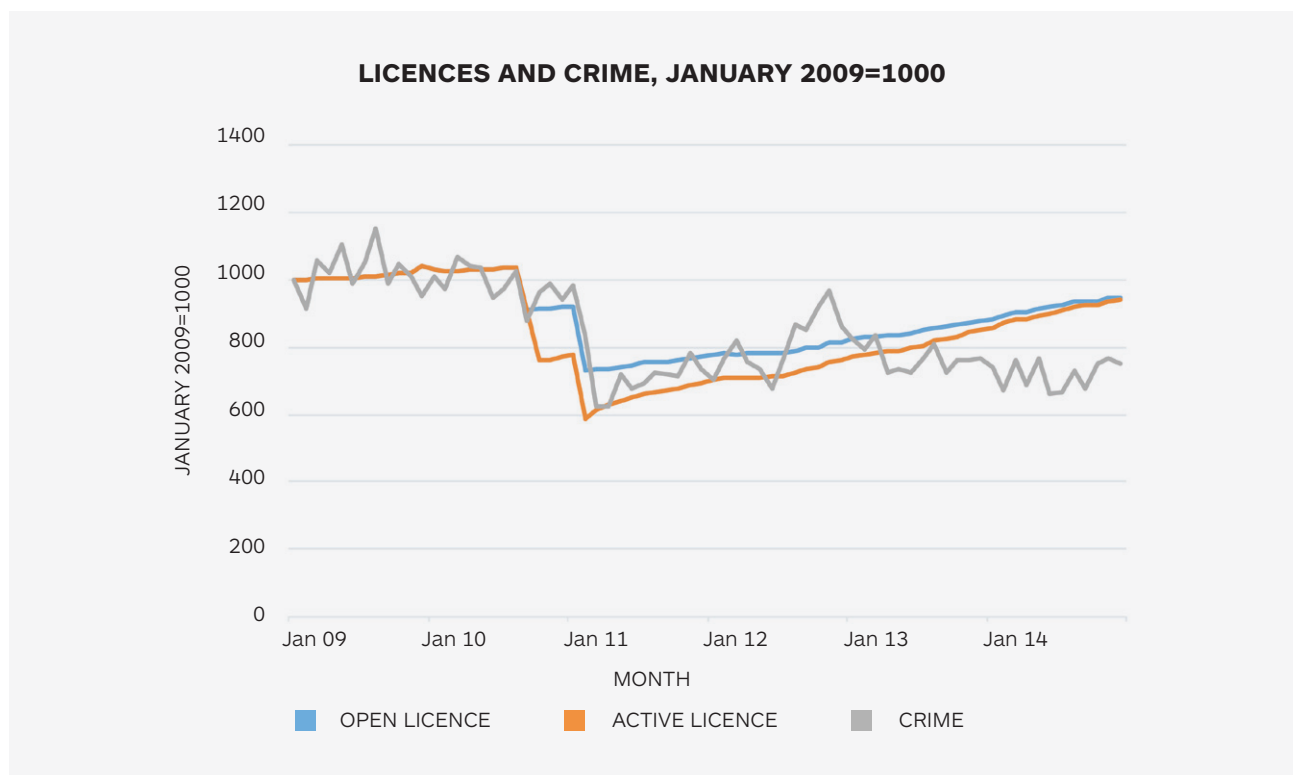


Figure 6: Licences and crime in Christchurch.

This graph shows the number of licences (both on and off) that were actually trading ('active licences'; in orange) against numbers of offences. Rather than showing raw numbers, this graph shows change from January 2009, which is set at a base of 1000 to accurately show comparison between alcohol licences and crime.

## RELEVANT LEGISLATION

There are two existing policy developments that are worth considering in relation to the goals of this study: *The Sale and Supply of Alcohol Act 2012 (SSAA)* and *the Land Transport Amendment Act 2014*.

The *Sale and Supply of Alcohol Act* came fully into force in December 2013, so the full effects of this legislation will register only in our 2014 crime data, meaning that its influence is very difficult to separate from other legislation and the earthquakes. The amendment to the Land Transport Act decreasing the alcohol limit for drivers came into effect on 1 December 2014, so can be presumed to have had little-to-no effect on the data here. A longer-term study (perhaps targeting other parts of the country) will be needed to usefully discriminate between the effects of these various influences on offending.

The SSAA was a subject of the telephone survey of licensed premises during the collection of our alcohol licence dataset. At time of interview (between April and May 2015) we found two thirds of licensed businesses we surveyed (66 percent,  $n = 209$ ) reported the law having no effect on their business. Those who reported that it had affected them reported concerns such as decreased sales and compliance issues. A majority of respondents (53.5 percent,  $n = 180$ ) thought the SSAA was generally positive for Christchurch while slightly less than a quarter thought it was negative (23.5 percent;  $n = 78$ ), with a similar number (22.5 percent,  $n = 74$ ) unsure.

Police reported that the SSAA has proven a useful tool in 'holding licensed businesses to task' and was favourably impactful on excessive drinking and alcohol-related harms. This may mean that although most businesses have been unaffected by the Act's changes, those upon which it has had an effect may include the minority of premises that are most prone to alcohol-related harms.

Similarly, but only at the very end of the period that we investigated, the Land Transport Amendment Act (2014) lowered the alcohol limit for drivers aged 20 years and over from 400mcg of alcohol per litre of breath to 250mcg. Because this law came into effect in December 2014, it will not have impacted on our data, but its future impact may be significant given that it appears to have a much greater effect on licensed premises: our survey found that more than half of respondents (52 percent,  $n = 175$ ) reported that the changes had impacted their business while only 40 percent said their business was unaffected.

This change appeared, anecdotally, to have been positive in regard to alcohol-related harms, with many respondents reporting that their sales of alcohol had fallen, and that customers were much more aware of how much they were drinking, suggesting public changes in behaviour. Many respondents also indicated that they were selling low or mid-alcohol beverages in greater quantities.

It is possible that these changes may shift some alcohol purchases from on-licence toward off-licence and that it may localise on-licence drinking as people stay closer to home. What effect this will have on offending may prove difficult to measure because the spatial isolation of at-home drinking may decrease recorded offences (by being less likely for the police to observe) and be difficult to connect with individual licences.

Crucially, although we know from the survey data that these legislative changes have had some effect in Christchurch, our ability to meaningfully separate their impact on offending data from that of the Canterbury earthquakes is extremely limited. Offending in our four categories in 2014 is noticeably lower, and many areas have displayed visible changes to the times of night that we see offending, but it is unclear whether this represents a continuation of the effects of the earthquakes (which certainly appears to be true to some extent), or can be linked to the effects of the SSAA. The effects of both events might be illuminated by a comparison between with similar offending over time in other New Zealand cities, but this falls outside of the scope of this research.

At the end of 2014, the most substantial effects of the SSAA had yet to be felt in Christchurch. Although the Act made wide-ranging changes to the responsibilities of licensed premises in regard to their patrons and the harms that might occur outside of the premises themselves, it is the provision in the law for local councils to enact their own Local Alcohol Policies (LAPs) that promises the greatest effect on the day-to-day function of licensed premises. While an LAP has been drafted in Christchurch, legal challenges have meant that it has not yet been enacted.

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# **PART I.**

## **The changing spatial distribution of alcohol outlets in pre- and post-quake Christchurch**

### **INTRODUCTION**

A large number of studies have investigated the spatial patterning of alcohol outlets. The results across this broad swathe of literature covering numerous geographic locales are that alcohol outlets generally cluster in space (see Han & Gorman, 2014; Zhang *et al.*, 2015; di Maggio, 2016), and are disproportionately located in minority (see Gorman & Speer, 1997; LaVeist & Wallace Jr., 2000; Romley *et al.*, 2007; Berke *et al.*, 2010) and/or in lower income neighbourhoods (see Bluthenthal *et al.*, 2008; Schneider & Gruber, 2014; Morrison *et al.*, 2015; Shortt *et al.*, 2015). Echoing the majority of findings from other countries, New Zealand studies have also found alcohol outlets to be spatially clustered (Pearce *et al.*, 2008; Hay *et al.*, 2009), and to be predominantly located in minority Māori and/or more deprived neighbourhoods (see Hay *et al.*, 2009; Vinther-Larsen *et al.*, 2013) although this has been found to vary by type of outlet (Cameron *et al.*, 2012).

The consequences of the spatial clustering of alcohol outlets are also well-known, particularly for crime and health. For example a large number of studies have found positive and significant relationships between alcohol availability and crime both internationally and in New Zealand (see Gorman *et al.*, 2001; Freisthler *et al.*, 2004; Britt *et al.*, 2005; Day *et al.*, 2012; Cameron *et al.*, 2016) while researchers have long shown significant associations between alcohol outlets and various adverse population health outcomes (see Popova *et al.*, 2009; Livingston, 2011; Fone *et al.*, 2012; Pereira *et al.*, 2013). Other studies have also found positive relationships between alcohol availability and other outcomes such as suicide (Escobedo & Oritz, 2002), sexually transmitted diseases (Cohen *et al.*, 2006), motor vehicle accidents (Treno *et al.*, 2011) and per capita alcohol sales (Stockwell *et al.*, 2009).

While the causes and consequences of the spatial patterning of alcohol outlets are generally well-known, studies examining the spatial location choice of outlets in a post-disaster setting are less forthcoming. In fact, we are unaware of any current work that has examined how the spatial distribution of alcohol outlets change in a city or region in the aftermath of a natural disaster. Such exploration is important from both an urban planning and population perspective. In terms of urban planning, natural disasters greatly impact the spatial design and configuration of cities. Notwithstanding the catastrophic infrastructural damage that afflicts the built environment, the impacts on the natural environment (i.e., liquefaction, biodiversity, water quality) can greatly hinder the rebuilding process. In terms of the population perspective, natural disasters greatly impact the affected population and have been shown to lead not only to a change in the attitudes to life (see Burke *et al.*, 1982; Mearidy-Bell, 2013) and mental health (Ursano *et al.*, 2009) of residents, but also to an increase in risk-taking behaviours (Cameron & Shah, 2015), including increased harmful alcohol consumption (Schroeder & Polusny, 2004; Cepeda *et al.*, 2010) and alcohol-related harm (Rohrbach *et al.*, 2009; Cerdá *et al.*, 2011). The causal pathways underlying these latter relationships are myriad but are generally thought to be related to the psychosocial stressors experienced by residents in the immediate aftermath of such an event. Post-disaster stressors such as relocation and the loss of social and capital resources may magnify the immediate distress induced by a disaster and can also lead to increased post-disaster alcohol use and abuse.



In Part I of this report we investigate how the spatial distribution of alcohol outlets in Christchurch changed in the wake of two major earthquakes that struck the Canterbury region of the south island of New Zealand in September 2010 and February 2011. Specifically, we ask the following research questions:

- 1) How did the spatial distribution of alcohol outlets change from 2009 (pre-earthquake) to 2014 (post-earthquake)?
- 2) Was there an increase in the spatial clustering of outlets post-quake?
- 3) What neighbourhood-level socio-demographic factors predict the redistribution of outlets in post-quake Christchurch?

Prior research has shown how the availability of alcohol, promoted through the physical location of outlets, is recognised as an important contextual influence on both levels of neighbourhood violence and other alcohol-related harms (see Popova *et al.*, 2009; Day *et al.*, 2012; Pridemore & Grubestic, 2013; Ayuka *et al.*, 2014; Brands *et al.*, 2014; Conrow *et al.*, 2015). The results of Part I of this report can reveal what socio-demographic factors predict this redistribution as well as allow us to speculate on the effects this redistribution is likely to have on future urban crime patterns and health outcomes.

## METHOD

### Dependent variable

The alcohol outlet data used in this analysis was created specifically for this report. Usually alcohol outlet data in New Zealand can be obtained from the Alcohol Regulatory and Licensing Authority (ARLA) which has statutory authority to collect licensing information. However in a post-disaster setting the reliability and validity of this information can be brought into question. This is because the alcohol outlet data held by ARLA does not record whether licensed alcohol outlets are actively trading. Although a large number of alcohol outlets in Christchurch were permanently closed as a result of the Canterbury Earthquakes, they were not recorded as closed by the ARLA until their licence expired, which in many cases was years after the outlets were demolished and even replaced. An alternative alcohol outlet database was built by contacting all liquor licence holders recorded by ARLA as operating alcohol outlets from 2009 to 2014. A team of ten computer-assisted telephone interviewers using Voice Over Internet Protocol (VOIP) phones were used to collect current information on alcohol outlets in pre- and post-quake Christchurch. Information was obtained about the type of licence, opening and closing (either permanent or temporary) dates of their alcohol outlet/s as a result of the Canterbury Earthquakes as well as more general open ended information regarding the effects the earthquakes had on their alcohol trading businesses. The operating address of each outlet type both pre- and post-earthquake was obtained and geocoded and a density measure per kilometre squared was calculated for each Census area unit (CAU) for both time periods: pre-earthquake (December 2009) and post-earthquake (December 2014). This database is among the most accurate and spatially complete of its kind in New Zealand.

A continuous dependent variable was developed to measure the difference in the density of alcohol outlets pre-and post-quake per CAU, by subtracting the 2014 density from the 2009 density. This yielded positive values for CAUs with increased post-quake densities, negative values for decreased densities and 0 values for neighbourhoods with no change. Alternative methods were considered in order to categorise neighbourhoods but the outlet data available to us was too sparse to conduct any form of time-series and/or trajectory analysis with any degree of statistical certainty, despite numerous attempts.

## Independent variables

Data from Statistics New Zealand's Census of 2013 were used to construct a number of neighbourhood level socio-demographic independent variables thought to influence the spatial location choice of alcohol outlets based on previous local and international research (see Gorman & Speer, 1997; Duncan *et al.*, 2002; Pollack *et al.*, 2005; Romley *et al.*, 2007; Hay *et al.*, 2009; Ellaway *et al.*, 2010). These variables included percent unemployed; percent non-partnered; percent male; percent residents aged 15-29; percent foreign born; and percent resided for less than five years per CAU.

An Analysis of Variance (ANOVA) between the dependent variable with each of the independent variables highlighted four significant associations: percent aged 15-29 years; percent lived in neighbourhood less than 5 years; percent non-partnered; and percent foreign born. These four variables were inserted into a principal components analysis with varimax rotation in order to counter the effects of multicollinearity observed between these variables. A set of principal components were computed to empirically determine the number of underlying constructs which accounted for most of the variance in alcohol outlet density change. Only one principal component with an eigenvalue greater than 1 was identified; it accounted for 71 percent of the total variance in the data. This component had high loadings on all four variables: percent aged 15-29 years (0.56); percent lived in neighbourhood less than 5 years (0.52); and percent non-partnered (0.50); and percent foreign born (0.41). Thus, this component could be considered an indicator of neighbourhoods with young, single, mobile, and foreign-born residents and was the independent variable of interest in subsequent regression analyses. Finally, three key control variables were included. These were the change in total households and population per CAU (pre- and post-earthquake) as well as the level of land damage recorded in a CAU. The latter variable is calculated as the proportion of the CAU that was 'red-zoned'. After the Canterbury Earthquakes each property within the city was placed into a color-coded category (i.e., green, orange, and red) based on the amount of land damage experienced. Properties that were so-called 'red zoned' were deemed uninhabitable by the New Zealand government and were scheduled to be cleared. These three additional controls are thought to negatively impact the spatial location choice of new outlets. Data for these variables were obtained from Statistics New Zealand and from the Canterbury Earthquake Recovery Authority (CERA).

It is important to note that the calculation of the independent variables was done using sub-national population estimates calculated by Statistics New Zealand as the denominator rather than population data derived from the Census alone. Understandably, there was considerable out- and intra-migration of residents in Christchurch following the earthquake which was difficult to monitor and resulted in much uncertainty regarding population numbers. To address this Statistics New Zealand combined official Census data with other available data (such as international travel documents and building consents) to produce three-monthly population estimates at various levels of aggregation (Statistics New Zealand, 2011). These estimates were used where applicable to calculate certain variables. In general, population estimates remain consistently higher than the New Zealand Census figures, taking into account the three month difference in observation, and Census non-respondents. Likewise the CAU boundaries across both periods were obtained from Statistics New Zealand who re-aligned the neighbourhood boundaries with updated Census data in rare instances where the boundaries changed over the period of investigation (see Statistics New Zealand, 2013).

## STATISTICAL ANALYSES

Two linear regression models were fitted to test the spatial association between the changes in alcohol outlet densities and the selected independent variables at the neighbourhood level. The first model included the continuous measure of change in alcohol outlet density per CAU as



the dependent variable and the principal component as the independent variable of interest. The second model included the same component as the first model but also controlled for the three variables thought to negatively impact the spatial location choice of new outlets.

## RESULTS

Figure 7 shows the difference in the spatial distribution of alcohol outlet density in Christchurch after the Canterbury Earthquakes. **There are noticeable shifts in alcohol outlet densities post-earthquake with outlets generally moving away from the central city and towards established neighbourhoods to the west and north of the CBD.**

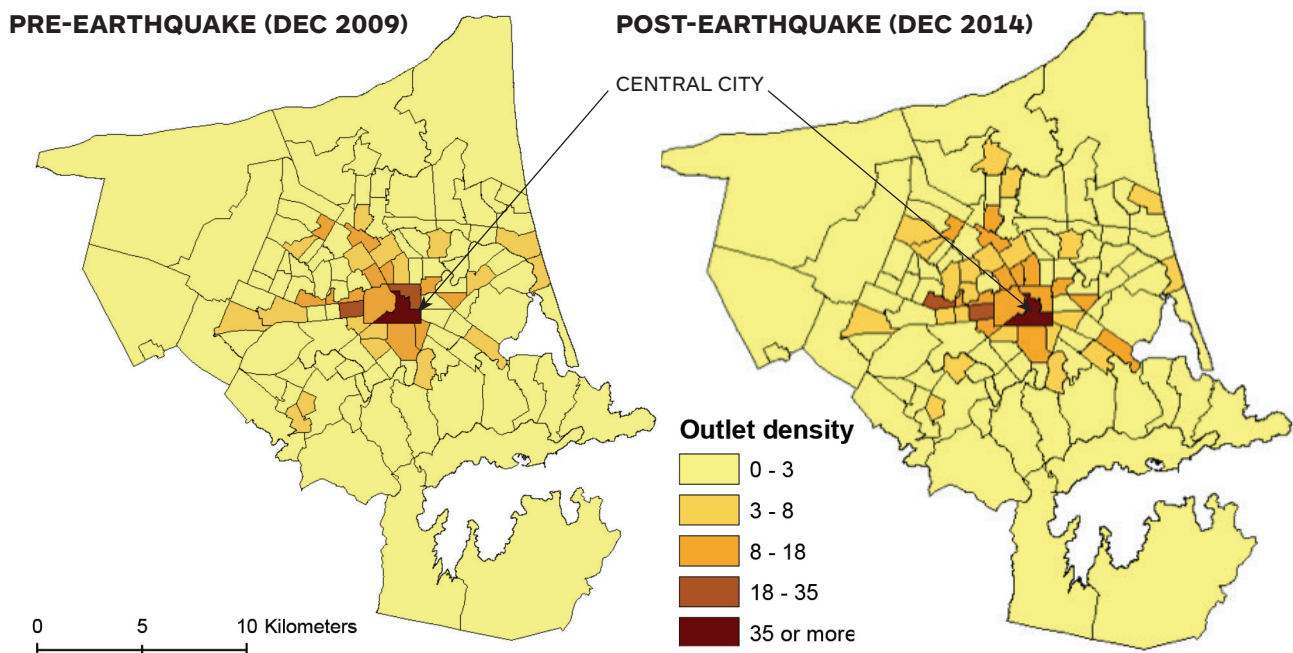


Figure 7: A comparison of alcohol outlet density (per kilometre squared) before and after the Canterbury earthquakes

Table 2 shows descriptive statistics of alcohol outlets per CAU pre- and post-earthquake. These figures indicate large spatial variability of outlets between the two periods. Alcohol outlet densities in the pre-earthquake period range from 0 to 105.67 outlets per kilometre squared per CAU whilst densities in the post-earthquake period range from 0 to a more modest 40.36 outlets per kilometre squared per CAU. Across both periods, the CAU which contained the greatest number of outlets per kilometre squared was Cathedral Square located in the CBD. **Interestingly, only 24 percent of registered alcohol outlets that were open in the CBD before the earthquake returned to the CBD after the cordon was lifted and were open post-earthquake (end 2014).** The remaining alcohol outlets (76 percent) either relocated permanently or closed down. The Moran's I for alcohol outlet densities was 0.15 ( $p < 0.001$ ) pre-earthquake and 0.28 post-earthquake, suggesting that **alcohol outlet densities are more spatially clustered in the post-earthquake period.** There were also notable differences between the mean densities of alcohol outlets between the two periods with densities higher in the pre-earthquake period perhaps attributable to the overall decrease in outlets post-earthquake.

Table 2: Descriptive statistics of alcohol outlets densities per CAU pre- and post-earthquake

	Minimum	Maximum	Mean	SD	Moran's I
Pre-earthquake density	0	105.67	3.69	10.30	.15
Post-earthquake density	0	40.36	3.59	5.99	.28
Change in alcohol outlet density	-65.31	11.40	-0.10	6.33	

The results of the ANOVAs calculated on the six selected variables at the beginning of the analysis are shown in Table 3. Interestingly, more CAUs experienced an increase in alcohol outlet density ( $n = 42$ ) than a decrease ( $n = 27$ ). As discussed in the methods above, four of the six selected variables were found to have significant differences across both periods. **Neighbourhoods that experienced an increase in alcohol outlet density were, on average, younger; had more foreign-born residents; likely to be unpartnered and had a more mobile population than other neighbourhoods.** Table 4 (Model 1) shows the results of the regression model examining the association between the change in alcohol outlet densities and the principal component combining those four variables. A positive and significant association was found between the 'the principal component' and alcohol outlet change with the results indicating that for every one-unit increase in the 'young, single, foreign newcomer' component, we would expect an increase in the alcohol outlet density difference of 0.43. After controlling for the change in total households and population pre- and post-earthquake as well as the level of land damage recorded (see Table 4, Model 2) a positive, significant association remained between the change in alcohol outlet densities and the 'young, single, foreign newcomer' component.

Table 3: Neighbourhood characteristics of CAUs with increased, decreased or no change in alcohol outlet density over the earthquake period

Neighbourhood characteristics post-quake*	Alcohol outlet density increased	Alcohol outlet density decreased	No change in alcohol outlet density	p-value †	Total
	( $n = 42$ )	( $n = 27$ )	( $n = 48$ )		( $n = 117$ )
% non-partnered, mean (SD)	41.5 (8.7)	37.7 (9.0)	36.3 (6.3)	0.007	39.5 (8.14)
% aged 15-29 years, mean (SD)	24.2 (10.2)	19.0 (6.8)	18.6 (3.8)	0.001	20.7 (7.8)
% lived in neighbourhood <5 yr, mean (SD)	54.4 (9.3)	46.5 (9.5)	46.1 (7.2)	<0.001	49.1 (9.3)
% foreign born residents, mean (SD)	23.5 (6.2)	20.2 (6.0)	18.4 (5.3)	<0.001	20.6 (6.2)
% male, mean (SD)	49.4 (2.3)	49.7 (1.7)	49.2 (3.3)	0.300	49.4 (2.6)
% unemployed, mean (SD)	3.4 (1.1)	3.2 (1.4)	3.0 (0.9)	0.215	3.2 (1.1)
* Data obtained from the 2013 New Zealand Census					
† Calculated using ANOVA					

Table 4: Results of linear regression models for changes in densities of alcohol outlets per kilometre squared

Variables	Model 1: No confounder adjustment			Model 2: Adjusted for confounders		
	$\beta$	95% CI	p-value	$\beta$	95% CI	p-value
Component	0.43	0.23-0.63	<0.001	0.47	0.26-0.67	<0.001
Total houses post-quake				-0.001	-0.001-0	0.055
Proportion 'red-zoned'				-0.02	-0.06-0.03	0.486
Change in population				-0.001	-0.02-0.01	0.861
R-squared	0.14			0.17		

## DISCUSSION

In Part I of this report we have examined the changing spatial distribution of alcohol outlets in Christchurch and have made a number of important findings.

Regarding our first question "How did the spatial distribution of alcohol outlets change from 2009 (pre-earthquake) to 2014 (post-earthquake)?", we found that that alcohol outlets in Christchurch – like most other retail businesses – experienced significant upheaval in the aftermath of the Canterbury Earthquakes. In fact, alcohol outlets diffused somewhat in the aftermath of the Canterbury Earthquakes with the density of alcohol outlets increasing in neighbourhoods to the west and north of the CBD, although the changes are not as stark as expected.

Regarding the second research question "Was there an increase in the spatial clustering of outlets post-quake?", we found that alcohol outlets close down (temporarily or permanently), change location, and according to our evidence, increasingly cluster together. The spatial clustering of alcohol outlet density increased post-earthquake. The Moran's I value for the post-quake clustering of alcohol outlets was higher in the post-earthquake period suggesting greater clustering post-quake. Visually however it appears as if alcohol outlet density is more diffuse in neighbourhoods post-earthquake. The reason for these counterintuitive statistics can potentially be found in the nature of the Moran's I statistic. The Moran's I statistic provides a global measure of spatial clustering which is not very robust and consequently is sensitive to a single value. In the Christchurch dataset Cathedral Square is an outlier so extreme that it has the potential to distort the results. For example, the average AOD for all neighbourhoods in Christchurch is 3.69 outlets per km<sup>2</sup> whereas in Cathedral Square the density is 105.67 outlets per km<sup>2</sup> pre-quake (see the maximum value in Table 2). That is an extreme difference in values and the reason for the lower Moran's I value pre-quake when it appears visually to be more clustered in the pre-quake era. Post-quake, Cathedral Square is 'less' of an outlier (the value decreases to 40.36 outlets per km<sup>2</sup>) so it has less of an effect on the Moran's I value. This is the reason for the counterintuitive stats when compared visually.

Regarding our third research question "What neighbourhood-level socio-demographic factors predict the redistribution of outlets in post-quake Christchurch?", we found that **changes in outlet density are related to the socio- demographic composition of neighbourhoods in Christchurch. Alcohol outlet densities were found to increase in neighbourhoods in Christchurch with residents that were young, single, foreign-born and new to the neighbourhood.** The fact that young and single people are more prone to hazardous drinking both in New Zealand (see Ministry of Health, 2013) and internationally (see Macinko *et al.*, 2015) makes this finding of particular concern. Moreover, it is increasingly clear that populations in post-disaster cities increase their alcohol consumption (see Schroeder and Polusny, 2004; Cepeda *et al.*, 2010) which makes examining the changing spatial distribution of alcohol outlets in a post-disaster city such as Christchurch an important topic for investigation in alcohol-related research.

## POLICY IMPLICATIONS

So what are the likely practical implications of a neighbourhood-level spatial change in alcohol outlet density on alcohol related harm? Previous research has examined this phenomenon mostly in the context of changing alcohol legislation and/or regulation, particularly in the United States. Conrow *et al.* (2015) for example found that changes in the alcohol outlet environment (i.e., bars that received a liquor licence) in Atlanta were related to an increase in the occurrence of crime events in the city while across California Gruenewald and Remer (2006) found that an increase in alcohol outlets accelerated violent crime rates particularly in impoverished neighbourhoods, and in neighbourhoods with greater income inequality. In Melbourne, Australia, Livingston (2008) found that changes in the number of alcohol outlets were positively associated with the amount of violence a community experienced although this relationship was found to vary by type of neighbourhood as well as the type of outlet. In a similar vein, Zhang *et al.* (2015) found that a modest reduction in alcohol outlet density in neighbourhoods with high density of alcohol outlets substantially reduced exposure to violent crime in affected neighbourhoods.

From a purely public health perspective, Johnson *et al.* (2009) found that changes in outlet densities were positively related to attempted and completed suicide rates while Cohen *et al.* (2006) found that a reduction in alcohol availability within neighbourhoods was associated with a significant reduction in gonococcal infection rates, although this association was partially mediated by neighbourhood social capital. Much less is known however about the effects on a changing urban alcohol environment in urban New Zealand but based on the wealth of evidence provided by international scholars it is reasonable to assume that similar adverse outcomes are likely particularly for neighbourhoods that have experienced an increase in rates of alcohol outlets in Christchurch. In fact a recent study by Breetzke *et al.* (in press) has already shown how crime in Christchurch has spatially diffused away from the CBD and into nearby neighbourhoods, particularly those with single and foreign residents while an increase in hazardous drinking has also been noted in neighbourhoods which have experienced an increase in alcohol outlets (see Ensor, 2013; King, 2016). Of greater concern however is the fact that the increase in alcohol outlets in certain neighbourhoods of the city is occurring in a post-disaster setting where residents are increasingly under strain. According to Renoef (2012) this strain and its psychological effects are likely to accumulate rather than lessen over time while previous research has found that the effects of delayed stress can significantly increase voluntary consumption among vulnerable persons (see Steptoe *et al.*, 1996; Magrys & Olmstead, 2015) which suggests that the full effects of the spatial redistribution of alcohol outlets in Christchurch on residents' health and wellbeing are yet to be felt.

Finally, one important contribution of Part I of this report relates to the implications for local policy makers as they provide support for measures that limit the number of alcohol outlet licences within new (or rebuilt) urban areas. The most relevant policy document in this regard is the Sale and Supply of Alcohol Act 2012 (SSAA). The SSAA was passed in 2012 but only came fully into effect in 2014 and was implemented to minimise alcohol-related harm by among other things, allowing for the restriction of access to, and availability of, alcohol particularly in at-risk communities. The SSAA does not permit a licence to be declined on the basis of the number of existing outlets in an area but does allow councils in New Zealand to develop their own local alcohol policies (LAPs) to manage and govern the sale and supply of alcohol. Whilst there is provision in each LAP for local authorities to 'limit the location and density of licences' the existing alcohol outlet density in an area is not taken into account in its criteria and as a result there are numerous clusters of high outlet areas both across the rebuilt Christchurch and across the country as a whole (New Zealand Law Commission, 2009). In a post-disaster setting, applications for new alcohol outlet licences need even greater scrutiny and additional criteria need to be applied such as the location of existing outlets and proximity to vulnerable populations. The increase in crime and hazardous drinking in neighbourhoods which have experienced an increase in alcohol outlets in Christchurch (see Ensor, 2013; King, 2016; Breetzke *et al.*, in press) has already led the Christchurch City Council (CCC) to place a number of temporary alcohol bans on these neighbourhoods (CCC, 2015b). This measure is applaudable but reactive and suggests a growing acknowledgement among authorities of the issues that are likely to emanate from a policy that does not take into cognisance the underlying social and built environment of new licence locations. In a post-disaster city, the problem can escalate and is even more acute.

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## **PART II.**

# **Assessment of "clusters of interest" crime-alcohol neighbourhoods in Christchurch**

### **INTRODUCTION**

As this research progressed it became increasingly apparent that an important variable was missing from publicly available data, that being the increases in patronage that occurred in many of the surviving businesses following the Christchurch earthquakes. The dramatic number of closures meant that many licensed premises that remained open entered a 'boom' time. This was evident to residents of Christchurch and particularly to police, and it is significant for purposes here. It became increasingly obvious that changes in how we used the existing data would be required to undertake analysis in this part of the report.

### **METHOD**

#### **IDENTIFICATION OF 'CLUSTER OF INTEREST' NEIGHBOURHOODS**

Analysis was conducted on a total of six areas of the city that were found to have experienced significant changes in outlet density post-earthquake. These areas were identified as having significant clusters of licences in close proximity, and were identified to be areas of higher alcohol consumption by stakeholders that we interviewed. 'Clusters' were defined as having had twenty or more licences within a 1.5 kilometre radius (including closed licences) and displaying visually apparent clustering when mapped. These criteria applied to some extent to other areas as well (such as New Brighton and Woolston) but the six areas with the greatest concentrations of licences were chosen. This method was chosen instead of identifying high-density CAUs<sup>1</sup> because many CAUs are bordered by major roads, meaning that clusters of alcohol licences (which also often follow major roads) are almost always spread evenly across two or more CAUs, greatly reducing the apparent alcohol outlet density.

These areas were:

- Papanui
- Hornby
- Merivale
- Riccarton
- Church Corner
- The central city/CBD

In order to capture these areas fully, a circular buffer with a radius of 1.5 kilometres was created at the centre point of each area. This allowed for the inclusion of adjacent neighbourhoods as well as crimes committed by people as they travelled in and out of the area, as well as in direct proximity to the licences themselves. Because many centre points were located along major roads that were host to multiple separate clusters (the CBD or Riccarton Road) some of these areas overlapped with one another to some degree.

<sup>1</sup> This method of analysis was initially conducted as part of the research process, but the results were not found to be useful.

As previously noted, a survey of 362 licensed premises was conducted during the process of building the alcohol licence database. The results informed both our reasons for identifying our clusters of interest – by gauging increases in patronage in different areas – but also in assisting our understanding of our findings stemming from the alcohol licence and crime datasets. The latter was assisted by further interviews with people connected to key licensed premises, as well as interviews with key people in and around licensing including those from New Zealand Police and the Christchurch City Council.

## QUANTIFYING HARMS

In order to quantify one aspect of the changes in harm associated with alcohol use, these neighbourhoods were analysed using crime data provided by the New Zealand Police. These data record the location and offence code of individual offences in Christchurch between the calendar years of 2009 and 2014. These data were drawn from the Police INCOFF database and the SAS Datamart and matched the data using the unique occurrence identifier for each offence to get the location coordinates and provided to us by the Statistics Manager of New Zealand Police.

In order to highlight crimes that are likely to have a relationship with alcohol, four categories of crime were selected<sup>2</sup>:

- Violence
- Drugs and antisocial
- Property damage
- Dishonesty

The six clusters of interest were then analysed by:

- Changes in crime by year in the broader crime categories
- Crime patterns by time of day
- Concentrations of offences per active licence

## THE DEMOGRAPHICS OF ‘CLUSTER OF INTEREST’ NEIGHBOURHOODS

These six ‘cluster of interest’ areas contained a total of 21 Census Area Units (CAUs), which were classified as ‘high density’ neighbourhoods because of their proximity to large clusters of licences. By identifying the CAUs connected with these clusters, it became possible to undertake analysis of demographic factors and neighbourhood level variables in the areas surrounding major clusters and contrast them with the remaining (lower density) neighbourhoods in Christchurch. The lower density neighbourhoods were those neighbourhoods which were not classified as high density. A total of 17 variables were examined, loosely categorised into four main themes: social, economic, crime and alcohol. The idea here is to determine whether the neighbourhoods contained in the six ‘clusters of interest’ (n = 21) were different socio-demographically from the neighbourhoods not contained in the six ‘clusters of interest’ (n = 98). The results are shown in Table 5 below.

<sup>2</sup> For more detail about why these categories were selected, see page 10.



Table 5: Descriptive statistics of clusters of interest

Identified 'high density' neighbourhoods (n = 21)					
Neighbourhood characteristic		Min	Mean	Max	SD
Social	Median age	22.9	35.2	45.1	6.4
	% Foreign born	15.7	26.2	39.7	6.8
	% Resided less than 5 years in the neighbourhood	44.6	59.3	76.1	10.2
	% non-partnered	32.8	46.2	62.1	8.5
	Diversity index	20.9	38.9	55.8	11.5
	Neighbourhood fragmentation	-.8	1	2.8	1
	% Smoking	4.4	11.9	20	4.7
Economic	NZDep	893	984.2	1054	45.8
	% Unemployed	1.9	3.8	8.2	1.4
	Median household income (\$NZ)	50600	67714.3	119400	17889.6
	Median personal income (\$NZ)	13200	29638.1	41900	8690.9
	Median rent per week (\$NZ)	270	323.3	480	45.8
	Index of concentration at the extremes (ICE) <sup>a</sup>	-.0	.1	.5	.1
Crime	Mean annual crime rate per 1000 population (2009/10)	115	609.9	4392	912.9
	Mean annual crime rate per 1000 population (2013/14)	71.5	380.2	1389.5	314.7
Alcohol	Alcohol outlet density in km <sup>2</sup> (2009)	0	12.3	105.6	22.4
	Alcohol outlet density in km <sup>2</sup> (2014)	.9	10.4	40.4	10.6
Other neighbourhoods (n = 98)					
Neighbourhood characteristic		Min	Mean	Max	SD
Social	Median age	30.8	40	49.7	4.5
	% Foreign born	6.1	19.6	32.3	5.4
	% Resided less than 5 years in the neighbourhood	28.9	47.5	71.1	8.3
	% non-partnered	23.5	37.1	55.3	7.2
	Diversity index <sup>b</sup>	8.5	32.1	58.3	11.9
	Neighbourhood fragmentation <sup>c</sup>	-1.8	-.0	2.6	.9
	% Smoking	4.1	13.6	28.3	6.1

Economic	NZDep	878	967.9	1157	60.8
	% Unemployed	1.3	3.1	7.2	1.1
	Median household income (\$NZ)	42200	69903	12880	17018.6
	Median personal income (\$NZ)	9100	31081.6	45900	5566.7
	Median rent per week (\$NZ)	180	319.2	550	65.1
	Index of concentration at the extremes (ICE) <sup>a</sup>	-.1	.1	.5	.1
Crime	Mean annual crime rate per 1000 population (2009/10)	27.5	237.9	1120.5	186.3
	Mean annual crime rate per 1000 population (2013/14)	21.5	191.6	826	149.4
Alcohol	Alcohol outlet density in km <sup>2</sup> (2009)	0	1.8	11.5	2.3
	Alcohol outlet density in km <sup>2</sup> (2014)	0	2.1	15.3	2.8

<sup>a</sup> The ICE is the *index of concentration at the extremes (ICE)* which measures income inequality within neighbourhoods. The ICE is calculated using the following formula:

$$[(\text{number of affluent households} - \text{number of poor households}) / \text{total number of households}]$$

Where 'affluent' is defined as households with income above NZ\$100,000 and 'poor' is defined as households below NZ\$30,000 per year. The ICE index ranges from a theoretical value of -1 (which represents extreme poverty, namely, that all households are poor) to +1 (which signals extreme affluence, namely, that all households are affluent).

<sup>b</sup> The *diversity index (DI)* (see Meyer & McIntosh, 1992) was calculated to provide a measure of racial and ethnic diversity within a CAU. The DI measures the probability that any two people chosen at random from a given CAU are of different races or ethnicities; and is measured on a scale of 0 to 100, with 0 indicating that a CAU is totally homogeneous and 100 stating a CAU is totally heterogeneous. The greater the DI score, the greater the probability of randomly selecting two people with different characteristics. The DI is frequently been employed in population studies (see Johnson & Lichter, 2010; Tam & Bassett Jr, 2004) and is calculated as:

$$\text{Diversity Index} = 1 - (E^2 + M^2 + A^2 + P^2 + MELAA^2)$$

Where E is the proportion European, M is the proportion Maori, A is the proportion Asian, P is the proportion Pacifica, and MELAA is the proportion *Middle Eastern/Latin American/African* populations. The DI was then multiplied by 100 in order to deal in whole numbers, rather than decimals.

<sup>c</sup> The *neighborhood fragmentation index* was calculated as a summary score, using three Census variables: percentage of single-parent families, percentage of residents moving out of the CAU within the past five years, and percentage of renters within the neighborhood (see Stjärne, Ponce de Leon, & Hallqvist, 2004; Fagg, Curtis, Stansfeld, Cattell, Tupuola, & Arephin., 2008). Principal components analysis revealed that these indicators loaded on the same factor: providing an empirical basis for combining them (Cronbach's  $\alpha = .71$ ). A higher neighborhood fragmentation score reflects greater social fragmentation in the neighborhood

The identified 'high density' neighbourhoods generally had younger residents; a much higher percentage of foreign residents; a more mobile population, and were generally non-partnered. From an economic perspective, there is much less difference between the identified 'high density' neighbourhoods and the rest of Christchurch. In terms of crime and alcohol, the high density neighbourhoods generally had much higher rates of crime both before and after the earthquake (although the rates of crime dropped significantly across both periods for both sets of neighbourhoods) and alcohol outlets were much more prevalent in the 'high density' neighbourhoods. Rather surprisingly, the mean alcohol outlets actually decreased in the 'high density' neighbourhoods and *increased* in the other neighbourhoods. This is largely a consequence of alcohol outlets decreasing dramatically in the post-earthquake period in CAUs in the CBD, especially Cathedral Square. An analysis of variance (ANOVA) was used to determine whether the differences in the socio-demographic characteristics of neighbourhoods classified as 'high-density' and 'low density' (see Table 5) were significant. These results are shown in Table 6 which largely indicate that differences in neighbourhoods by the social variables and alcohol and crime variables did differ significantly.



Table 6: Analysis of variance (ANOVA)

Neighbourhood characteristic		Mean			
		'High'	Other	F	Sig.
Social	Median age	35.2	40	16.8	.000
	% Foreign born	26.2	19.6	23.5	.000
	% resided less than 5 years in the neighbourhood	59.3	47.5	31.9	.000
	% non-partnered	46.2	37.1	25.8	.000
	Diversity index	38.9	32.1	5.8	.018
	Neighbourhood fragmentation	1	-.0	20.9	.000
	% Smoking	11.9	13.6	1.4	.230
Economic	NZDep	984.2	967.9	1.3	.250
	% Unemployed	3.8	3.1	4.9	.028
	Median household income (in NZ\$)	67714.3	69903	.7	.419
	Median personal income (in NZ\$)	29638.1	31081.6	.9	.336
	Median rent (in NZ\$)	323.3	319.2	.1	.782
	Index of concentration at the extremes (ICE) <sup>a</sup>	.1	.1	.0	.883
Crime	Mean annual crime rate per 1000 population (2009/10)	609.9	237.9	13.9	.000
	Mean annual crime rate per 1000 population (2013/14)	380.2	191.6	17.4	.000
Alcohol	Alcohol outlet density in km <sup>2</sup> (2009)	12.3	1.8	20.8	.000
	Alcohol outlet density in km <sup>2</sup> (2014)	10.4	2.1	46.9	.000

## RESULTS

This section compares the clusters of interest to rates of offending in the city in general, then takes a closer look at each individual cluster, examining the changes to offending and alcohol licences in the area over the period under study.

### COMPARISON WITH THE CITY OVERALL

Studying the increases and decreases in offending in each area directly is somewhat complicated by the declining crime rate city-wide. Offending in our four chosen crime categories has fallen by 30 percent city-wide, meaning that even if an area shows a decrease in offending, it may in fact be an increase relative to the quantity of offending that recorded across the city. In other words, we are interested in relative rather than absolute movements in crime.

Table 7 compares the number of offences, with a base of 2009, in each area against the city as a whole. This allows us to identify areas that have experienced increases in offending against a backdrop of decreasing post-quake offending.

Areas with a positive number, for example, have had an increase in offending relative to the amount of offending occurring within the city as a whole, regardless of whether the number of actual incidents of offending have increased or decreased. Because city-wide offending decreased after the earthquakes, areas where changes in offending are limited will show relative increases.<sup>3</sup>

Table 7: Crime in clusters of interest by year, relative to Christchurch-wide changes

	Central City	Church Corner	Merivale	Papanui	Riccarton	Hornby
2009	0	0	0	0	0	0
2010	-2	-12	2	-8	-7	4
2011	-37	33	-3	18	43	47
2012	-36	13	21	7	73	59
2013	-35	8	-7	-1	40	50
2014	-36	11	-3	10	15	29

What becomes immediately clear in Table 7 is the dramatic drop in crime in the central city, which was a direct outcome of the displacement of people caused by the earthquakes. This included some residents but was largely those who frequented the CBD for shopping, work and recreation; all these things were at once pushed out into the suburbs. The consequences of this are of significant interest. **A key point to note is that the closing of the central city led to less crime in the city overall, both immediately and seemingly ever since. Where we might have expected offending to simply be displaced, only some offending moved to new areas.** This may be for a number of reasons, the first of which is that the extremely high density of alcohol outlets in the CBD may have been producing more offending than the relatively low densities of outlets in our other clusters, a hypothesis that is supported by existing research<sup>4</sup>. The second is that with activity divided up among a number of different clusters, the crime stemming from alcohol use may simply be more difficult to report and accurately police.

**Another point to note is that in our clusters of interest offending did not change uniformly.** To look at this we grouped these data in two-year blocks and averaged the totals: 2009 and 2010 as 'pre-quakes'; 2011 and 2012 as post-quakes; and 2013 and 2014 as 'longer-term'. Table 8 compares rates of offending in each area with 2009 and 2010 (pre-quake) as a baseline of 1000.

Table 8: Crime in clusters of interest by period

	All of Christchurch	Central City	Church Corner	Merivale	Papanui	Riccarton	Hornby
Pre-quake	1000	1000	1000	1000	1000	1000	1000
Post-quake 2011/12	768	492	1002	835	894	1262	1133
Post-quake 2013/14	739	482	860	695	800	979	1153

<sup>3</sup> Crime is indexed against January 2009 in each area and city-wide in order to make each figure comparable. The equation used to generate these figures is: (Crime city-wide 20XX-crime in area 20XX)/crime in area 20XX\*100. This shows how far (in percent) the crime in an area each year differs from crime in the city overall. A result of -25, for example, shows that an area has 25 percent lower crime relative to the city overall.

<sup>4</sup> See the 'policy implications' discussion on page 25.

Excluding the central city, in the post-quake period two of the six clusters had meaningful increases in raw numbers of offences, but in the longer term only Hornby maintained that status.

Table 9: Crime in clusters of interest by period, relative to Christchurch-wide changes

	All of Christchurch	Central City	Church Corner	Merivale	Papanui	Riccarton	Hornby
Pre-quake	0	0	0	0	0	0	0
Post-quake 2011/12	0	-36	31	9	16	64	48
Post-quake 2013/14	0	-35	16	-6	8	33	56

When we look at these areas relative to the city-wide decrease in crime in Table 9 however, we find that in the post-quake period the crime trends in all of our clusters (ignoring the CBD) were worse than the overall average experienced by the city. **In the longer term, while only Hornby saw an increase in raw offending, relative to the city as a whole just one of these areas (Merivale) was bettering the average.**

## THE CENTRAL CITY

The central city suffered significant infrastructural damage during the earthquakes, primarily due to the concentration and age of the buildings located there. Many of these heritage buildings were highly prized as restaurants or bars, and alcohol licences were often densely clustered into small areas such as The Strip, Sol Square and Poplar Lane. Many alcohol outlets in these areas were destroyed entirely, and even intact premises were forced to close indefinitely when the CBD was closed to the public.

We drew a larger buffer zone (shown in Figure 8), with a radius of 2km, around the central city because of its size. This area includes the CBD and the 'Rebuild Zone' public exclusion zone (colloquially known as the central city red zone) and the surrounding area, some of which has remained open throughout the rebuild period.

Although the major clusters of bars in the CBD were destroyed, this buffer includes areas on the periphery of the central city that suffered less damage and became more popular in the post-quake period, primarily Victoria Street, Lincoln Road and St Asaph Street. Because of the distorting presence of the CBD Rebuild Zone, these areas could not be analysed independently.

Victoria Street is dominated by restaurants and bars, and is a key corridor for moving in and out of town from the northwest. Anecdotally the restaurants there are higher-end, and attract a professional clientele. This area became a popular place for drinking in the post-quake period, with many new bars opening and existing restaurants recognising the opportunity to profit by keeping their bars open later. In more recent years, as more bars open elsewhere, police and licence holders anecdotally reported that many of these premises have begun converting back into their original function as primarily restaurants.

St Asaph Street on the south side of the CBD has developed a number of bars and restaurants, and become more significant in the longer-term period. Many bars in this area are higher-capacity and mid-range in terms of pricing. These premises are fewer in number than those in Victoria Street, but higher capacity and more oriented toward alcohol and late-night entertainment. As of the time of writing, the St Asaph Street area continues to expand in alcohol outlets, as is the city generally.

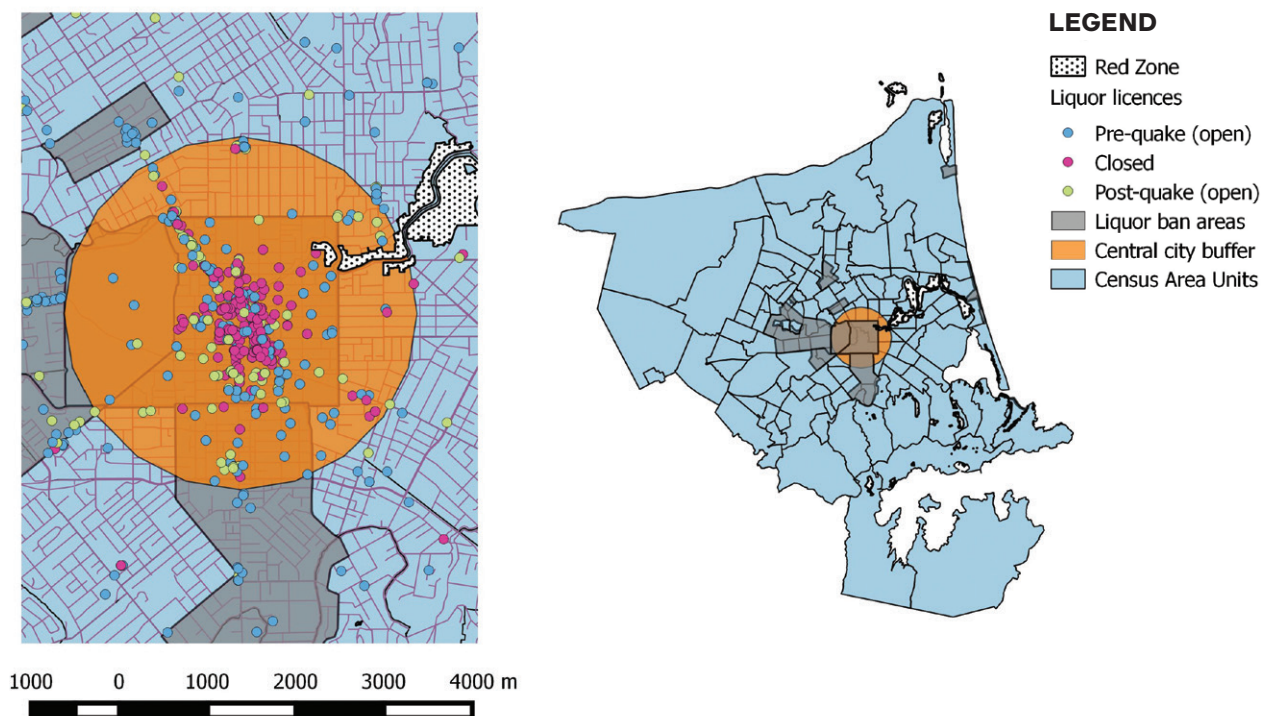


Figure 8: The central city buffer zone

The buffer zone is shown here in orange. The large concentration of alcohol licences within the 2010 cordon is visible, as are the concentrations in Victoria street (running northwest) and St Asaph Street (to the south, within the orange area). The current red zone area (much of which follows the Avon river) is visible intersecting with the buffer at the top right.

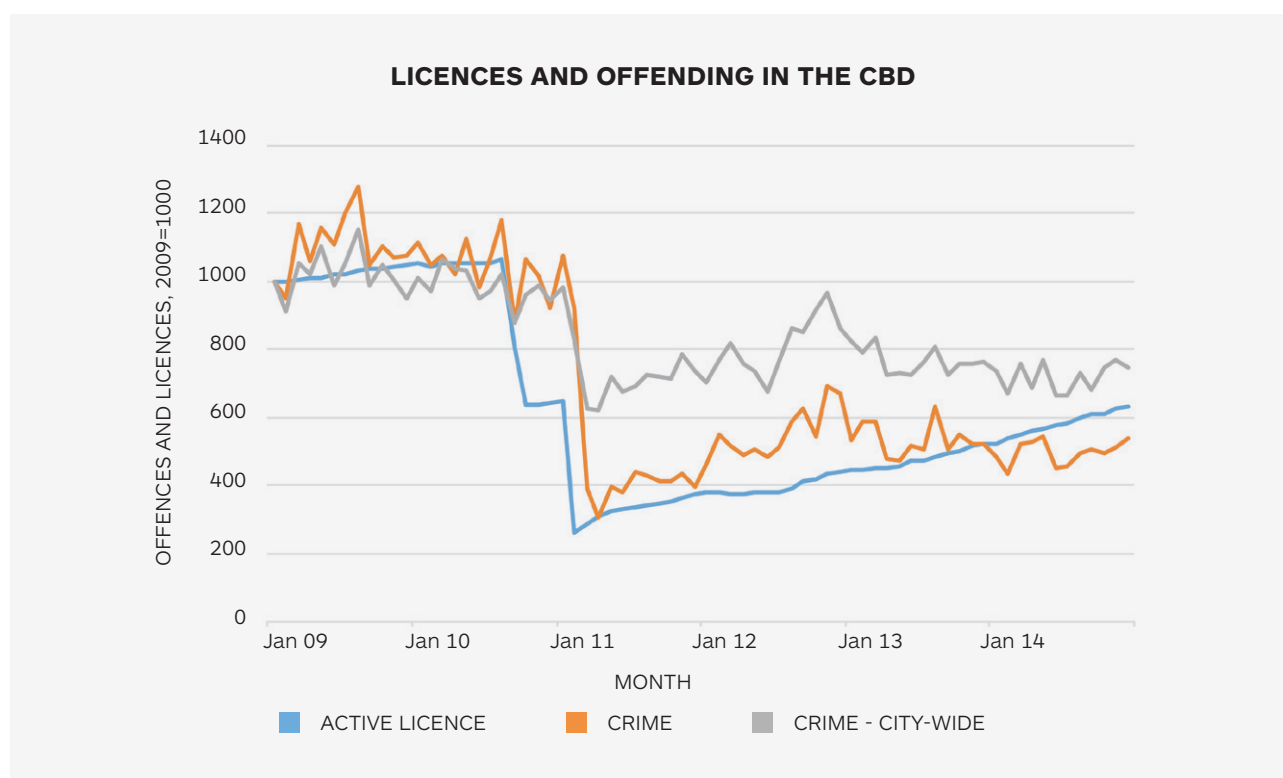


Figure 9: Licences and offending in the Central City, compared with the city-wide offending, crime in the CBD fell substantially more after the 2011 earthquake than elsewhere

Table 10: Offences by year and by category in CBD

	2009	2010	2011	2012	2013	2014
Dishonesty	5293	5015	2666	2402	2595	2616
Violence	1113	1013	517	659	647	722
Drugs & Antisocial	2555	2562	944	1345	1061	715
Property damage	1076	899	422	644	576	478
Total	10037	9489	4549	5050	4879	4531
Change in crime rate relative to city-wide	-	-19%	-37%	-36%	-35%	-36%
Active alcohol licences (December)	361	222	128	151	179	217

As shown in Table 10, the number of licences in the central city fell substantially after both the 2010 and 2011 earthquakes, with the number of open and actively trading licences falling from 366 pre-quake to 219 in 2010 and only 128<sup>5</sup> in 2011, a reduction of more than 75 percent. A further 59 licences remained in existence but were not able to trade after the 2011 earthquake, gradually resuming business over the next three years, with only two still closed at the end of 2014. By the end of 2014, the total number of active licences had grown to 217.

The central city has the highest number of off-licences of any area, with 48 in 2009, falling to a low of 21 active in 2011, and rising back to 33 in 2014. Despite this, the ratio of off-licences to on-licences was lower than the average for the city as a whole, which is unsurprising given that the CBD area contains fewer residential properties.

Crime fell in tandem with the loss of alcohol licences after the 2011 earthquake, primarily because access to the CBD was physically prevented by the public exclusion zone, meaning that there was little opportunity to commit crimes other than trespassing and looting. Offending has remained low throughout the gradual return of businesses and reopening of the CBD.

Interestingly however, we can see very little decrease in offending after the first earthquake in 2010, despite a considerable decline in the number of licensed premises. This is shown in Figure 9, and shown in greater detail in Figure 10. During the four months between the two earthquakes there was little change in offending, even though the number of actively trading licences in the CBD fell by 26 percent to 222. When compared with the year before, the effect of the September 2010 earthquake on crime in the Central City is very limited: offending between October 2009 and January 2010 fell by only 6.6 percent, despite the number of actively trading licenses having fallen by 40 percent.

As shown in Figure 10, all offence categories visibly dip in September 2010, when the first earthquake occurred, but only very slightly. During the four-month period between earthquakes, offending remained relatively steady, showing little deviation from pre-quake patterns, despite sharply decreased alcohol outlet density in the area. **This suggests that the flow of patrons to the CBD remained relatively static as the decreases in outlet numbers were not enough to change routine drinking behaviour; fewer licensed businesses managed to absorb demand.**

<sup>5</sup> The number of temporary closures in this area may be higher than this: of the 82 respondents who reported having closed for a month or more, only 59 were able to identify the period of time that they had closed for. The remaining 23 were treated as having remained open in these data presented here.

The much more substantial effect of the closure of the Rebuild Zone is visible in Figure 11, with crime decreasing considerably at all times of the day after 2010.

Crucially crime at night no longer rises above daytime levels, and does not peak meaningfully at midnight. This is expected in 2011 and 2012 when the Rebuild Zone was closed entirely, but it is noteworthy that **offending does not rise in the two later years as alcohol licences return, and in fact continues to decrease year on year.**

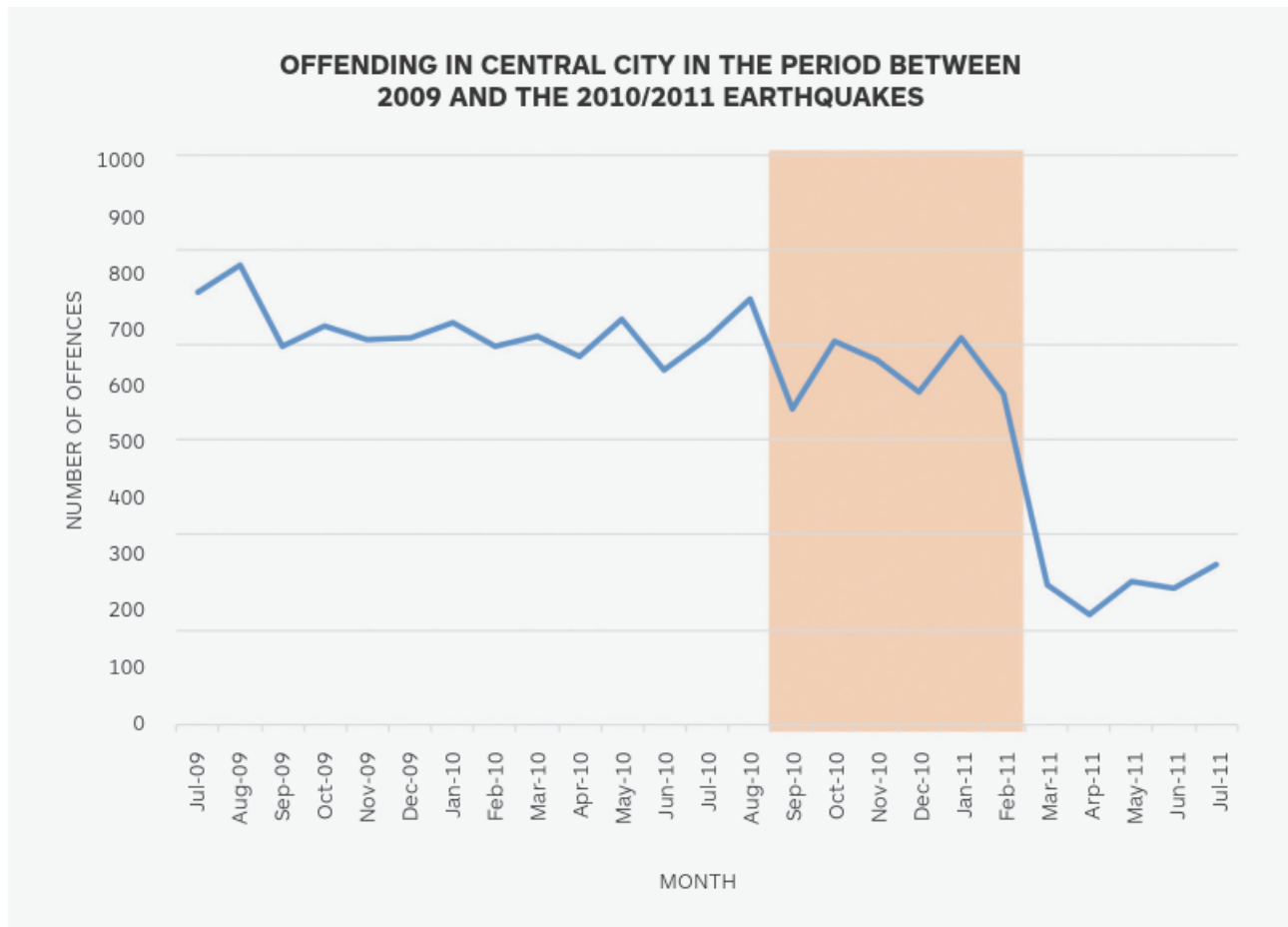


Figure 10: Number of offences in the central city (all four categories)

*The section highlighted in orange is the period between major earthquakes, showing the very limited effect that the decrease in licence numbers after the 2010 earthquake had on crime. During the period between September and February the year before, offending shows less variation, but is only slightly higher on average. After the second earthquake in February 2011, licence numbers decrease dramatically, and the majority of the central city is cordoned off, resulting in a substantial decline in offences.*

This may be attributable to a change in the nature of the premises in this area: although some higher-capacity venues exist, they are much fewer and are no longer clustered together in high-traffic areas. Bars along St Asaph Street are spread out, and the amount of unrelated foot traffic in the area at night is very limited. While premises in Victoria Street are heavily clustered, police and licence holders anecdotally reported that many are in the process of transitioning back into dining focused restaurants.



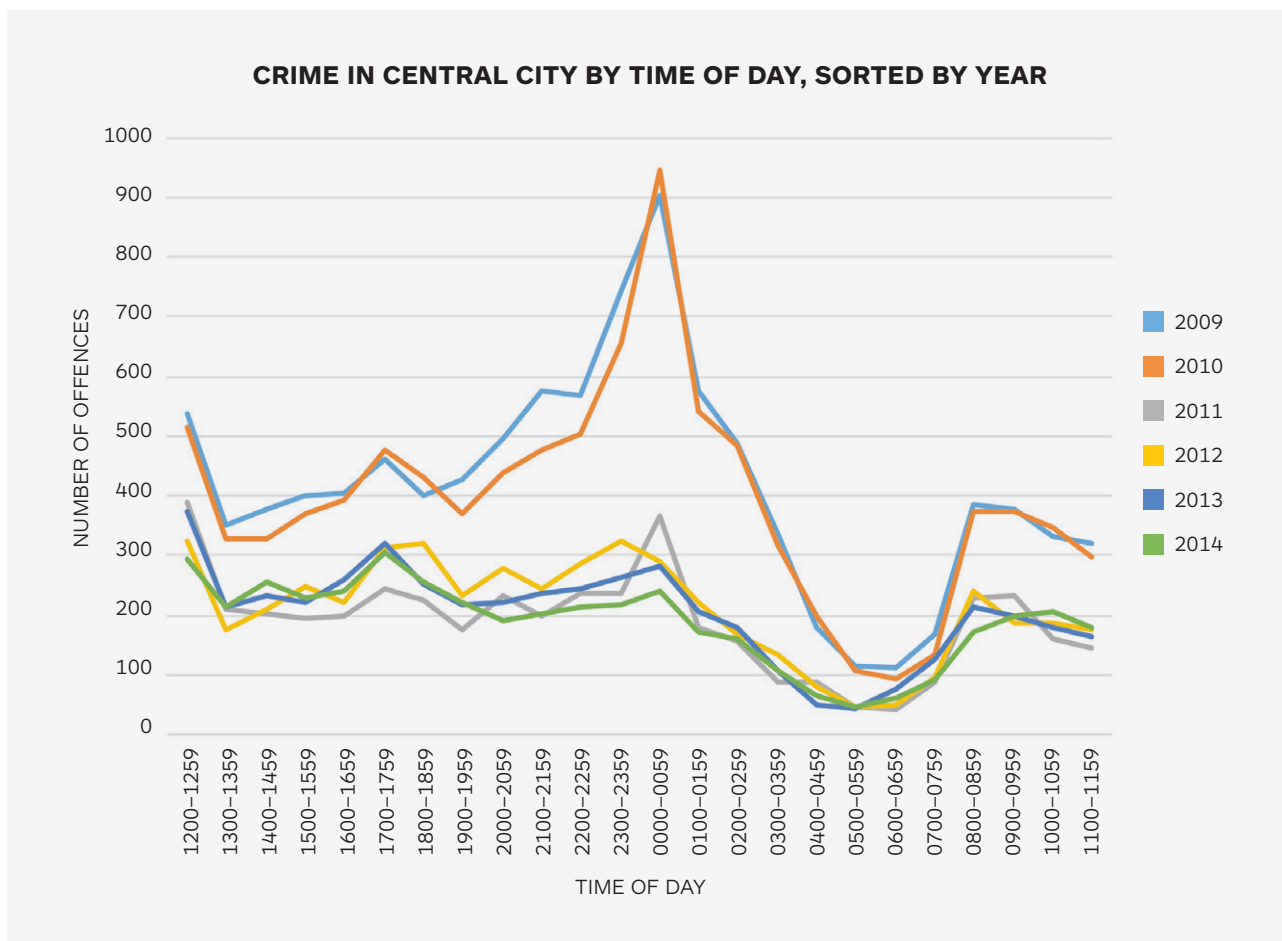


Figure 11: Crime by time of day in the Central City

Midnight is in the middle, and shows substantial spikes in 2009 and 2010, but not in the post-quake years

## RICCARTON

The buffer zone drawn around Riccarton centres on the section of Riccarton Road that includes the Westfield Riccarton mall, which is one of Christchurch's largest shopping malls. This zone is bordered on its east side by Hagley Park, and on the west Riccarton Road runs down into the Church Corner area, which was analysed separately. The centre of the area is within walking distance of the University of Canterbury (1.2km, or fifteen minutes' walk), and has a number of established student bars. A large amount of the area of this buffer is subject to a council-imposed alcohol ban, which restricts alcohol consumption to private and licensed premises at all times.

The CAUs included in this buffer show substantial variation, ranging from Fendalton where the median age is 41.1 and the median income is \$30,700, to nearby Riccarton West, where the median age is 23.6 and the median income is just \$16,300, making it one of the city's poorest neighbourhoods. This disparity is largely attributable to the University and the student population it attracts.

As shown in Figure 12, the majority of alcohol outlets in the area are clustered around Riccarton mall, which is a large indoor shopping centre with 198 stores on its premises. Because of its size and relative lack of damage, Riccarton mall became a key shopping area after the earthquakes destroyed the shops in the CBD and temporarily closed many other malls. The existing bars and restaurants that surround the mall saw increased patronage, and a number made temporary transitions into de

facto nightclubs as a response to increasing demand. As more dedicated ‘nightlife’ areas such as the clusters in St Asaph Street have begun to reopen, these premises have largely returned to pre-quake operations.

The majority of premises surveyed in this area reported an increase in patronage ( $n = 21$ ), with some reporting substantial increases ( $n = 5$ ). A small number of premises also reported that their patronage decreased ( $n = 7$ ). Some interviewees in the area reported that although the number of patrons increased, they had lost some or all of their regular customers.

Offending in Riccarton rose during the post-quake period, with crime increasing by 26 percent in 2011 and 2012, which is 64 percent greater than we would expect relative to the city as a whole. As shown in Figure 13, much of the increase in offending is concentrated in late 2012, caused by a sudden increase in the number of breaches of the area’s alcohol ban. In the longer-term period this increase has subsided, falling to an average of 2 percent less than pre-quake levels in 2013 and 2014. Although this is a decrease in raw offending numbers, crime in the area remains 33 percent higher than we would expect given the much greater decreases in offending city-wide. This appears to have primarily been caused by substantial increases in foot traffic in the area.

Despite suffering some damage and enduring a number of long-term temporary closures, the number of licences in Riccarton has grown by 51 percent ( $n = 21$  new licences) since 2009. The majority of these licences are restaurants, with very few new off-licences or bars opening in the area. The proportion of off-licences in the area is lower than others, comprising only ten percent of licences ( $n = 4$ ) in 2009, increasing slightly to twelve percent ( $n = 7$ ) in 2014.

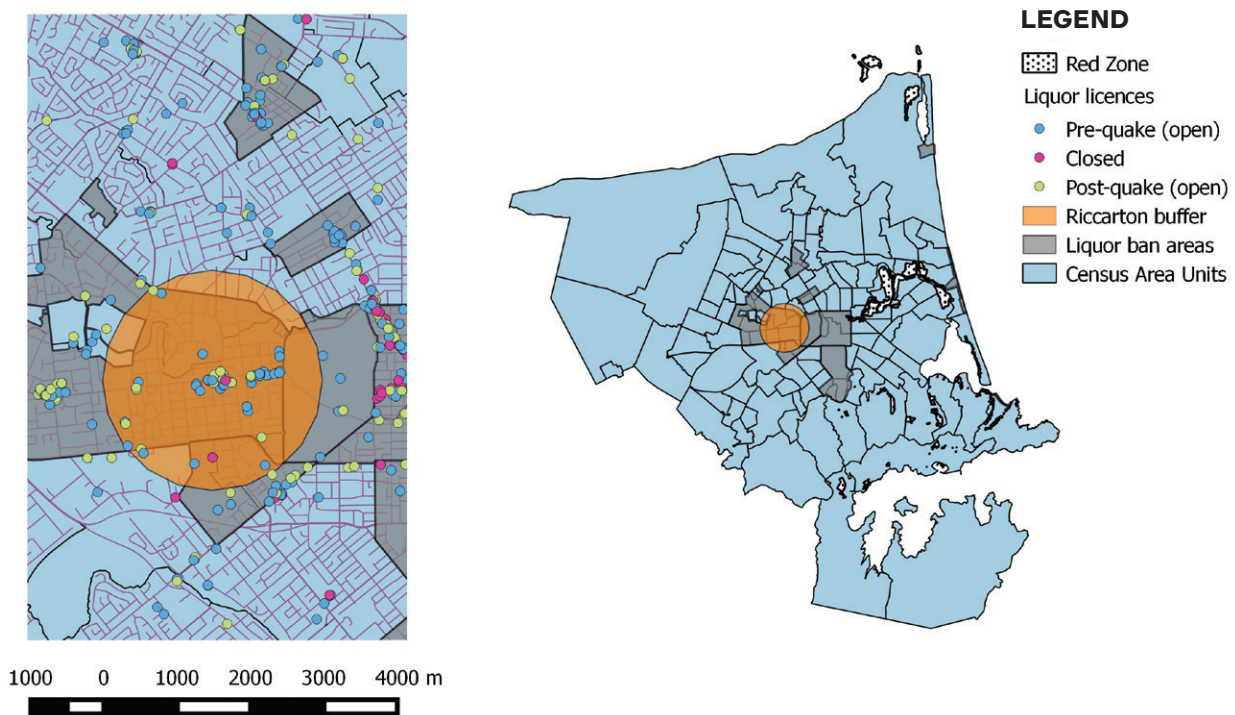


Figure 12: The Riccarton buffer zone

Riccarton Road is visible running horizontally through the centre of the circle, with Hagley Park and the Rebuild zone visible on the right, and the Church Corner licence cluster visible on the left. Licences closed in the earthquake are shown in pink, and licences that opened post-quake are shown in green. Council alcohol ban areas, which cover almost all of this area, are shown in grey.



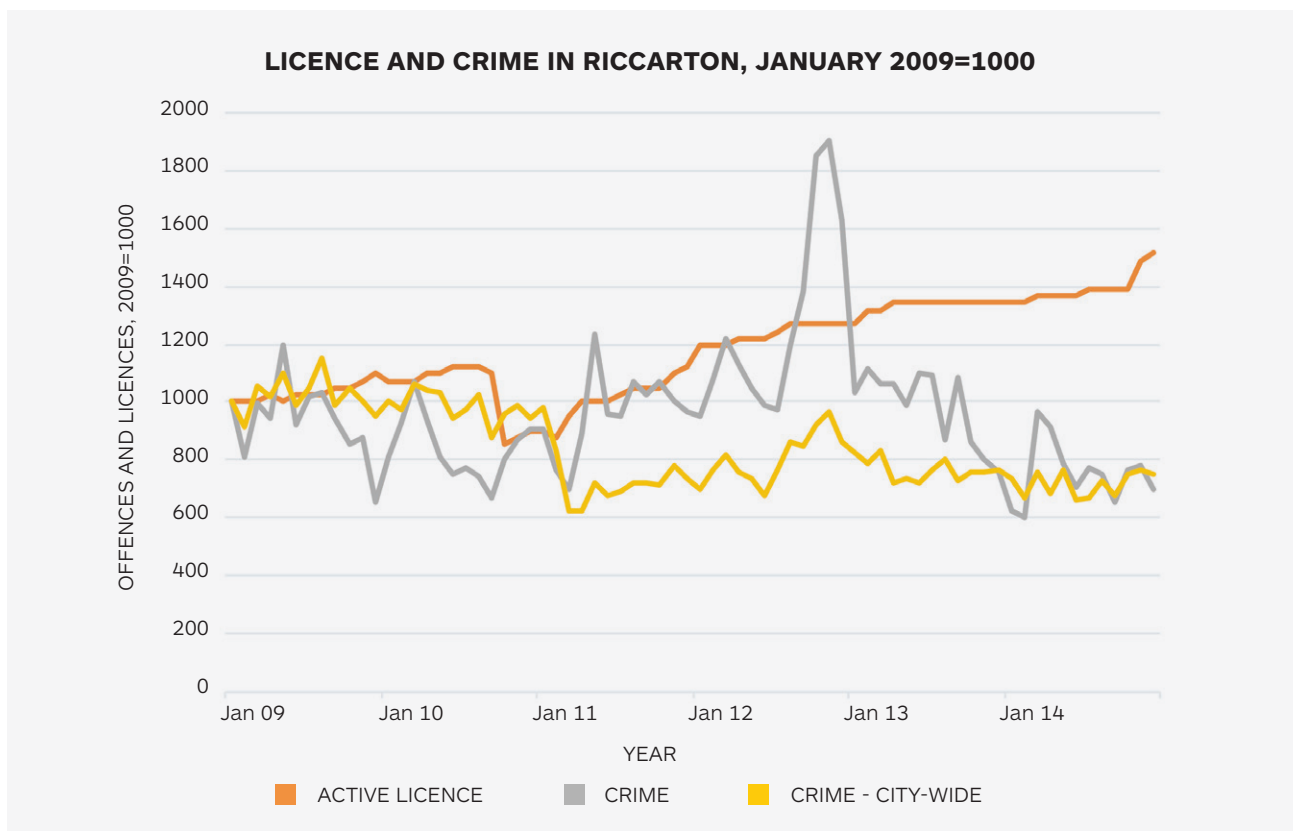


Figure 13: Alcohol licences in the Riccarton area compared with offending, and with offending city-wide

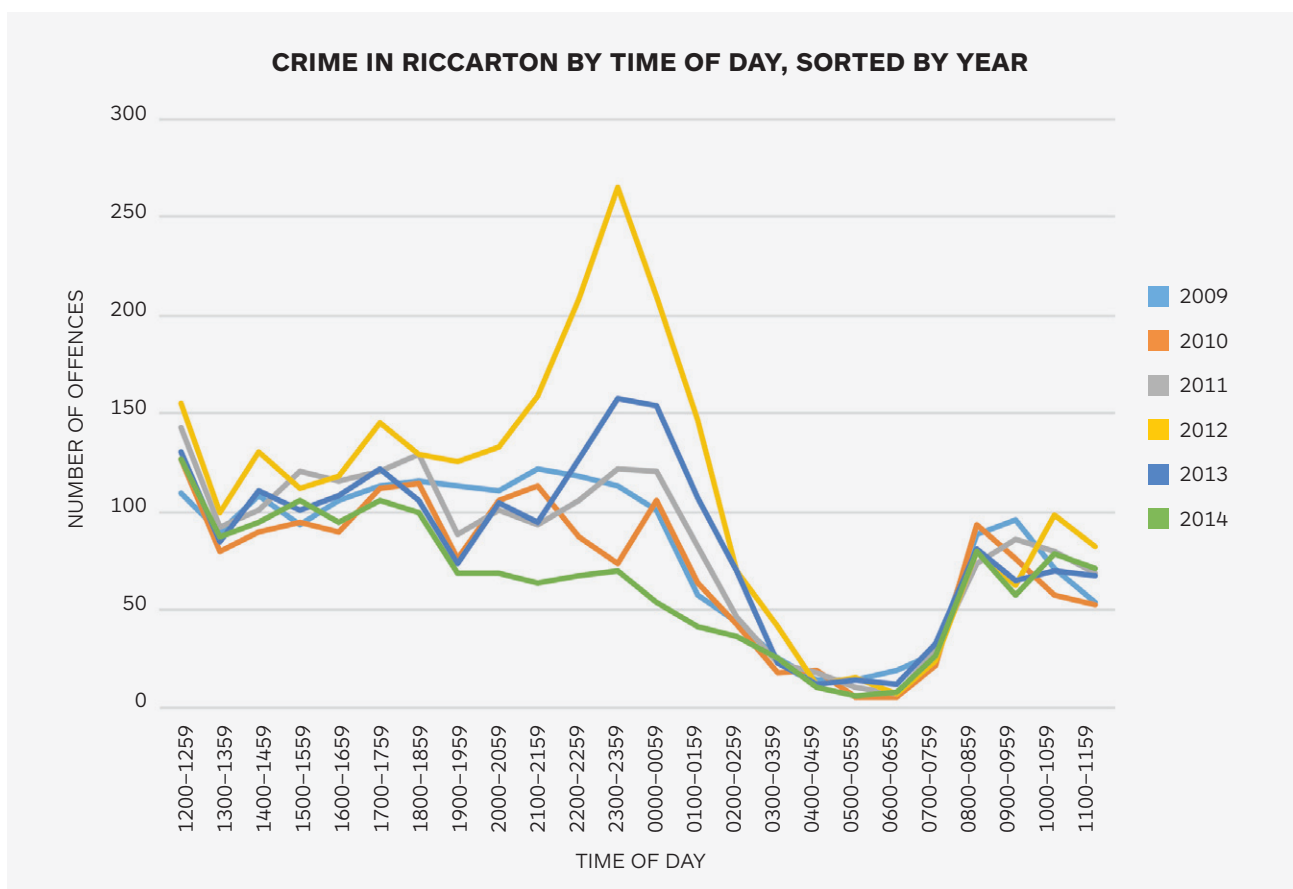


Figure 14: Crime by time of day in Riccarton

As we can see in Figure 14 above, the quantity of night-time offending increases substantially in 2012 and to a lesser extent in 2013, centred around the hours from 10pm to midnight. These were the years that Riccarton was most popular as an alternative area for drinking, first in 2012 when there were few other places to go, and then to a lesser extent in 2013 as the number of new or reopened premises elsewhere began to increase. In 2014, night-time offending drops considerably, falling below afternoon offending for the first time in any of the years in question.

Table 11: Offences by year and by category in Riccarton

	2009	2010	2011	2012	2013	2014
Dishonesty	1398	1214	1289	1319	1166	1074
Violence	121	171	159	189	182	191
Drugs & Antisocial	114	118	319	881	487	136
Property damage	289	218	208	233	190	142
Total	1922	1721	1975	2622	2025	1543
Change in crime relative to city-wide	-	-7%	43%	73%	40%	15%
Active alcohol licences (December)	45	37	46	52	55	62

As we can see in Table 11 above, the majority of this sudden increase in offending is in the category of Drug & Antisocial, which rose from 114 offences in 2009 to 881 in 2012. This was primarily due to breach of alcohol ban charges, which are included in this category and are often used by police as a method of controlling drinkers in the area. Police have confirmed that these figures are in line with deliberate initiatives to enforce alcohol bans in the area as a means of pre-empting later offending. The rates of this offence may be particularly high because pre-charge warnings became available for use during this period as well, allowing police to enforce the alcohol ban more easily and with fewer long-term consequences.

Table 12: Breaches of alcohol ban in Riccarton

	2009	2010	2011	2012	2013	2014
Breaches of alcohol ban	0	4	82	513	264	-

As shown in Table 12, this was concentrated in 2012, but remained high in 2013. Unfortunately data for this charge was unavailable for 2014, because it was moved to a different offence category. Police have confirmed however that the use of this charge was substantially lower in 2014 after the deliberate pushes in 2012 and 2013 had ended.

Other categories of offending also show considerable variation between 2009 and 2014 in Riccarton. Violence increases sharply between 2009 and 2010 and then remains relatively steady until 2014. The explanation for this is not readily apparent: although the increase in 2010 coincides with the earthquake and the resulting increase in patronage, the earthquake occurred in September, while the increases are distributed across the year as a whole. It is possible that 2009 was an outlier, or that new licences or facilities had opened earlier in 2010 that are responsible.

Property damage exhibits a substantial post-earthquake decline, falling by 51 percent from 289 in 2009 to 142 in 2014. This change is mirrored to varying extents in Merivale, Papanui, and Church Corner, where property damage fell by 61 percent, 43 percent, and 43 percent respectively. This may be explained by increased police presence in these areas (particularly in Merivale and Riccarton, in response to increased alcohol delivery) and the increased natural surveillance created by intensified use (Desyllas, *et al.*, 2003). Where more crowded areas may create greater opportunity for violence by pushing people together, they may naturally inhibit vandalism and property damage by ensuring that no area provides the relative invisibility needed to commit such crimes.

## MERIVALE

As with Riccarton, Merivale is an area with an existing cluster of licences that experienced a temporary but substantial increase in patronage after the earthquakes. As shown in Figure 15, there is a cluster of licences in the area centred around Merivale Mall, which is a small and upmarket shopping area with around forty stores that suffered limited damage in the earthquakes. There is a council alcohol ban in the area surrounding this mall, which restricts alcohol consumption to private and licensed premises seven nights a week from 6pm to 6am.

The majority of premises in this area reported an increase in patronage after the earthquake ( $n = 19$ ), with some reporting a substantial increase ( $n = 8$ ). A small number reported a decrease ( $n = 8$ ). Interviewees in the area reported an increased range of customers, with more business-people, tradesmen, and younger patrons with disposable income visiting the area.

The buffer zone centres on four CAUs whose corners touch the Merivale mall area. These areas have median ages ranging from 39 to 42.8, and median incomes between \$36,600 and \$41,900, placing them among the city's oldest and wealthiest. Populations in these areas show an overrepresentation of professional and management occupations, and low numbers of trade workers or labourers.

As shown in Figure 16, offending in Merivale fell during the post-quake period, with the average number of offences decreasing by 17 percent in the post-quake period, which however remains 9 percent greater than we would expect relative to the city as a whole. In the longer-term period offending has decreased further, falling to an average of 31 percent less than pre-quake levels, which is a further 6 percent less than we would expect given the decrease city-wide. **This makes it the only cluster of the five examined to be performing better than the city-wide average (excluding the CBD).**

Some of this decrease may be attributable to the area's proximity to the CBD: where foot traffic would previously enter the southeast section of the buffer area on the way out of town, creating increased opportunities for offending, with the CBD's patronage diminished much of this traffic is reduced.

Table 13: Offences by year and by category in Merivale

	2009	2010	2011	2012	2013	2014
Dishonesty	1007	1071	702	906	570	630
Violence	138	102	104	144	151	166
Drugs & Antisocial	112	101	113	212	170	127
Property damage	243	201	130	174	158	95
Total	1500	1475	1049	1436	1049	1018
Change in crime rate relative to city-wide	-	2%	-3%	21%	-7%	-3%
Active alcohol licences (December)	51	44	41	49	54	61

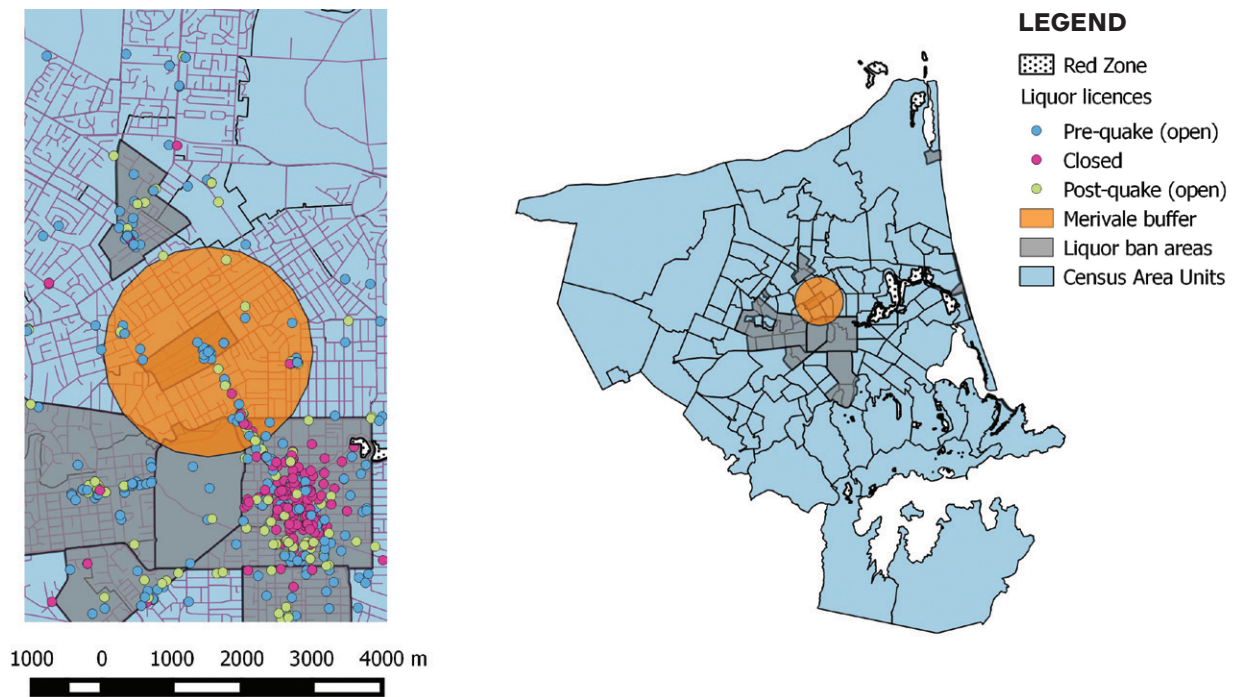


Figure 15: The Merivale buffer zone

The central city is visible to the southeast. The high degree of clustering of licences in the area can be seen in the centre of the buffer, where nineteen licences are clustered in an area less than 800 metres across. There is an alcohol ban area around this cluster (shown in purple), and the buffer zone intersects with part of the Hagley Park alcohol ban area to the south. A degree of overlap with the Victoria Street section of the Central City buffer is visible.

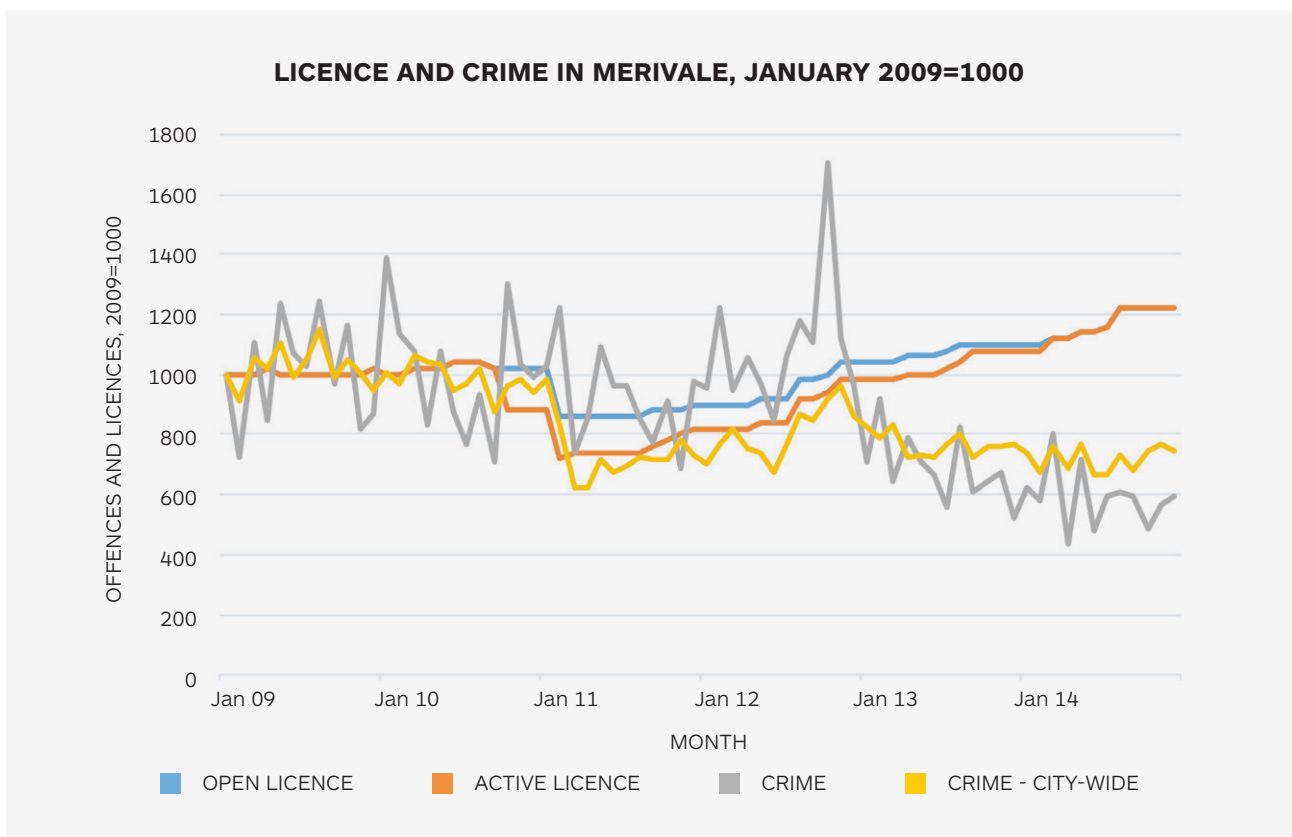


Figure 16: Alcohol licence and crime in Merivale

Note that the crime rate shows significant variation because the number of offences each month is low, and therefore easily influenced by a small number of offences.

Although Merivale became known as a popular alternative to the CBD bars after the earthquake, substantial increases in Merivale's popularity (and an associated increase in crime) appear to be confined to a single year. As shown in Table 13, offending in 2012 ( $n = 1436$  offences) visibly stands out from what was otherwise a remarkably consistent drop in offending in 2011, 2013 and 2014.

This area experienced limited earthquake damage, with one outlet closing in the 2010 earthquake and eight closing in 2011. There were a small number of temporary earthquake closures in this area, the majority of which were long-term. Of those that were able to recall the dates of their closures, the average was 586 days, with three premises closed for more than two years. In the years following the earthquake, the number of licensed premises in the area rose by 20 percent, from 51 to 61, many of which were bars opening in 2012/13 in the southeast section of the buffer zone (toward the CBD and the Victoria Street area).

As with other areas that were markedly popular post-quake, offending in 2013 and 2014 can be seen dropping noticeably, even as alcohol licences in the area continue to increase gradually.

Much of the decrease in offending comes from the categories of dishonesty and property damage, which decreased by 37 percent and 61 percent respectively. Violence shows a steady and gradual increase, rising by 20 percent over 2009 values, despite falling temporarily during 2010 and 2011.

Drug & antisocial offending also increased, rising by 89 percent in 2012, then declining to only 13 percent above 2009 by 2014, most closely mirroring the developments that we might expect from an area that experienced a brief but substantial increase in patronage. This appears to have been motivated in part by increased use of breach of alcohol ban charges, which increased substantially during those years. This mirrors the increased use of the alcohol ban by police seen in the Riccarton area, but to a considerably lesser extent.

As shown in Figure 17, crime by time of day in Merivale varies significantly between the pre-and post-quake periods, with a significant flattening of night-time offending visible in the longer-term period. In 2012, we can see that the peak in offending temporarily moves to midnight, putting it

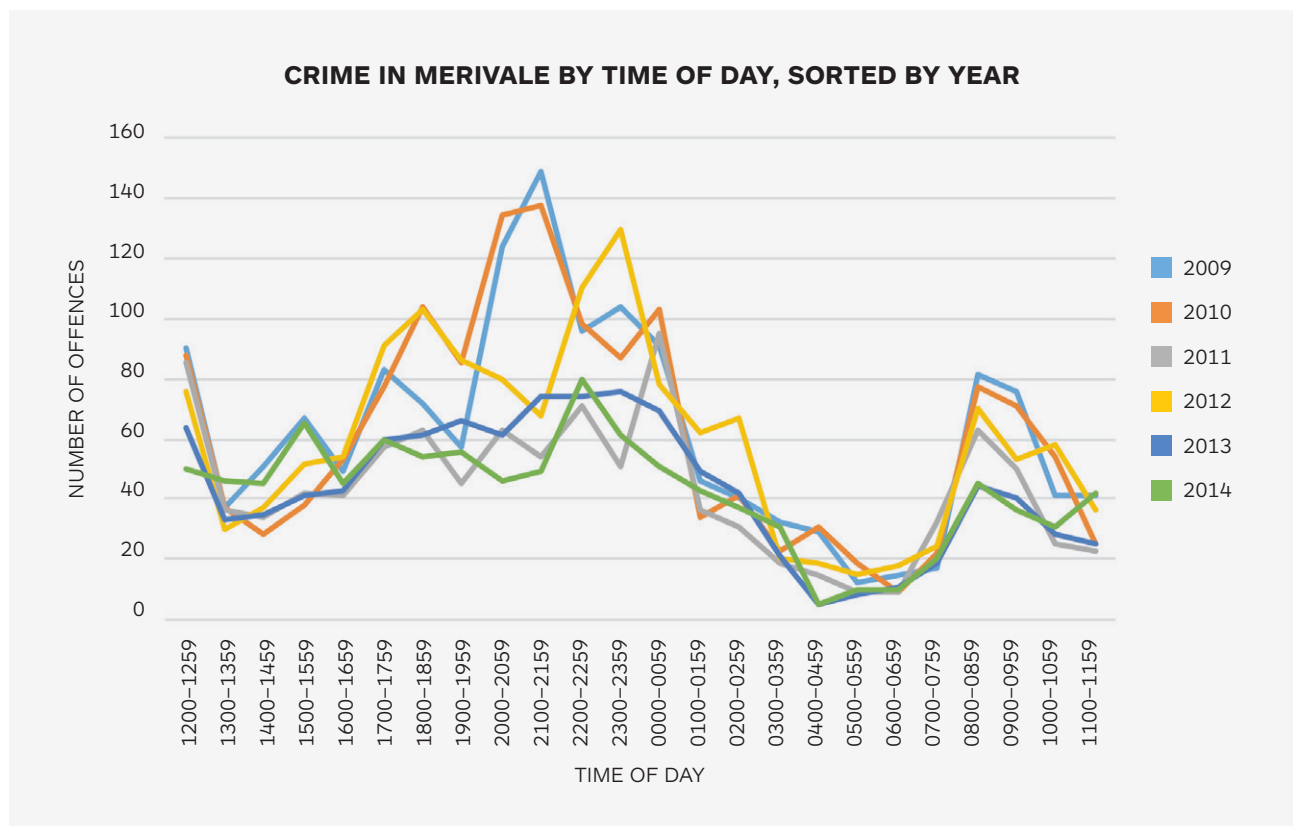


Figure 17: Crime by time of day in Merivale



more in line with what we might expect from the area's changing role during that year, with patrons staying in the area later and the police making their most concentrated efforts to control drinkers during that time period.

The reason for the substantial decrease that we can see in earlier-night offending (between 8pm and 10pm) after the earthquake is not apparent, but appears to reflect an immediate and ongoing change in patterns of night-time use in the area.

## HORNBY

Located on the western edge of Christchurch, with close access to the Christchurch Southern Motorway, Hornby has a very large number of businesses devoted to industrial manufacturing and distribution, and a primarily working-class population with large numbers of machinery operators and labourers residing in the area. The average income in the two main CAUs covered by the buffer is slightly below the city-wide average, and the average ages of the populations in these areas are 35.6 and 36.1, which is below the city-wide average of 38.6. Of the six clusters, Hornby is the farthest from the centre of the city.

At the centre of the buffer zone is a mid-size mall with 60 retail stores, which, as shown in Figure 18 below, is surrounded by a number of alcohol licences in the immediate vicinity. Beyond the mall, the area has undergone development during the period in question, adding shops and new industrial premises. Despite this, alcohol licence numbers in the area have remained largely static, with no earthquake closures and no new licences opened since late 2011. The area suffered very limited damage in the earthquake and businesses in the area reopened quickly.

Despite the size of the shopping mall, this area has a much lower alcohol outlet density than other areas, with only 16 active licences in the area in 2014 compared to 62 in Riccarton and 61 in Merivale.

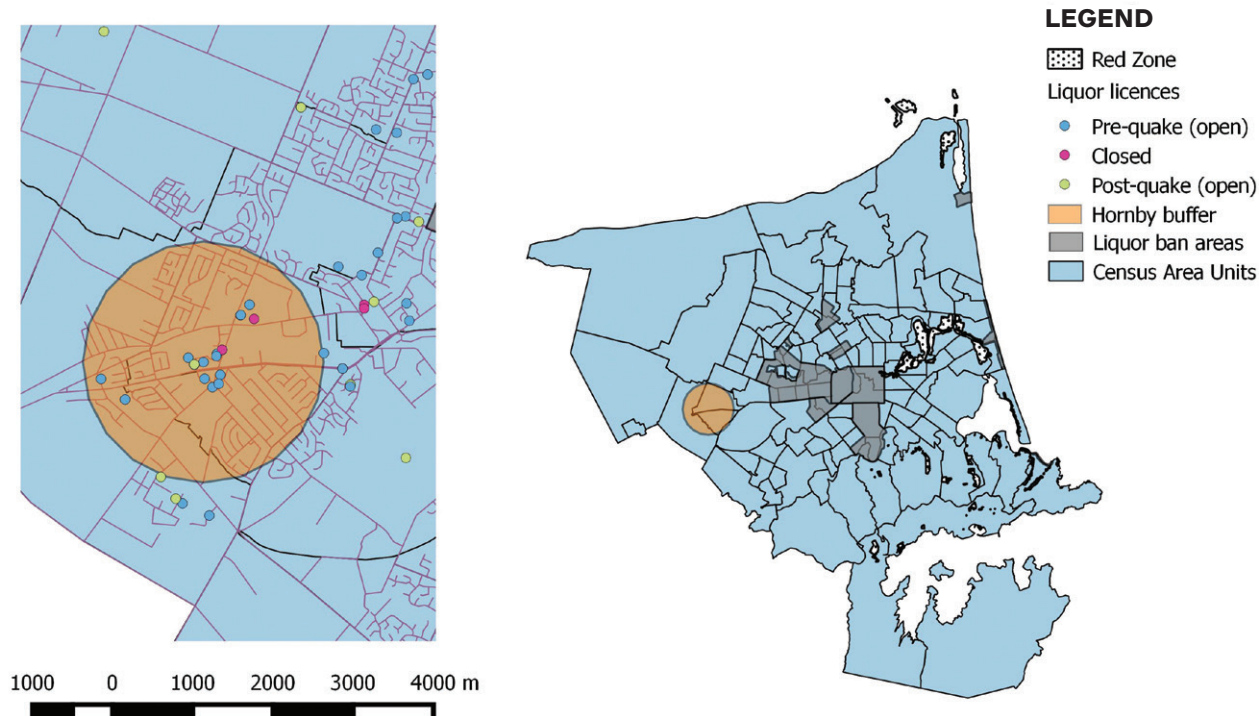


Figure 18: The Hornby buffer zone

The Riccarton Road and CBD areas are visible to the right, and the edge of the city on the left. This is the only buffer area that contains no council alcohol ban area, and the farthest from the CBD. Located at the eastern edge of town, Hornby is close to major highways and Christchurch airport.

Nonetheless offending in the area is comparable, with 1080 individual offences in our categories in this area in 2014, compared with 1018 in Merivale and 1543 in Riccarton. Many of the licensed premises in this area are bars, sports clubs and liquor stores, with very few licensed restaurants that are not primarily bars as well. The proportion of off-licences in Hornby is substantially higher than in other areas, with forty percent of licences in 2014 making off-licence sales (two of which are bars that have both on and off-licences). There are three dedicated bottle stores and one supermarket in the area, which is the same as the number in Riccarton and greater than the number in Merivale, indicating a substantially different variety of demand in the area, despite the small number of total licences.

As illustrated in Figure 19, offending in Hornby rose during the post-quake period, with the average number of offences increasing by 11 percent in 2011 and 2012, which is 48 percent greater than we would expect relative to the city as a whole. In the longer-term period this increase has remained steady at 11 percent above pre-quake levels. Although this is a relatively small increase in raw offending numbers, crime in the area remains a full 50 percent higher than we would expect given the much greater decreases in offending city-wide.

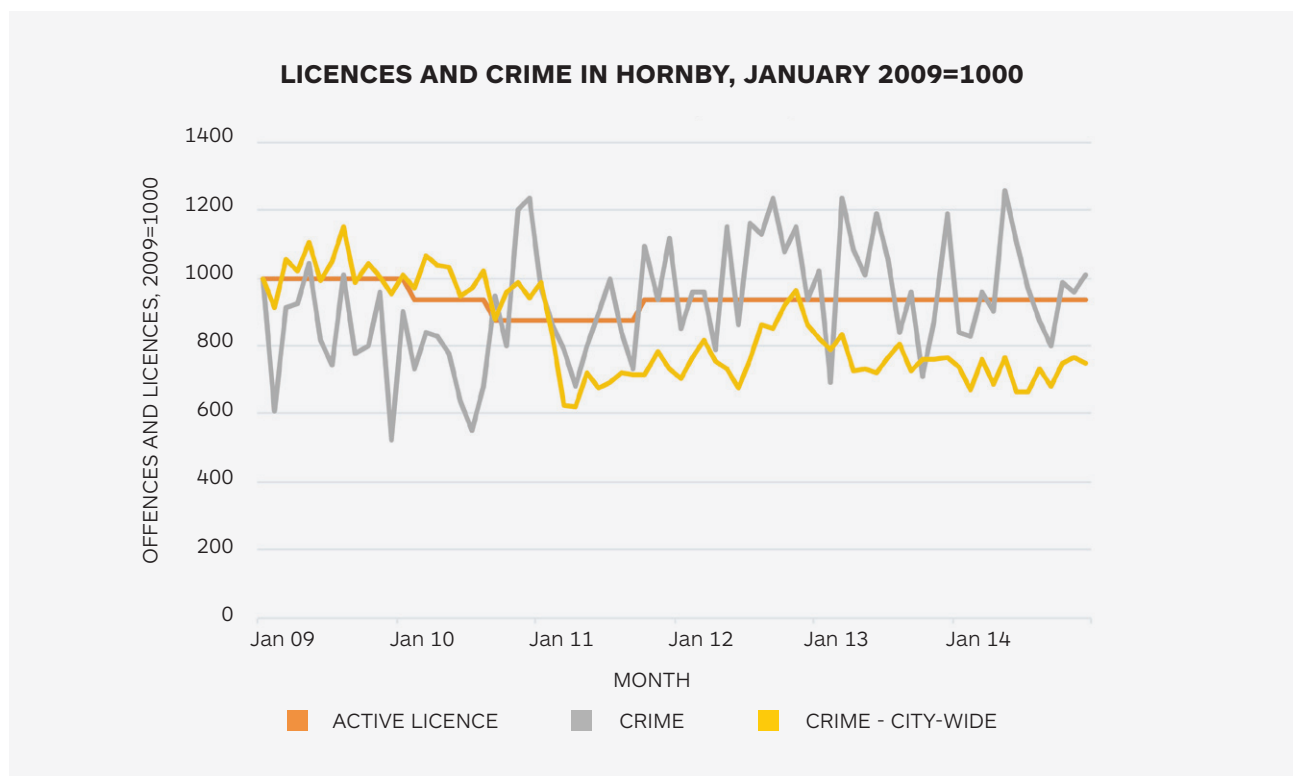


Figure 19: Licence and crime in Hornby compared with city-wide crime

Note the substantial monthly variation in offending in Hornby, and the apparent lack of change after the earthquakes.



Table 14: Offences by year and by category in Hornby

	2009	2010	2011	2012	2013	2014
Dishonesty	558	620	594	724	712	661
Violence	114	111	158	158	186	163
Drugs & Antisocial	79	75	121	106	66	102
Property damage	200	147	134	163	151	154
Total	951	953	1007	1151	1115	1080
Change in crime relative to city-wide	-	4%	47%	54%	56%	49%
Active alcohol licences (December)	16	14	15	15	15	15

As shown in Table 14, of all of the areas analysed Hornby's offending diverges most conspicuously from offending in Christchurch overall. This is because raw offending have remained largely unchanged throughout the period in question: where in other areas offending fluctuates, crime in Hornby is highly consistent, varying by no more than 11 percent in any of the years in question. Hornby is the only area to display an increase in raw number of offences from 2009 to 2014, although it is relatively small. Notably, violent crime increases considerably in 2011 and remains high for the remainder of the period under study. Only one new licence opened in Hornby during this period, but it is one with a focus on late-night alcohol provision and a younger clientele, which therefore may have attracted a range of different patrons to the area.

Some of this lack of variation may be attributable to Hornby's isolation from the rest of Christchurch. Where all other areas were altered in some way, either in terms of licences present or their use by the public, licences in Hornby remained extremely static, and as an industrial area that quickly returned to work post-quake, Hornby's clientele presumably remained consistent. In other areas such as Merivale and Riccarton, which are closer to the CBD, their geographic convenience can be assumed to be a major component of their increased popularity, but as a suburb on the edge of the city, most of those frequenting Hornby licences were likely to be locals or people working in the area. Hornby is also a transport 'hub' and a central spoke in the wheel of many public transport routes, which may indicate that where many residents would previously have travelled out of Hornby for the CBD, they may have begun to visit and remain in local premises instead, contributing to the relative increase over city-wide crime.

As we can see in Figure 20 below, crime by time of day shows little change in Hornby during the period in question, which stands as a stark contrast to other areas which consistently saw decreases in offending during the late-night period. Because the number of actual offences is reasonably low, any spikes in offending are difficult to discern from normal fluctuations, however. There is a noticeable increase in offending at midday (shown on the far left of the graph) in 2013 and 2014, the origin of which is unclear. Police have indicated that crime spikes at midday may be caused by a lag in reporting or recording of overnight offending such as property damage or burglary, and may therefore be representative of an increase in (potentially alcohol-related) offending distributed over the night. There is no similar increase in the morning, however, when we might also expect to see a similar effect as night-time damage is discovered. Unlike other areas with a specifically late-night-oriented drinking culture, offending remains relatively flat during the night in Hornby. This may be owing to the types of premises in the area: bars appear targeted toward an older demographic, meaning that younger residents may be more likely to travel into town.

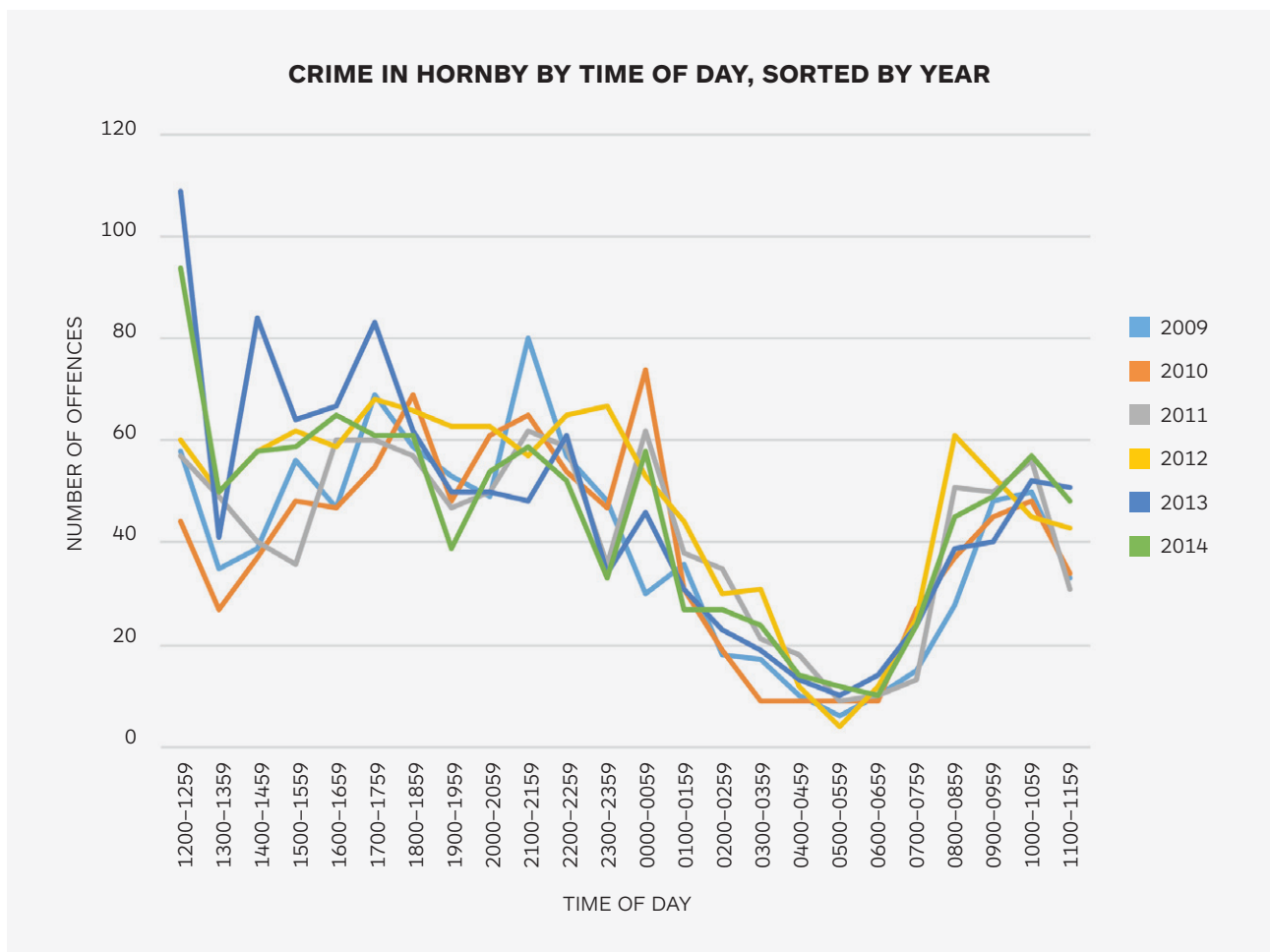


Figure 20: Crime in Hornby by time of day

## PAPANUI

Papanui is another area with a large shopping mall (135 stores) at its centre surrounded by a cluster of alcohol licences that were largely undamaged by the earthquakes. The mall reopened early after the earthquakes. As shown in Figure 21, Papanui is on the northern border of the city, and has a liquor ban area at its centre surrounding the shopping mall.

The cluster in this area is predominantly comprised of restaurants, but has a number of premises that focus on alcohol, some of which were identified by police as having been hotspots for alcohol-related offending. The area experienced increased popularity in 2011 and 2012, but did not experience any increases in raw numbers of offences. Offending did increase relative to city-wide crime, but not to the same extent observed in other areas.

The CAU at the centre of this buffer has a median age of 41.8, and a median income of \$34,300. The neighbourhoods on the periphery have median incomes ranging from \$24,700 to \$39,800, but similar median ages. The Papanui CAU has a higher number of professionals than the city-wide average, and less manufacturing or labouring workers.

Premises in this area adapted to service a greater demand post-quake, and a short-lived nightclub opened in the area. Half of existing premises surveyed reported an increase in patronage ( $n = 11$ ), with some others reporting no change ( $n = 7$ ), but few reporting a decrease ( $n = 4$ ). Interviewees in the area reported an increase in tradespeople and foreign workers after the earthquake. Only one licence holder (a restaurant) reported increasing their trading hours to accommodate this demand, while all others reported no change.



Figure 21: The Papanui buffer zone

The alcohol ban area is visible at the centre of the buffer zone. Northlands mall and the cluster of licences around it is visible in the centre

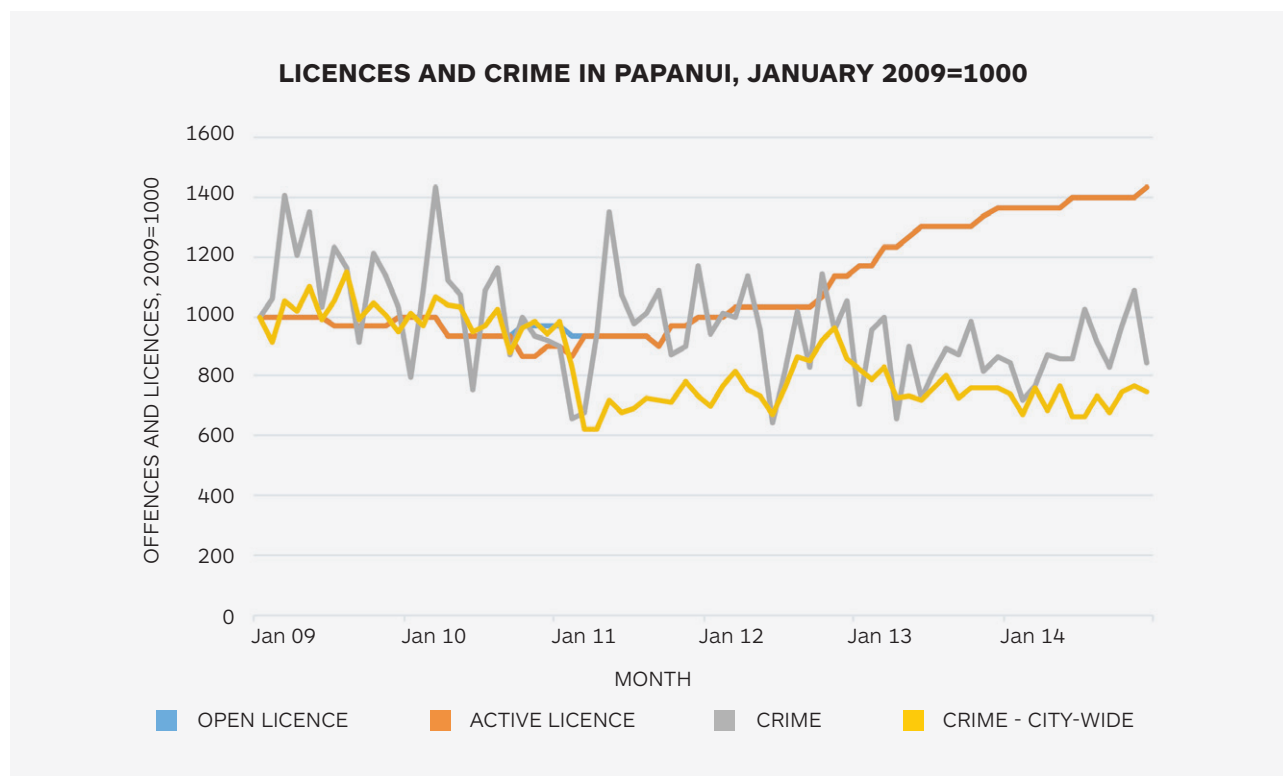


Figure 22: Licences and crime in Papanui compared with city-wide crime.

Table 15: Offences by year and by category in Papanui

	2009	2010	2011	2012	2013	2014
Dishonesty	1135	933	904	919	783	881
Violence	159	157	182	143	157	167
Drugs & Antisocial	110	146	136	131	110	79
Property damage	217	208	148	177	152	123
Total	1621	1444	1370	1370	1202	1250
Change in crime rate relative to city-wide	-	-8%	18%	7%	-1%	10%
Active alcohol licences (December)	30	27	30	34	41	43

As shown in Figure 22 and Table 15, Papanui shows considerable increase in alcohol outlet density, with total licences in the area increasing by 43 percent (from 30 to 43) between 2009 and 2014. Temporary earthquake closures in this area were few ( $n = 3$ ), with two licences closing for only a month and one for three months. While on-licences have increased the number of off-licences in the area has remained static, meaning that the proportion of off-licences fell from 30 percent ( $n = 9$ ) in 2009 to 21 percent ( $n = 9$ ) in 2014.

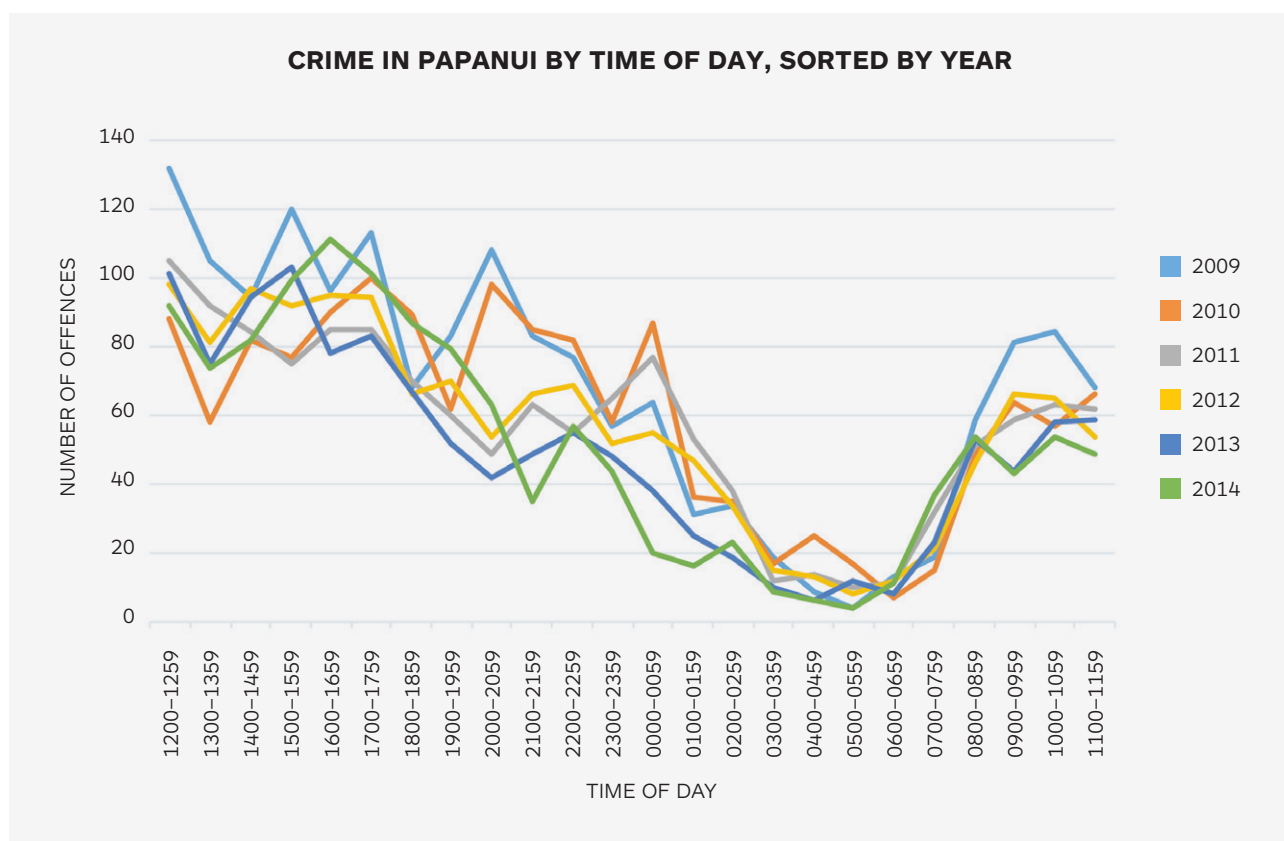


Figure 23: Crime in Papanui by time of day, sorted by year

As shown in Table 15 and Figure 23, overall crime in this area has consistently fallen since 2009, with all categories of crime except violence dropping. Total offences increased slightly from 2013 to 2014 (increasing by 4 percent, or fifty offences), caused by small increases in violence and dishonesty, but remained substantially lower overall than pre-quake totals. Only violence has increased over 2009 levels at any stage, rising 14 percent above the base in 2011 and 5 percent above in 2014, but remained steady in other years, despite continuing growth in licence numbers. Property damage in the area has fallen more substantially than other offence categories, dropping by 43 percent between 2009 and 2014.

Because the number of total offences in Papanui is relatively low, discerning patterns of timed offending in the area is difficult. What is apparent in Figure 23 is that night-time offending has decreased significantly since the earthquakes: where night-time spikes in offending are visible in 2009 and 2010, offending falls away substantially in 2013 and 2014. The same is true for offences in the early morning, which are likely to be night-time offences that are not reported or discovered until the morning. Offending during the afternoon, which is less likely to be connected to alcohol, remains relatively steady however. This indicates that changes to offending – which occur during time periods that coincide with alcohol provision – are likely to be driven by increases in alcohol provision and alcohol-related use of the area. An increase in offending between the hours of midnight and 1am is visible in 2011, and it was suggested by police that we might expect to see an increase during that year because of a short-lived high-volume nightclub that opened near the centre of the Papanui cluster of interest.

## **CHURCH CORNER**

Church Corner is of interest because it shows high growth in alcohol licences in the area during the period in question, rising by 57 percent from 30 licences to 47.

Church Corner is a relatively small (in comparison to the shopping malls in other areas) cluster of shops and licensed premises directly to the west of the Riccarton buffer, following along Riccarton Road. This area contains both the Bush Inn Shopping Centre, a small shopping mall with a number of fast-food restaurants, a liquor store and a supermarket, and the Church Corner Mall, a series of small arcade-style malls with primarily Asian-style restaurants and shops. These two malls are directly next to one another, separated by a busy road. Although there are a large number of on-licences in the area, the majority are restaurants.

As with nearby Riccarton, this area suffered limited earthquake damage and so appeared likely to attract increased patronage as other areas waited to rebuild or reopen. Premises surveyed in this area reported a wide variation of changes in patronage however, with eleven premises reporting an increase, five reporting no change and seven reporting a decrease. No premises in the area increased their hours, but one did report a decrease after suffering a substantial loss in patronage. Interviewees in the area reported that increases were comprised of tradesmen, younger people and patrons from outside of the area.

As shown in Figure 24, Church Corner is on the periphery of Christchurch to the north, and its area also includes the University of Canterbury. The University has a number of licensed premises on campus, and frequently hosts licensed ticketed events of varying scales. A large number of University students live in the area, although anecdotally the off-campus bars that they frequent are more likely to be in the Riccarton buffer area to the east. This area has a high student population, as represented by median incomes in the CAUs at its centre ranging from \$21,800 to just \$13,200, and median ages ranging from 35.6 to as low as 22.9.



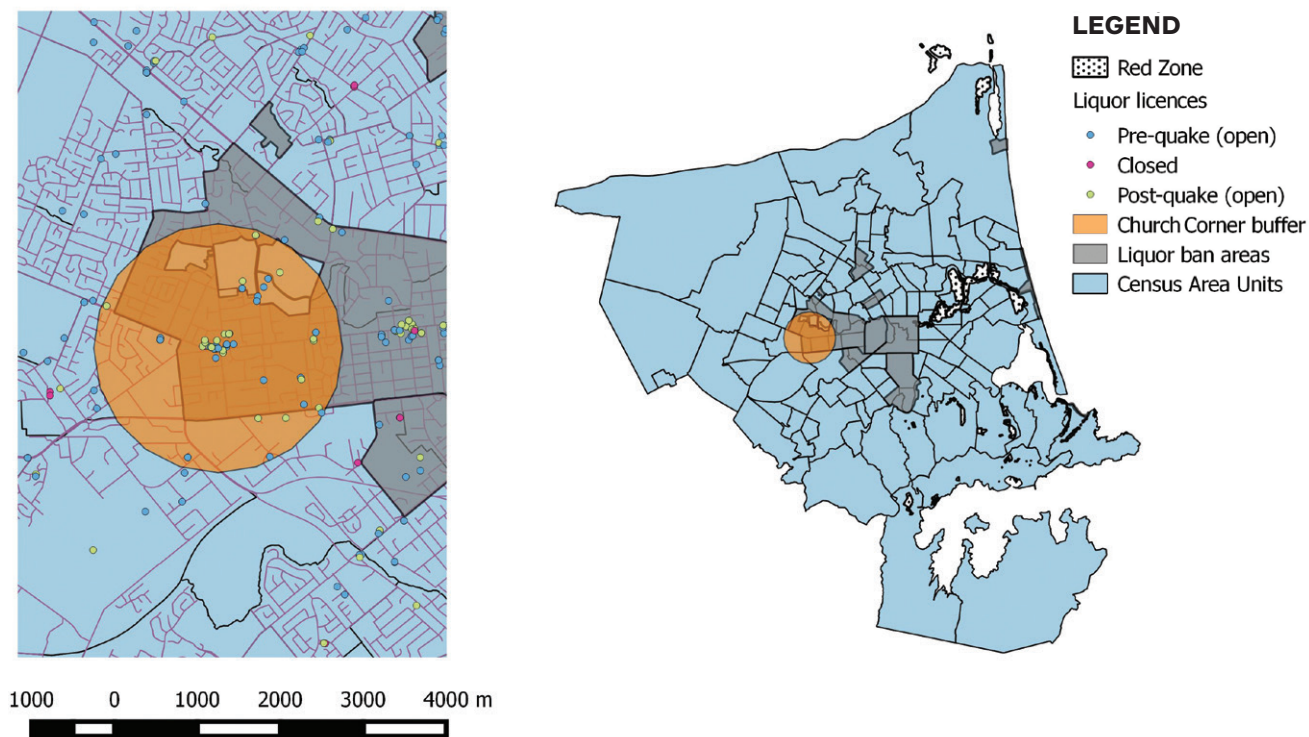


Figure 24: The Church Corner buffer zone

The Riccarton cluster and the central city are visible to the east. The Church Corner and Bush Inn malls are both at the centre of the buffer zone. The three large sections to the north that are excluded from the alcohol ban area are the University of Canterbury campus, which is excluded from the marked Council alcohol ban areas, but has a similar policy maintained by university security.

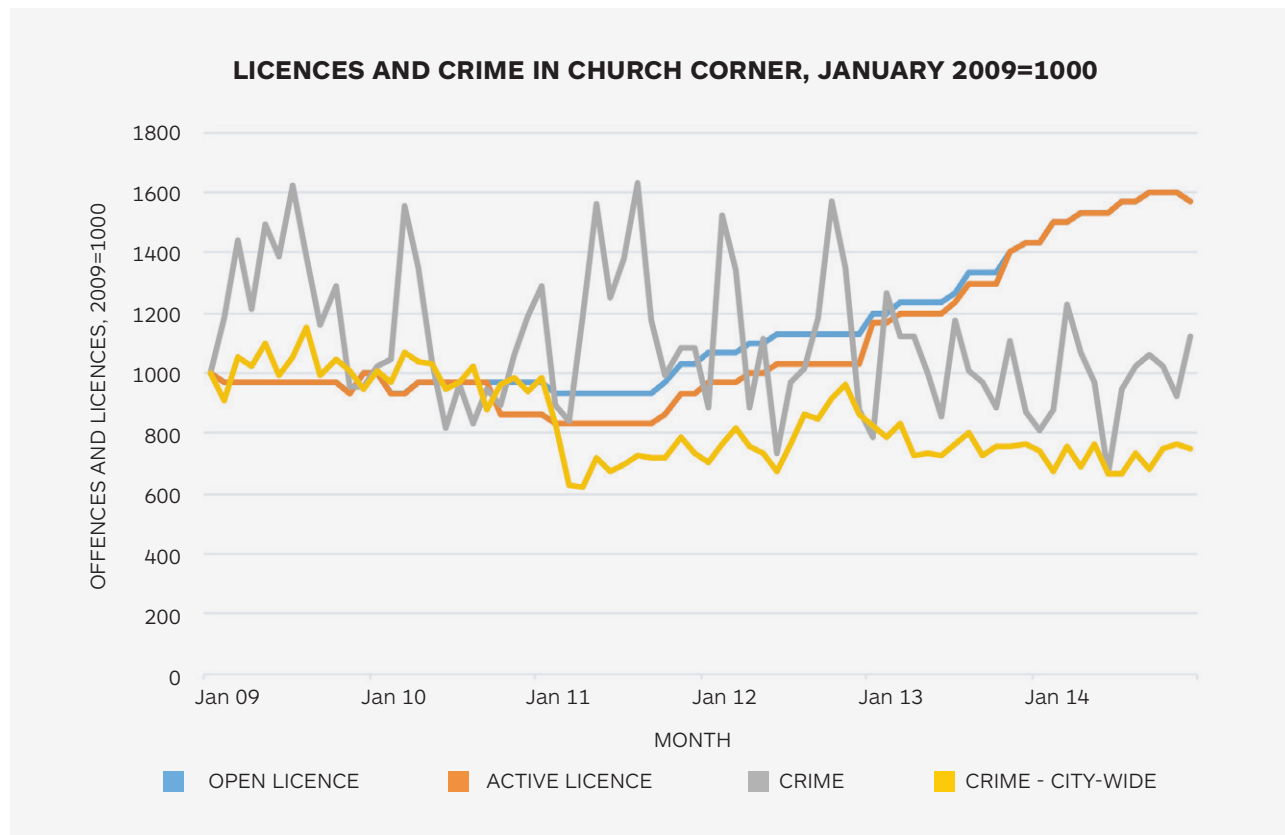


Figure 25: Licences and crime in Church Corner compared with city-wide crime rates.

Table 16: Offences in Church Corner by year and by category

	2009	2010	2011	2012	2013	2014
Dishonesty	1241	1044	1099	920	873	959
Violence	105	112	144	138	147	162
Drugs & Antisocial	117	87	223	301	186	72
Property damage	256	207	174	176	182	144
Total	1719	1450	1640	1535	1338	1337
Change in crime rate relative to city-wide	-	-12%	33%	13%	8%	11%
Active alcohol licences (December)	30	26	28	31	43	47

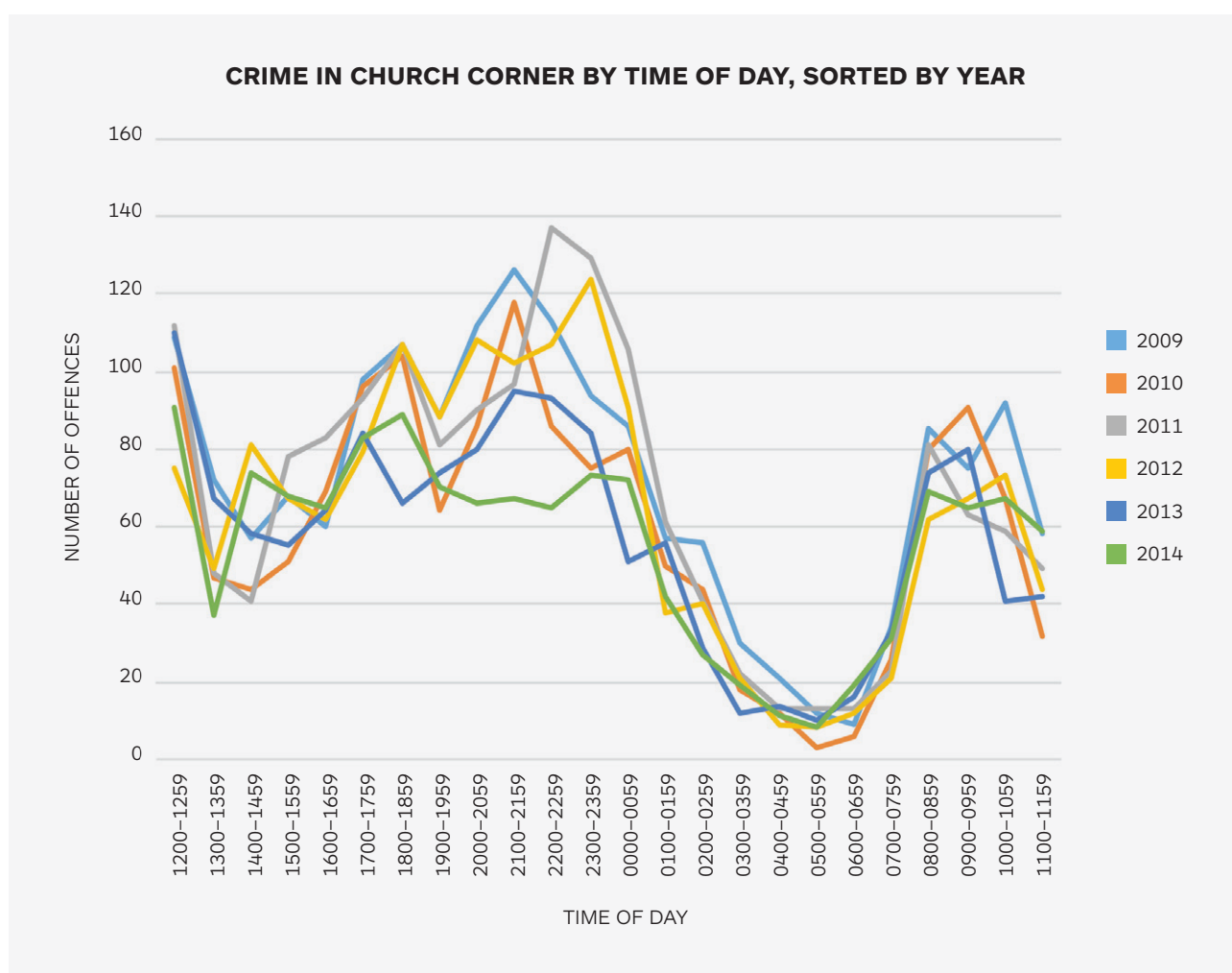


Figure 26: Crime by time of day in Church Corner

As shown in Table 16, the number of licences in the area has grown substantially since 2009, rising by a total of 17 active licences to 47. Some of this increase is due to extensions of the Bush Inn complex, the majority of which are fast-food style restaurants. Earthquake closures were limited but tended to be longer-term. The number of off-licences in the area showed little variation, rising from seven in 2009 to eight in 2014, despite a greater increase in the number of on-licences. The proportion of off-licences fell from 23 percent in 2009 to 20 percent in 2014.



Offending in Church Corner remained consistently higher than offending citywide from 2011 onwards, although it remains lower than it was in 2009 (see Table 16). This is particularly apparent in 2011, when city-wide offending fell substantially after the earthquake, but did not fall in Church Corner. Crucially, crime and licence numbers in this area diverge substantially, with the sharp rise in licence numbers after 2012 appearing unconnected to the rate of offending, which continues to decline slowly. While other categories of offending show limited apparent predictability, violent offending shows a steady and considerable increase during the period under study, rising by 54% from 105 in 2009 to 162 in 2014. This increase appears to broadly follow the concurrent rise in alcohol outlets – a pattern that is unique to Church Corner and not readily explicable.

As evidenced in Figure 26, crime in this area shows a much greater monthly variability than city-wide offending because of the much lower quantities of offending involved, making it difficult to determine clear patterns in offence timing, but night-time offending appears to have decreased considerably, particularly in 2014, while daytime offending remains more consistent. This indicates that alcohol-related offending has fallen in the area, despite a 57 percent increase in alcohol outlet numbers since 2009. This may be explicable by the changing nature of licences in the area: while many restaurants have opened, few are open late, and one popular high-volume bar/nightclub (which was known to be problematic) closed in late 2011, leaving few premises outside of the university bar with a focus solely on alcohol. Although it was suggested by police that we might expect to see a substantial decrease in offending after that bar closed, there is little visible distinction between 2011 and 2012.

## DISCUSSION

The findings in this section provide a number of interesting discussion points and also some important policy considerations.

Given the significant spikes in crimes at night, the consumption of alcohol appears significantly linked to offending in our four categories in Christchurch's central city. This was a connection that was supported by police. It is also clear that the central city was a hotspot for crime, and that this area created more reported offending than when city activities were pushed into the suburbs where the density of alcohol outlets was lower. While it must be noted that the central city's concentrated environment may also mean that the police are more able to observe and respond to offences when they occur, potentially resulting in more reported offences, it is more likely that the concentration of people is of greater significance. **The quantity of crime that transferred from the central city to the suburbs was substantially less than what we would have expected. If the central city had been unaffected by the earthquakes, it appears likely that overall crime would now be higher.**

One hypothesis of this research was that we would find a significant rise in crime in the areas that were heavily patronised in the aftermath of the earthquakes. Observing this change proved to be difficult because of the sharp decline in crime across the city as a whole after the earthquakes, but by looking at offending in our areas relative to declining overall crime, it became clear that something akin to this was observable in our chosen areas. Only two areas (Riccarton and Hornby) showed increases in real numbers of offences, but every cluster of interest (excepting the Central City) performed worse relative to the declining city-wide crime during the post-quake period (2011 and 2012). This pattern held in the longer term (2013-2014), with the exception of Merivale, which by 2014 was performing better than average. Of the remainder, Hornby was the most troublesome, exhibiting a small increase in real offending and comparing extremely poorly relative to city-wide crime, but was also the most isolated cluster from the rest of the city, and had a substantially different makeup of licences and population demographics.

Given what we know about alcohol licence density and its relationship to crime from other studies (see Gorman *et al.*, 2001; Freisthler *et al.*, 2004; Britt *et al.*, 2005; Day *et al.*, 2012; Cameron *et al.*, 2016), we might expect problems to become pronounced in certain areas where we see ongoing growth in alcohol outlet density. What we saw, in fact, was that there was little apparent relationship between the number of licences in an area and the number of offences in the areas under study.

**When the number of licences in these areas increased, increased crime did not directly follow, and during the periods when crime did increase in some areas, it did not appear to be the result of increased licences in those areas.** In the areas of Riccarton, Church Corner, Papanui and Merivale, substantial increases in total licences were observed, but while these areas experienced some short-lived increases in offending and most remained somewhat higher than we might have expected relative to the rest of the city, there was no visible connection between crime and the number of licences in the area. Instead, the spikes in offending post-quake largely occurred before many new licences were able to open in those areas. **While the spikes in offending appear to be alcohol-related and may come as a result of alcohol provision in these areas, they were associated with increased demand and patronage, rather than changes in the number of local alcohol outlets.** By the end of 2014 the number of alcohol outlets in areas such as Riccarton and Merivale was continuing to grow (which would anecdotally appear to have continued into 2017), but offending had fallen back and remained lower. Any post-earthquake increases in offending (relative or absolute) may therefore be better explained by the increases in patronage that these areas were experiencing as a result of population movement and the loss of premises in the CBD.

It may be that there is a point of alcohol outlet density at which we begin to see a relationship between offending and the number of licensed premises, but in the areas under study, it appears that this has yet to be reached (although comparative analysis against other cities would assist in confirming this); and interestingly, the area of greatest (relative) crime in our clusters of interest is the one with the lowest alcohol outlet density (Hornby). A key confounding factor in this analysis is the type of alcohol licences in each area: where Church Corner has experienced very high alcohol outlet growth in the period in question (there was a 60 percent increase between January 2009 and December 2014) but no corresponding increase in offending, the majority of those new premises were restaurants, rather than bars. Even in areas with a clearer emphasis on nightlife such as Riccarton, increases in alcohol outlets were primarily comprised of restaurants and other premises focused on food. While some of these premises may close at later times, and may or may not shift to focus on alcohol (thereby confusing any attempt to usefully distinguish restaurants from bars) the number of dedicated bars in each area was relatively low.

In Hornby, by comparison, substantially more of the local licences appeared to be primarily bars, and there were also more off-licence outlets. This suggests that while the raw number of licences in an area could not be linked to offending, the number of licences in an area that actually focus on alcohol provision might be more closely related. While an intuitive distinction can be made by those familiar with each licence, separating bars from restaurants on a statistical level was not possible. Moreover, it was noted by police that certain premises have outsized impacts on their local areas, and that anecdotally, the level of offending in a given area is often strongly influenced by a further minority of problematic licences. This was difficult to pinpoint in our data, however: in the two areas where such premises were known to have existed and then closed (Church Corner and Papanui) the impact of their closures was obscured by the impact of the earthquakes.

Perhaps the place most likely to experience substantial growth in licence density is the central city, which due to the slow return of licensed premises currently resembles something more akin to the clusters we see in the suburbs. With significant growth inevitable (construction is nearing completion on the Terrace complex, for example, which is expected to contain 17 bars and restaurants), consideration as to how this growth is managed becomes important. Furthermore, as the central city revitalises, there is an opportunity to set the standards to mitigate criminal activity stemming from

alcohol consumption. These range from opening hours, outlet density and management through to crime prevention through environmental design (CPTED) considerations.

In establishing lessons that may be valuable in similar situations of mass disruption to a city, we can make some observations. **Where we expected that the areas that saw increases in patronage would see the opening of new bars, we found instead that for the most part, a few existing licences in each area adapted themselves to suit larger numbers instead.** Existing tavern-style premises adjusted organically into de facto nightclubs in order to service the patronage that they were experiencing. Similarly, some restaurants became quasi-bars, switching to a focus on alcohol delivery after dinner service had finished. In most cases, these changes were relatively minor, with few having to adjust their opening hours. Crucially, these changes were also easily rolled back as patronage ebbed. The areas that saw substantial temporary increases in patronage (and offending) were those clustered around existing shopping malls, where existing infrastructure of transport, shopping, food and other amenities was also clustered, and they were areas that – much as the CBD had been – were most readily accessible from any part of the city. While we did observe a visible and continuing uptick in licence density in some of our clusters of interest following the earthquake, in the vast majority of cases the new licences were restaurants.

In the event of any future disasters in other cities, we can conceivably predict that redistribution of patronage will follow similar lines: the areas that see substantial patronage increases will be multi-use areas with pre-existing food, shops and transport infrastructure that are within easy reach of most parts of the city. Barring exceptional circumstances, these factors appear to be most influential over public decision-making.

The effect that policing factors had on the crime data in some areas under analysis was significant, most notably in changes to how crime was recorded (such as the introduction of pre-charge warnings, and the reclassification of breach of alcohol ban offences in 2014) and in an acute operation targeting Riccarton in the post-quake period. In this way, of course, spikes in crime may not actually indicate increasing problems, but in fact it may signal them coming to an end, which also raises the issue that certain areas may have a greater police presence and therefore have higher incidents of recorded crime (as mentioned above in relation to the central city). It is possible there are others we are unaware of: individual ‘pushes’ by police in certain areas may be informally outlined and undocumented because they respond to issues that can be short-lived or specific to certain local events.

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# Conclusion

This report goes some way toward documenting and quantifying one aspect of a tremendous upheaval in Christchurch, and makes use of the post-disaster environment as a means of testing the effect of alcohol outlet redistribution. By using a uniquely fine-grained database of alcohol licences in Christchurch, it was possible to provide a snapshot of changing distribution, challenge assumptions about the effect of outlet density, and finally investigate the nature of changes in depth in six key areas. This study found reason to believe that the changes in alcohol outlet densities and distribution after a natural disaster are to some degree predictable, but also that predictions of follow-on effects such as crime distribution are inherently resistant to simple measures.

While the majority of the alcohol outlets that closed after the two Canterbury earthquakes were in the central city, the cordon and widespread destruction meant that many new licences opened in other areas, creating a city where outlets were more clustered but less centralised than they had been. This created a number of areas that appeared to be at greater risk of alcohol-related harm than they were before the earthquake, but also substantially decreased the offending that was occurring in the central city, where licences had been extremely concentrated.

Increases in post-quake alcohol outlet density was observed in areas where residents were more likely to be young, single, and newer to the neighbourhood. While this creates some cause for concern because these are also the populations most likely to be prone to hazardous drinking, there is reason to believe that the raw numbers of new alcohol outlets in an area may not be directly related to increased alcohol-related offending.

The interrelation between growing alcohol outlet numbers and offending was clarified somewhat when we looked more closely into some of the key areas where licensed premises are clustered. We looked at the six areas with the highest densities of licensed premises and found significant variation in the relationships between offending, licences, and patronage that we observed in each. While we found that crime spiked significantly in some areas (such as Riccarton, Papanui and Merivale) in the first two years post-quake, it fell back in the longer term despite steady increases in the number of outlets in each area. This supports the idea that alcohol-related harm, rather than directly following outlet density, is most meaningfully affected by the type of drinking behaviour occurring in the area.

Defining types of licences may be crucial here: although the law (and our licence database) makes the simple distinction between categories such as on, off, and club-licences, we found that the more ephemeral distinctions between the use patterns of restaurants and bars were more important. While some areas saw substantial increases in outlet density, that measure proved to be largely disconnected from harm because the new premises were often almost entirely restaurants. Similarly, those individual premises that were identified by interviews as being directly related to harm were very few and far between, but exerted a disproportionate influence. Looking closely at certain neighbourhoods allowed us to describe the effects of changing concentrations and uses of bars, restaurants and nightclubs, but defining a means of predicting changes to alcohol-related harm may be more difficult.

The findings of this research were in many ways surprising and unexpected, and illuminate a hitherto unknown area of study. Valuable on their own, our findings also lay foundations for future work.

## LOOKING AHEAD – FUTURE RESEARCH

Whilst the results generated in this research report represent a significant step toward understanding the alcohol-crime relationship in Christchurch, we have identified a number of avenues for potential future work that may prove to expand upon them in ways that can be further operationalised in policy.

First, it would be valuable to attempt to understand the local associations between alcohol and alcohol-related harms. This can be done through the use of local indicators of spatial association (LISA) statistics which were originally proposed by Anselin (1995). These indicators are designed for the decomposition of global indicators to find the contribution of each observation. One of the most commonly used of these indicators is a local version of Moran's  $I$ , a measure of spatial autocorrelation. It can be used to identify local spatial clusters and find spatial outliers in global measures of spatial association. This can be employed to find local clusters of high alcohol/high crime neighbourhoods but also low crime/high alcohol neighbourhoods which could potentially indicate valuable information regarding what drives resilience to alcohol and crime in neighbourhoods. There could be, for example, neighbourhoods throughout the South Island which have a high concentration of alcohol outlets but low crime. Understanding what makes these communities resilient to their circumstances could be vital for future alcohol policy and crime prevention strategies.

Second, the spatial relationship between the location of alcohol outlets and the consumption patterns could be investigated. As previously mentioned, most customers may not consume their purchased alcohol in the neighbourhoods in which they bought the alcohol. Understanding the nature of the relationship between the i) location of crime, the ii) location of alcohol outlets and, iii) the location of consumption of the alcohol could be undertaken using GIS methods combined with a survey of alcohol customers at the site of purchase (i.e., off-site licences).

Third, it could be possible to identify spatial dispersion of crime around alcohol outlets. This could be done by using a GIS-based methodology that is able to spatially locate and map the dispersion of crime around outlets at various spatial intervals (i.e., 100m, 200m, upwards). A temporal aspect could be added here too which would investigate whether these patterns change depending on the day of the week or, during 'special' events such as on sports days, public holidays, festival days.

Fourth, it would be valuable to disaggregate both the alcohol outlet but not only on-site/off-site but also by their pricing, the types of alcohol they sell, and opening hours to see whether this has any effect on the results we generated at a global level in this research. This can be coupled with the further disaggregation of the crime data to very specific incidences that could be alcohol-related. The division of alcohol outlets and crime by neighbourhood level deprivation would also be valuable as this would indicate, at a local level, whether these relationships hold true in local clusters in wealthy neighbourhoods *and* deprived neighbourhoods, or whether this is a deprivation issue as much as it is an alcohol/crime issue.

Fifth, future research may benefit from considering finer-grained data around licences, either at a local or city-wide level. While making an effective distinction between restaurants, bars, and nightclubs can be difficult (some restaurants become bars at night, for example), distinctions may be possible based on factors such as opening hours, drink prices, or units sold, and may lead toward a more applicable measure of predicting harm.

Finally, this research would benefit significantly from comparative analysis. While we can isolate and describe many factors caused by the earthquake, it has proven difficult to separate the effects of legal changes in 2014 (the SSAA and Land Transport Act Amendment) from the long-term effects of the earthquake. By comparing Christchurch with a similarly sized city unaffected by natural disaster, the impact of each individual influence would become much more apparent. Similarly, while we have uncovered important points of difference between our various clusters of interest, comparisons with similar areas in other cities may offer predictions about how our clusters will mature over time, and what they might have looked like without the earthquake – providing obvious policy benefits.

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