

Less than idyllic: Crime specialization in rural and remote Queensland, Australia

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ABSTRACT

Rural areas have long been considered bastions of community safety and cohesion. However, recent research in rural criminology has demonstrated the heterogeneity of crime and safety in rural areas. In areas like Australia and Canada, crime rates in rural communities often surpass those of their urban counterparts. However, many have critiqued this as a denominator effect, emphasizing that a small number of events will produce a higher rate of crime when the population is low. In 2014, Carleton and colleagues examined crime in British Columbia, Canada and found that, by using the location quotient, a measure of crime specialization, rural areas indeed specialized in violent crime, but urban areas specialized in property crime. The current study replicates and extends this strategy in Queensland, Australia, to determine if these findings are representative in the international context, examining these differences across five diverse area types (highly accessible, accessible, moderately accessible, remote, and very remote), and then determining specifically which types of crimes are driving violent and property crime specialization. In addition, this study also explores social disorder, as it accounts for a large proportion of police activity. As such, this study offers a more extensive and specified understanding of crime patterns along the rural/urban divide.

1. Introduction

Rural areas have long been considered idyllic and relatively safe (Donnermeyer, 2012). However, research indicates that these areas are not as homogenous as some may think, as they often deal with a myriad of crime problems (Scott and Hogg, 2015). For example, in countries like Canada and Australia, crime rates in rural communities often surpass those of their urban counterparts (Hogg and Carrington, 2006; Hodgkinson et al., 2020). Issues like violence and drug use are often rampant and support services are lacking (Abraham and Ceccato, 2022; Carleton et al., 2014; Hodgkinson and Harris, 2021; Ruddell, 2016; Hodgkinson, 2022). Nevertheless, much of the research on crime and violence in rural areas remains limited to one community, or subsection of a community, with small sample sizes and cross-sectional data. There is a need to better understand crime and violence in rural areas, across contexts, and

over time.

In order to better understand the patterns of crime in rural areas, an examination of typical comparison measures is necessary. Many have critiqued the validity of high crime rates in rural areas, claiming they are a product of a denominator effect, i.e. low population (Carleton et al., 2014; Hodgkinson, 2022). Furthermore, crime rates are a measure of victimization risk relative to the population risk in an area. However, other dimensions of risk may be important: if one is to be a victim of crime in an area, which crime type is more likely? This may have implications for fear of victimization, but also understanding the spatial distribution of crime risk. The *Location Quotient (LQ)* measures this form of risk as the crime specialization in one area compared to surrounding areas without the need for population counts.¹ Because of this, LQs are instructive to studying/understanding spatial crimes patterns through comparisons of these different dimensions of risk.

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¹ Standardized offence ratios are another measure of risk (Ceccato and Haining, 2004) but still requires a population at risk, similar to ambient-based crime rate calculations (Andresen, 2011).

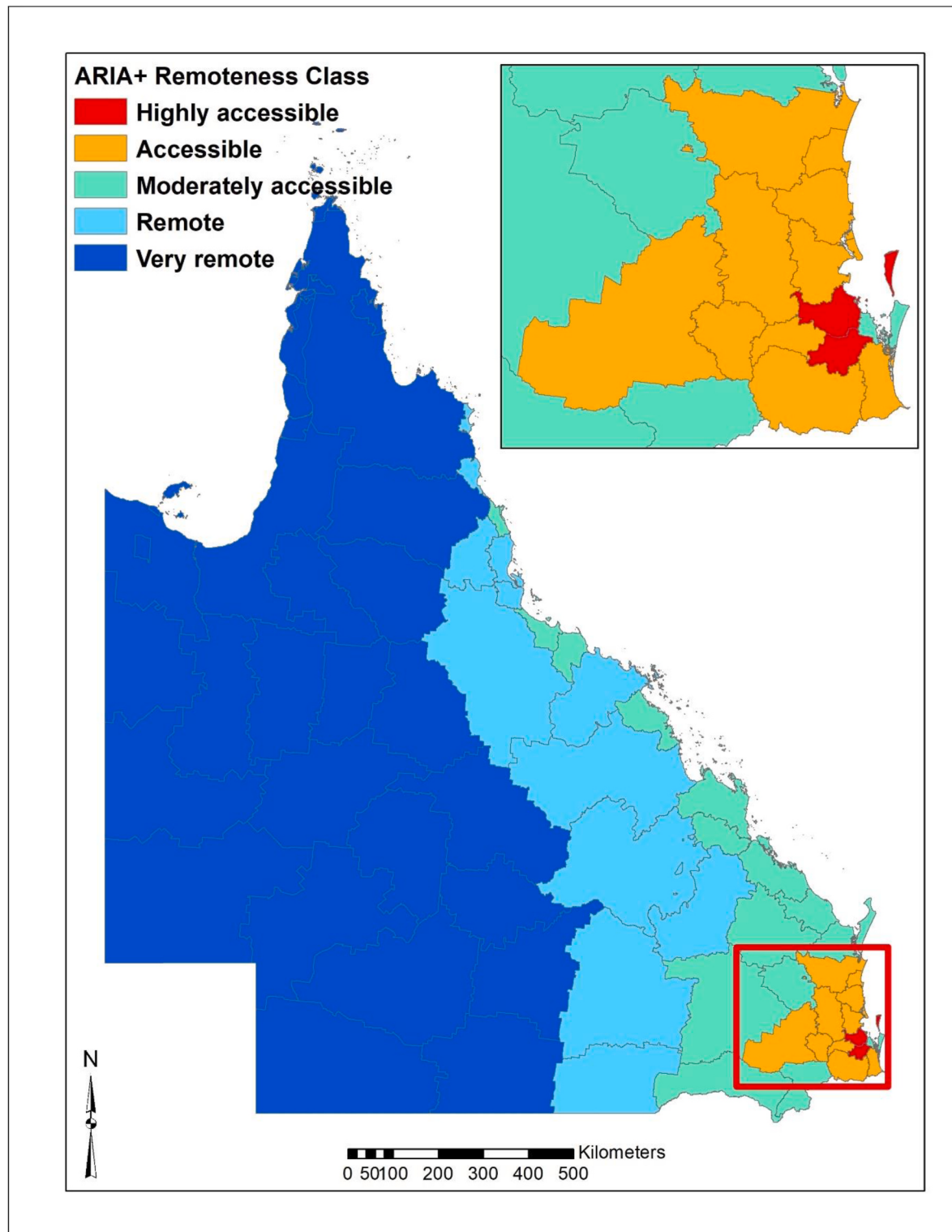


Fig. 1. ARIA + classification for Queensland, Australia by local Government Area (2016).

LQs emerged out of economic geography and have gained traction in criminology to complement and bolster crime rates (Brantingham and Brantingham, 1998; Andresen, 2007; Wuschke et al., 2021). In 2014, Carleton and colleagues used LQs and determined that rural areas specialized in violent crime (while urban areas specialized in property crime) in British Columbia, Canada. These findings are important, as they provide cross-jurisdictional analyses of crime specialization for

rural and urban areas. However, several questions remain. 1. Do these findings extend to the international context? 2. Do these patterns of specialization change when we look at a longer time frame to avoid an aberrant year of data? 3. Do these findings change when different forms of rurality are considered? 4. Which specific crime types are driving this specialization? And 5. are there other crime-related issues that may specialize differently, such as social disorder? In this study, we aim to

answer these questions by examining the specialization of crime and disorder across several geographic contexts and years in the state of Queensland, Australia.

2. Background

2.1. Defining rural

How to define ‘rural’ has proven difficult (Donnermeyer, 2012). In fact, one of the defining features of rurality in the literature is its lack of definition (Scott and Biron, 2016). This issue is further exacerbated by the numerous ways in which rurality is measured and operationalized (Harris, 2016). Researchers commonly use political and census boundaries, population size, and distance from an urban or service centre, to define rural communities (McGrane et al., 2017; Hodgkinson et al., 2020; Harris and Harkness, 2016). In the Canadian context, Statistics Canada recently changed their definitions of urban and rural to populations centres and rural. Population centres have populations of 1000 or more people, and 400 or more people per square kilometre. Everything else is defined as rural (Statistics Canada, 2019). Similarly, in the United States of America the United States (US) Census Bureau defines urban areas as comprising of group of census blocks with a density of at least 2000 housing units or at least 5000 people.² All other areas are considered rural (US Census United States Census Bureau, 2020). Alternatively, in places in Europe, like Sweden, rurality is divided into accessible and remote rurality. Accessible rural is defined by areas that are between 5 and 45 min by car from urban locations of 3000 residents or more, and remote rural is defined by areas that are more than 45 min away by car from these urban locations (Ceccato, 2016). In Australia, rural and remote communities are defined by their proximity to ‘significant urban areas’ and then classified as major cities, inner regional, outer regional, remote, and very remote (ABS, 2018; Harris and Harkness, 2016). However, these classifications overlap with community boundaries, such as local government areas, making it difficult to clearly demarcate these areas.

Alternatively, the Accessibility/Remoteness Index of Australia (ARIA+) is an index from Adelaide University identifying how accessible each area is to service centres. This index provides a clearer picture of rurality and remoteness across Australia. Each location is provided a score (between 0 and 15) related to the road distance to different sized service areas. These scores are averaged based on a square kilometre grid. The ARIA + produces five classes across the country of Australia (and within Queensland). These remoteness classes include: Very remote (score 10.5 to <15), remote (5.95 to <10.5), moderately accessible (2.40 to <5.95), accessible (0.20 to <2.40) and highly accessible (0 to <0.20), in which accessibility ranges from “very little accessibility to services, goods, and opportunities for social interaction” to fairly “unrestricted accessibility to a wide range of goods, services, and opportunities for social interaction” (Hugo Centre for Population and Migration Studies, 2018). Fig. 1 shows the breakdown of ARIA + remoteness across Queensland by Local Government Areas (LGAs).³ 2 LGAs are highly accessible (red), 11 LGAs are accessible (orange), 16 LGAs are moderately accessible (green), 15 LGAs are remote (light blue), and 34 LGAs are very remote (dark blue). 12 of the 78 LGAs are identified as Aboriginal Shires, meaning they are special LGAs managed under a Deed of Grant of Trust under the Local Government Act of 2004.

The ARIA + index is used here as it provides a clear and temporally stable picture of accessibility across Queensland, demonstrating that much of Queensland is considered remote and very remote (almost 63%). Though recent rural research has indicated the importance of the rural-urban continuum (Ceccato and Abraham, 2022), the ARIA + classifications are specifically Australian and spatially align with the units of analysis: Local Government Areas (LGAs).⁴

2.2. Measuring crime across rural and remote areas

Much of the official comparison of crime across urban, rural, and remote communities is done using crime rates. This involves dividing the total crime (or crime type) count in an area by the total population and multiplying the output by a standard scalar (e.g., 1000 population, for example). However, this means that areas with a small population will have artificially higher crime rates.⁵ For example, one homicide in a community of 13,000 people (Maranoa, QLD) compared to one homicide in a community of 190,000 people (Ipswich, QLD) would produce a homicide rate of 7.69 and 0.52 per 100,000 population, respectively. Although an extreme example, this is a typical calculation for crime rates and greatly impacts the comparability of crime across urban and rural areas. One more recent alternative to the crime rate is the crime “severity” or “harm” index.

In Canada, the Crime Severity Index (CSI) is used to compare crime severity across regions. It assigns a weight to each incident type, based on sentencing surveys, so that crimes like homicide and aggravated assault are weighted more heavily than property crimes (Statistics Canada, 2009). A similar measure, known as the crime harm index, was proposed by Sherman (2013, 2020) and Sherman et al. (2016), and assigned a weight to the harm caused by each crime using a standardized system. To date, Canada is the only country that uses a CSI in its national statistical agency. However, the CSI is also influenced by population size (as well as sentencing decisions). Moreover, because of the weighting system in the CSI and other harm indices, the population effect is magnified rather than being mitigated. Furthermore, both crime rates and severity indices are not particularly useful for crime prevention strategies, as these measures can be misleading and do not provide information about specific crime types that might be driving the overall rate/index (Andresen, 2007; Carleton et al., 2014; Hodgkinson, 2022).

2.3. Location quotients

Location quotients (LQ) address some of the limitations of crime rates, standard offence ratios, and crime severity/harm indices (Brantingham and Brantingham, 1998; Andresen, 2007; Wuschke et al., 2021). LQs are not susceptible to the same denominator issue as crime rates and severity/harm indices and are not influenced by sentencing decisions. LQs examine the spatial concentration of crime in one area compared to the spatial concentration of crime in the study area as a whole (Carcach and Muscat, 2002). This type of measure is useful in crime analysis, as it determines if, and which, crimes are disproportionately present compared to crime in a larger geographic area, such as a region, province, or country (Andresen, 2007; Brantingham and Brantingham, 1998; Hodgkinson, 2022). The LQ measures crime specialization by dividing the percentage of a crime type for a specific area by the percentage of a crime type the entire study area (Andresen,

² The Census definition recently changed to remove person density per square mile to add housing units in 2022. <https://www.pbs.org/newshour/politics/u-s-census-bureau-redefines-the-meaning-of-urban-areas-in-america>.

³ Local Government Areas (LGAs) are local council areas in Australia. These can include cities, shires, towns, or municipalities. Australia has 537 LGAs, 78 of which are in Queensland. These census boundaries can change, however the last change in Queensland occurred in 2008 at the beginning of the study period, allowing for analytical consistency.

⁴ Brisbane and Logan are the only areas that are defined as highly accessible in Queensland. At the time of the last ARIA + classification, Gold Coast had not completed the entire G:link light rail system. However, our data are largely consistent with this time period.

⁵ There is also a literature that considers alternative denominators in crime rate calculations that goes back almost 60 years (Andresen, 2009; Boggs, 1965; Boivin and Felson, 2018; Stokowski, 1996). These measures still all suffer from data measurement issues.

2009). By calculating a ratio of the proportion of a crime in a sub-area, in comparison to the proportion of the same crime in a greater region, we are able to determine if that area “specializes” in a particular crime type (Wuschke et al., 2021). As such, LQs offer a locally based, standardized measure that identifies areas with an over or under-representation of the measured crime (Wuschke et al., 2021). LQs aim to answer the question of whether an area has a particular crime problem, such as burglary or domestic violence, or if it is a high crime area overall (Andresen, 2007; Hodgkinson, 2022). Such a metric may prove to be instructive to supplement the use of crime rates.

LQs are more stable than crime rates because they rely strictly on crime data for both the numerator and denominator resulting in fewer sources of error. By standardizing the metric based on crime rather than population, the LQ is less susceptible to overinflating crimes than their corresponding crime rates in smaller population (i.e. rural) areas. Additionally, the LQ, which is inherently a geographical measure, allows us to understand crime with specific attention to location and opportunity. By investigating the ways in which areas may specialize in certain types of crime, we can begin to identify spatial correlates of crime and potential prevention opportunities (Brantingham and Brantingham, 1998; Hodgkinson, 2022).

2.4. Use of location quotients in criminology

LQs were originally used in economic geography and regional planning to address questions of the relative structure, and importance, of local economies, compared to surrounding economies (Brantingham and Brantingham, 1993, 1995, 1998). The LQ was first utilized in criminological research in the early 1990s. Brantingham and Brantingham (1993, 1998) used this method to measure the specialization of violent crime in municipalities throughout British Columbia (BC) using crime counts, rates, and LQs. They found that different areas had different problems than initially predicted. Using crime counts in BC, Brantingham and Brantingham (1998) found that violence counts were tied to city size, with larger cities like Vancouver, Surrey, and Burnaby, ranking the highest in the volume of violence. However, when using crime rates, they found that smaller cities in the Northern and North-western parts of the province had the highest rates of violent crime. Finally, using LQs demonstrated that some cities with low total crime counts, or violent crime rates, had high LQ values because violent crime made up a disproportionate share of all the crimes that occurred in that municipality when compared to the provincial pattern. Despite having a low risk of criminal victimization, if one is to be a victim of crime it is more likely to be violent. Brantingham and Brantingham (1998) also found evidence of the opposite trend, where cities had high violent crime rates or counts but low LQ values indicating that further examination of crime specialization was needed.

The use of LQs in criminological research has been increasing. LQs have been used to explore crime issues spatially (Andresen, 2007; Brantingham and Brantingham, 1998; Robinson, 2008), focusing on illegal drug crime and drug arrests (Rengert 1996), burglary (Breetzke and Cohn, 2013), alcohol density and violence (Pridemore and Grubestic, 2012), crime generators and attractors (Caplan et al., 2011), and rural and regional comparisons of crime specialization (Carleton et al., 2014). Rengert (1996) found a pattern reversal when analyzing illegal drug crimes in the United States using both crime rates and LQs. He predicted that the north central region of the United States would have the greatest proportion of marijuana-related crimes due to its agriculture and lack of coastline. He also predicted that heroin and cocaine crimes would be higher in coastal regions as these locations created the opportunity to transport drugs internationally. Counterintuitively, Rengert (1996) found that the north central region of the United States had the lowest of

all drug-related crimes (marijuana, heroin, and cocaine). However, when using the LQ, his original hypothesis was confirmed, as the north central region specialized in marijuana-related drug crimes. These findings suggest that crime rates can often be misleading and LQs may be more useful when testing theory.

More recently, scholars have been using the LQ to measure the specialization of crimes in certain neighbourhoods or areas. For instance, McCord and Ratcliffe (2007) researched illicit drug markets in Philadelphia by analyzing drug sales and possession-for-sales cases. The authors found that drug markets cluster near certain criminogenic locations, such as pawnshops, bars, and transit stations. Similarly, in their study of near-repeat shooting patterns in Philadelphia, Ratcliffe and Rengert (2008) concluded that some areas have greater intensities of shootings relative to the remainder of the city, especially on blocks where a previous shooting occurred. Caplan et al. (2011) used LQs to assess the impact of CCTV on crimes such as shootings, vehicle thefts, and thefts from vehicles in Newark, New Jersey. They found that CCTV camera installation was associated with a significant decrease in the number of shootings and vehicle theft, reducing the specialization of crime in these areas.

Beyond studies on particular crime types, in particular cities, Carleton et al. (2014) extended the work of Brantingham and Brantingham (1998) by examining violent and property crime patterns across urban and rural communities in British Columbia. According to crime rates, people in small northern communities had the greatest risk of becoming victims of property crimes. In contrast, by using LQs, Carleton et al. (2014) demonstrated that the northern and rural areas of the province did not specialize in property crime, but rather violent crime. This indicates that rural areas appear to be disproportionately violent when compared to their urban counterparts (Carleton et al., 2014). These findings demonstrate the importance of being crime specific when investigating crime patterns (Andresen, 2007; Carleton et al., 2014). Another study conducted by Hodgkinson (2022) compared 15 different municipalities across Saskatchewan of varying sizes on violent and property crime rates, CSIs and LQs. She found that not only were crime rates and CSIs misleading for smaller communities (denominator effects), but they did not always accurately represent the crime concerns for those communities. For example, North Battleford, Saskatchewan, the “crime capital” of Canada for ten years running, had the highest CSI in the province and the country, but this was actually driven by mischief, not violence.

Overall, these findings suggest that further investigation is needed into the specialization of crime across different geographies. Not only do LQs offer additional information about crime specialization, but they provide an opportunity to engage crime-specific prevention policy (Andresen, 2007). The research to date does not indicate if the differences in specialization of crime extend to the international context. Nor does it discern between different types of rurality (ex. Rural, remote, very remote). Furthermore, many studies are either too crime specific, using one or two crime types, or too general, focusing only on violence and property as all-encompassing categories. A more thorough understanding of these categories and the crimes that make up these categories is necessary. In addition, new categories, such as social disorder, should be explored. Considering social disorder, such as public intoxication, noise complaints, mischief, panhandling, and related issues account for a significant amount of police time and resources (Wuschke et al., 2018), understanding how these issues specialize across space may also help guide allocation of these resources (Andresen, 2007). Finally, studies on crime specialization often only examine a short period of time, calling into question if these results are generalizable over time or the result of an aberrant year of data. This study sets out to answer these questions in the context of Queensland, Australia.

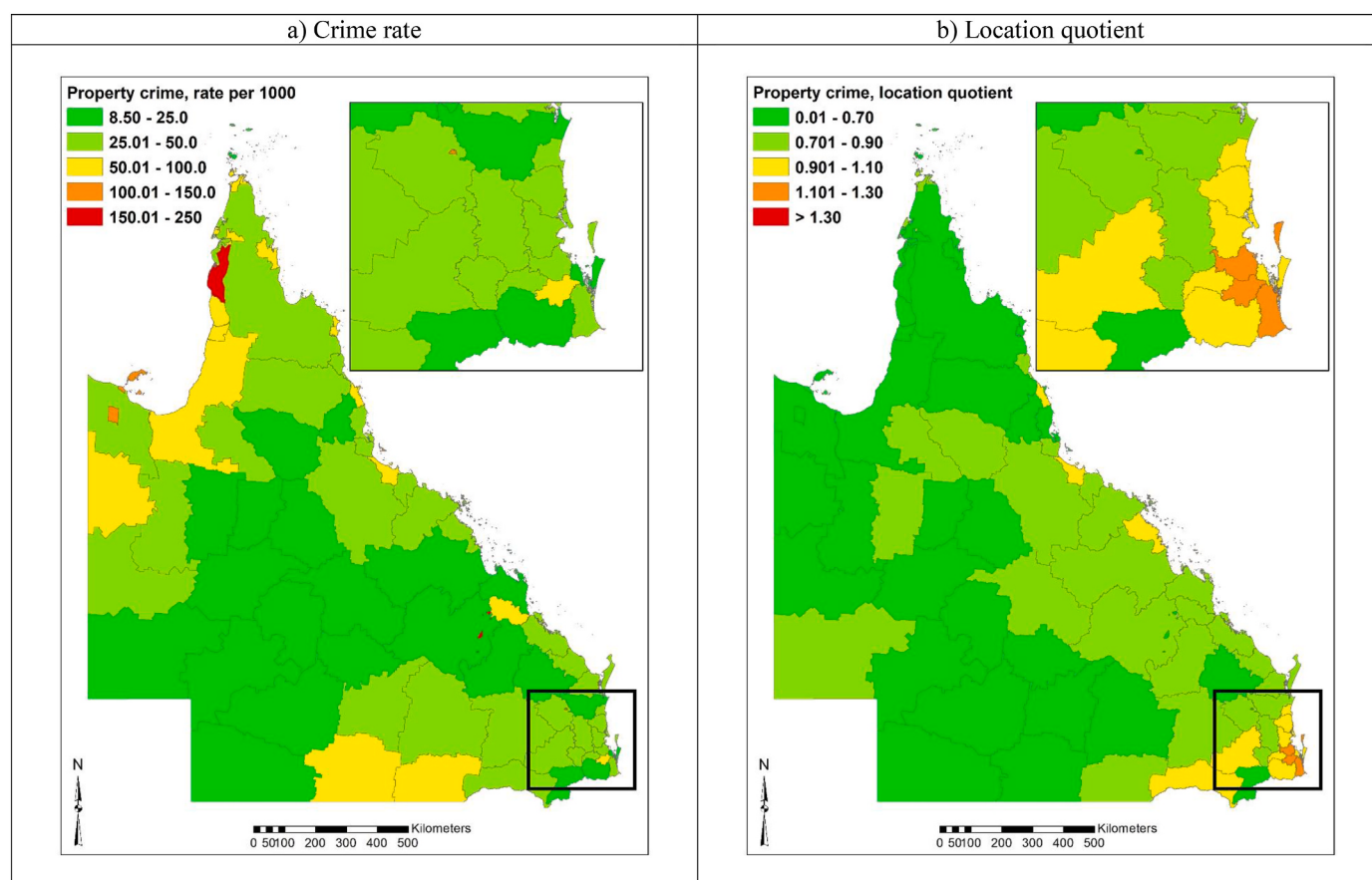


Fig. 2. Property crime.

2.5. Current study

The current study examines crime specialization in the state of Queensland, Australia. We extend other methodologies by exploring twelve years of (averaged, to avoid any aberrant year under analysis)⁶ police-recorded data, examining differences in crime specialization across five similar but diverse area types (highly accessible, accessible, moderately accessible, remote, and very remote), and comparing violence, property crime, and social disorder, and their subtypes within these contexts. The study aims to replicate previous research on rural versus urban crime specialization, while extending this research to additional area types, crime types, and over time to provide a more extensive and specified understanding of crime specialization along the rural/urban divide. We aim to answer the following five questions (with our hypotheses in brackets):

1. Do the findings regarding rural specialization of crime extend to the international context? (Yes).
2. Do these patterns of specialization change when we look at a longer time frame – i.e. an average of 12 years of data? (No).
3. Do these findings change when different forms of rurality are considered? (Yes).

⁶ For example, the range of LQs for all property crime is 1.55 (range of all μ : 1.00 and range of all σ : 0.41), the range of LQs for all violent crime is 6.61 (range of all μ : 2.37 and range of all σ : 1.96), and the range of LQs for all social disorder is 2.26 (range of all μ : 2.26 and range of all σ : 0.62). The range of these ranges, and the range of means and standard deviations for all crime types across LGAs varies, with the largest range occurring for all violent crime. This only emphasizes the need to standardize these values from year to year.

4. Which specific crime types are driving this specialization? (Violence: assault and domestic violence will specialize in rural areas, while robbery will specialize in urban-highly accessible – areas; Property crime: theft of vehicle will specialize in rural and remote areas, all other property crime will specialize in urban – highly accessible – areas).
5. Are there other crime-related issues that may specialize differently, such as social disorder? (All social disorder types will specialize in urban – highly accessible).

2.6. Data

We use 12 years of police reported occurrence data for Queensland, Australia for 2008–2019,⁷ covering 78 LGAs (Local Government Areas), and three major crime types with fourteen subtypes: violent crime (robbery, assault, domestic violence, homicide, and sexual assault), property crime (commercial burglary, residential burglary, theft from vehicle, theft of vehicle, theft, and shoplifting), and social disorder (mischief, drugs and public disorder⁸). Despite being available, the years of 2020 and 2021 are excluded, as the COVID-19 pandemic had significant effects on crime and crime trends in Queensland and internationally (Andresen and Hodgkinson, 2020; Hodgkinson and Andresen, 2020;

⁷ The Queensland Police Service polices the entire state, and as such, the database for these data is consistent across the state. This reduces concerns about comparison across different police services and their differing reporting strategies. Furthermore, these data are standardized annually, reducing any possibility of temporal changes related to policy or reporting practices.

⁸ All three subtypes of social disorder are classified as criminal offences in Queensland.

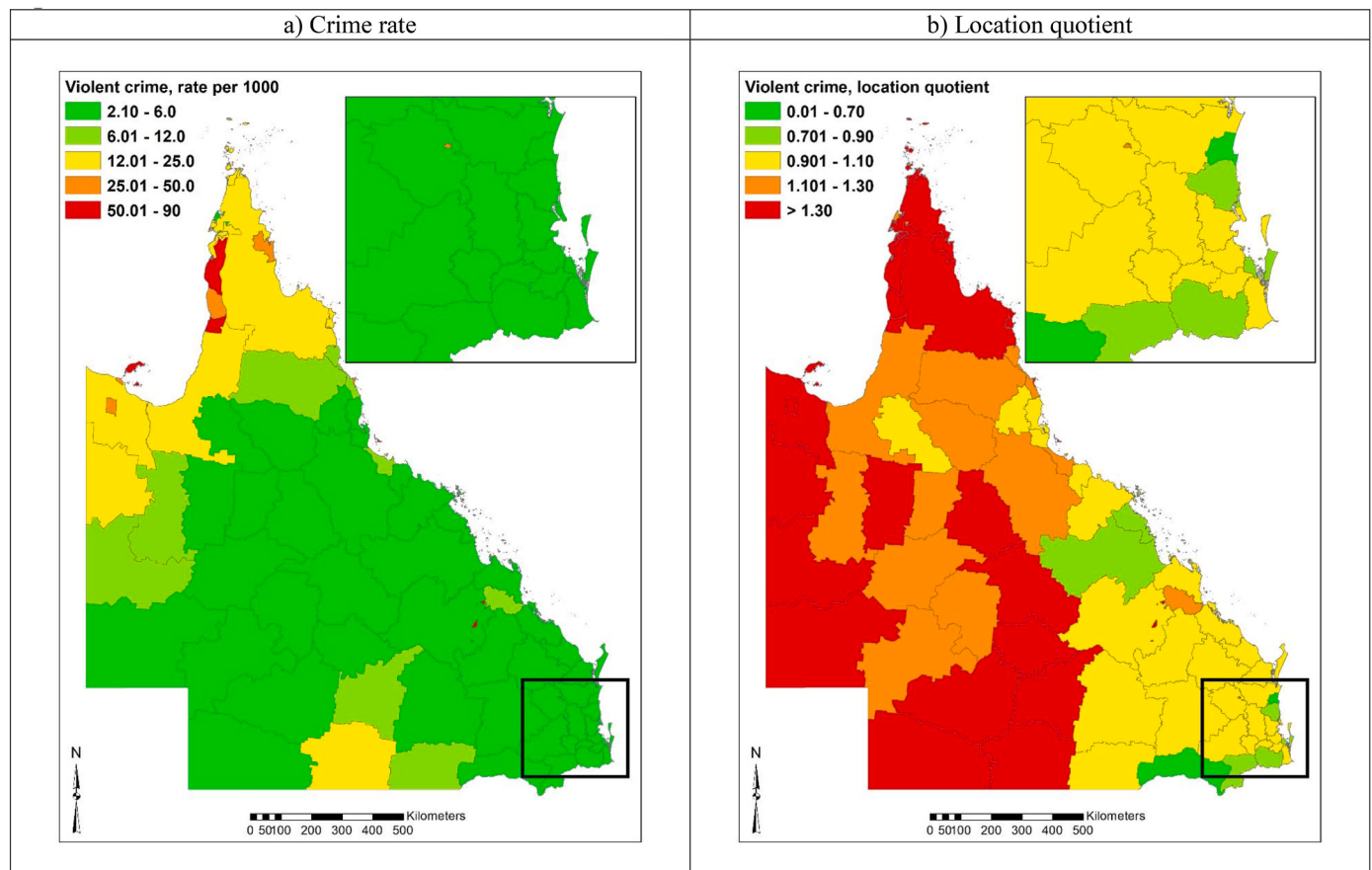


Fig. 3. Violent crime.

Nivette et al., 2021).

3. Methods

Crime rates and LQs are calculated for three major crime types, and LQs are calculated for all sub-types of crime across 78 LGAs in Queensland, Australia to evaluate the crime patterns in these areas. Crime rates are calculated by dividing the number of police-reported incidents by the population for each LGA and multiplying that figure by 1000 people. Crime rates are calculated for the broad categories of violence, property, and social disorder. Maps were then created to visually highlight the difference between crime rates and crime specialization across the state of Queensland and demonstrate general spatial trends of crime specialization.

LQs are averaged across twelve years for violent crime, property crime, and social disorder, as well as their sub-types. The LQ is calculated as follows:

$$LQ_{in} = \frac{C_{in}/C_m}{\sum_{n=1}^N C_{in} / \sum_{n=1}^N C_m}, \quad \text{Eq. 1}$$

where C_{in} is the count of crime i in LGA n , C_m is the count of all crimes in LGA n , and N is the total number of LGAs (the entire state of Queensland). The LQ is calculated for violent, property, and social disorder related crimes to determine if there is a particular area type (ex. highly accessible, very remote, etc.) that consistently produces high LQs for these crime types, and then which specific crime types are driving specialization in these areas. To determine if an area is over, or under, represented, we use Miller et al. (1991) criteria for the LQ ratios:

- > 1.30 is a very over-represented area,
- > 1.10 to 1.30 is a moderately over-represented area,
- > 0.90 to 1.0 is an averagely represented area,
- > 0.70 to 0.90 is an under-represented area, and
- 0.00 to 0.70 is a very under-represented area.

In order to identify statistically significant differences across the ARIA + classifications, we use parametric and non-parametric difference in means tests (ANOVA and Kruskal-Wallis), as well as *post-hoc* tests (Dunnnett's T3) to identify which ARIA + classifications are driving any statistically significant changes.

4. Results

Figs. 2–4 provide a visual representation of crime rates and location quotients across the 78 LGAs of Queensland, for property crime, violent crime, and social disorder to crime specialization across the same areas. Table 1 shows the results of the difference in means tests (ANOVA and Kruskal-Wallis) for all crime types, and Table 2 shows the results for the post-hoc tests for the aggregate classifications of property crime, violent crime, and social disorder. Post-hoc results for the individual crime and social disorder are discussed when instructive.⁹

Overall, both the ANOVA and Kruskal-Wallis tests indicate statistically significant variation across ARIA + classification types for the location quotients—see Table 1. Notably, the results are qualitatively similar for both the parametric and nonparametric tests, likely due to the location quotient variables adherence to the distributional assumptions of ANOVA. The same cannot be said for crime rates, where ANOVA

⁹ Posthoc tests generate a lot of output. Full tables available from the authors.

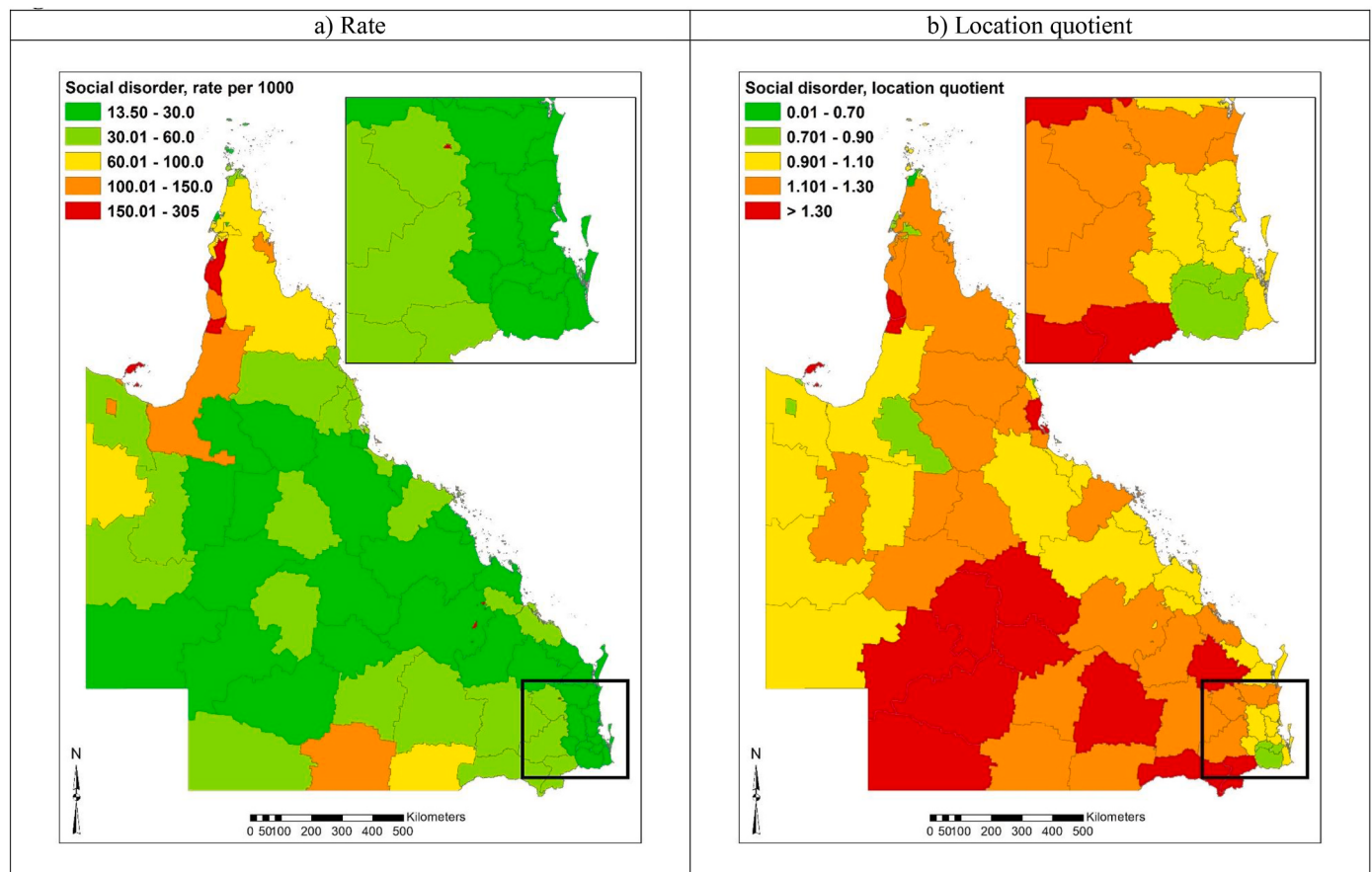


Fig. 4. Social disorder.

Table 1
Parametric and nonparametric difference in means tests.

Crime type, LQ	ANOVA p-value	Kruskal-Wallis p-value	Crime type, rate	ANOVA p-value	Kruskal-Wallis p-value
Property crime LQ	< 0.01	< 0.01	Property crime Rate	0.794	0.933
Violent crime LQ	< 0.01	< 0.01	Violent crime Rate	0.181	< 0.01
Social disorder LQ	0.181	0.177	Social disorder Rate	0.355	0.079
Assault LQ	< 0.01	< 0.01	Assault Rate	0.141	< 0.01
Commercial burglary LQ	0.505	0.599	Commercial burglary Rate	0.334	0.182
Residential burglary LQ	< 0.01	< 0.01	Residential burglary Rate	0.699	0.879
Drugs LQ	0.422	0.264	Drugs Rate	0.603	0.526
Domestic violence LQ	0.023	0.01	Domestic violence Rate	0.367	0.067
Mischief LQ	0.358	0.416	Mischief Rate	0.723	0.733
Robbery LQ	< 0.01	< 0.01	Robbery Rate	0.848	< 0.01
Shoplifting LQ	< 0.01	< 0.01	Shoplifting Rate	< 0.01	< 0.01
Theft from vehicle LQ	0.005	< 0.01	Theft from vehicle Rate	0.905	0.518
Theft LQ	0.004	< 0.01	Theft Rate	0.113	0.07
Theft of vehicle LQ	0.027	0.019	Theft of vehicle Rate	0.758	0.909
Public disorder LQ	< 0.01	< 0.01	Public disorder Rate	0.157	< 0.01

results indicate that only shoplifting has statistically significant variation across its means in different ARIA + classifications, but the Kruskal-Wallis tests indicate such variation is present for violent crime, assault, robbery, shoplifting, and public disorder.¹⁰ The post-hoc results for crime rates should be interpreted with caution because crime rates are not normally distributed and impact the ANOVA output. As such, we use nonparametric tests for the overall difference in means test.

Fig. 2a presents the results of crime rate calculations for *property crime* between the years of 2008–2019. Red areas represent the highest crime rates between 150.01 and 250.0 property crimes per 1000 people. Generally, these higher crime rates appear in more remote areas of Queensland. Comparatively, Fig. 2b presents the results of the LQ calculations. Here, we see that property crime specialization appears to occur closer to the coast, in the accessible and highly accessible areas. This variation is confirmed with the difference in means tests. While the spatial patterns differ for rates compared to LQs, generally most areas across the state have low rates and are very under or under-represented for property crime. Only four LGAs are moderately or very over-represented for property crime (LQ between 1.12 and 1.15) from 2008 to 2019, including Brisbane, Logan, Weipa, and Gold Coast. This is highlighted by the post-hoc tests showing the Highly Accessible and Accessible areas exhibiting significantly higher LQs than Remote and Very Remote. Considering the four areas that specialize in property crime, residential burglary contributes to specialization in Brisbane, Logan and Weipa. Brisbane's property crime specialization is also driven by shoplifting. Theft from vehicle, theft of vehicle and theft all contribute to property crime specialization in Logan, Weipa, and Gold

¹⁰ This also highlights the importance of using LQs, in addition to crime rates when exploring crime trends across different types of rurality.

Table 2
Posthoc ANOVA test results.

a) Location quotients				
ARIA + Classification	ARIA + Classification	Property crime LQ	Violent crime LQ	Social disorder LQ
Highly accessible	Accessible	0.24	0.05	−0.14
Highly accessible	Moderately accessible	0.32	−0.05	−0.18
Highly accessible	<i>Remote</i>	0.44	−0.25	−0.21
Highly accessible	<i>Very remote</i>	0.52	−0.59	−0.27
Accessible	Moderately accessible	0.08	−0.10	−0.04
Accessible	<i>Remote</i>	0.20	−0.29	−0.07
Accessible	<i>Very remote</i>	0.28	−0.64	−0.13
Moderately accessible	<i>Remote</i>	0.12	−0.19	−0.03
Moderately accessible	<i>Very remote</i>	0.20	−0.54	−0.09
<i>Remote</i>	<i>Very remote</i>	0.08	−0.34	−0.06
b) Crime rates				
ARIA + Classification	ARIA + Classification	Property crime Rate	Violent crime Rate	Social disorder Rate
Highly accessible	Accessible	2.57	−3.04	−24.73
Highly accessible	Moderately accessible	8.59	−1.94	−8.65
Highly accessible	<i>Remote</i>	−9.45	−11.06	−46.66
Highly accessible	<i>Very remote</i>	−3.45	−12.68	−46.44
Accessible	Moderately accessible	6.02	1.10	16.08
Accessible	<i>Remote</i>	−12.02	−8.02	−21.93
Accessible	<i>Very remote</i>	−6.02	−9.64	−21.71
Moderately accessible	<i>Remote</i>	−18.04	−9.12	−38.01
Moderately accessible	<i>Very remote</i>	−12.04	−10.74	−37.79
<i>Remote</i>	<i>Very remote</i>	6.00	−1.62	0.22

Notes. Bold indicates 5 percent significance level; italics highlight *Remote* and *Very Remote* ARIA + classifications.

Coast. This is specifically the case for residential burglary, shoplifting, and theft.

Fig. 3a and b compare the results of the crime rate calculations and LQ calculations respectively for *violent crime* between the years of

2008–2019. Here we see that, save for a few remote and very remote communities in northern Queensland, violent crime rates are generally low across the state; the violent crime rate only emerges as statistically significant in the Kruskal-Wallis results. However, a much different

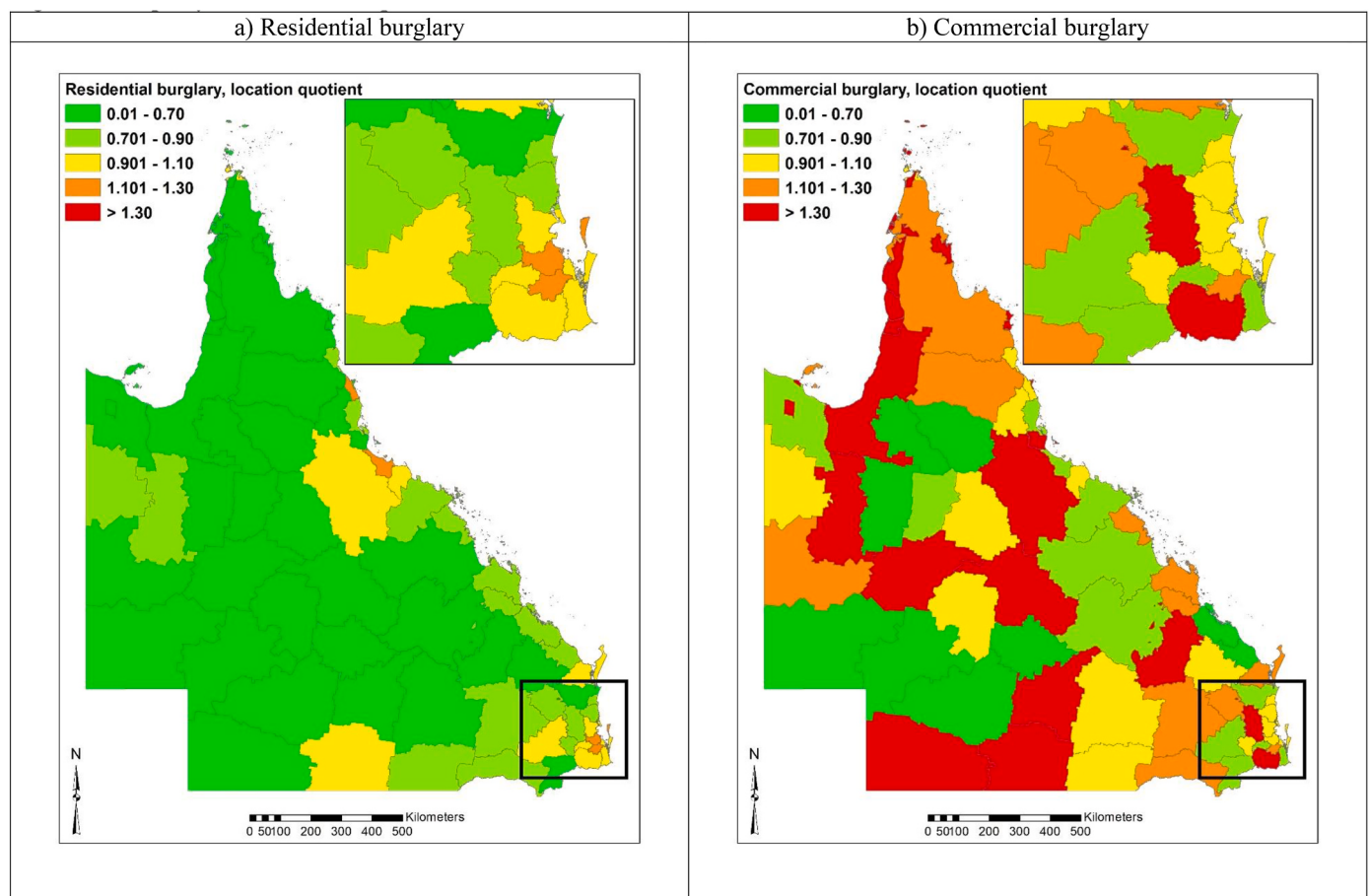


Fig. 5. Property crime location quotients.

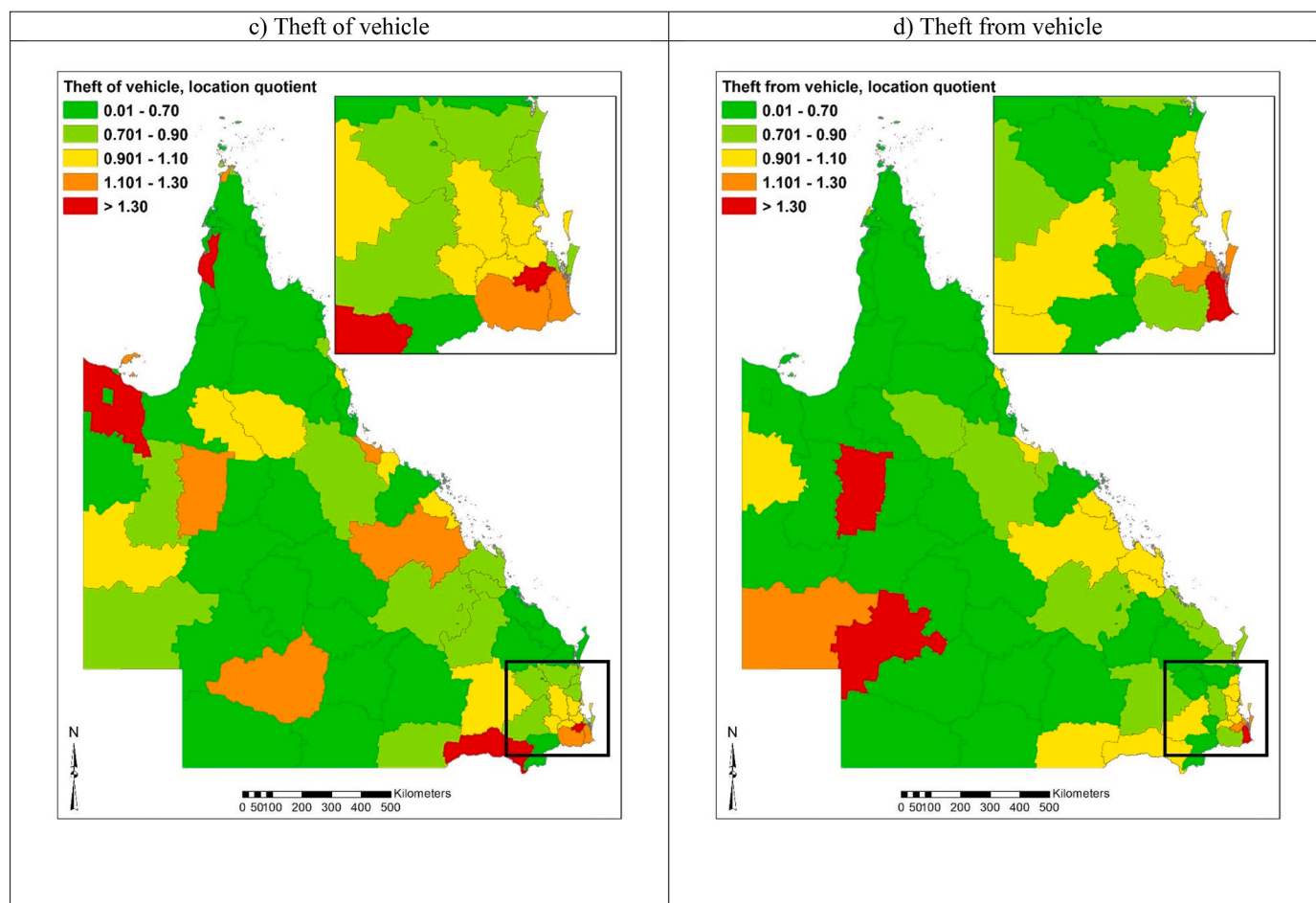


Fig. 5. (continued).

picture emerges for violent crime LQs. Fig. 3b demonstrates that many of the remote and very remote areas of Queensland, are over-represented for violent crime. This stark difference highlights the importance of employing additional metrics when attempting to understand crime across different geographies. This is shown in both Tables 1 and 2, with this difference primarily emerging in assault and robbery.

43 LGAs are very over-represented or over-represented for violent crime. Of the 28 LGAs that are very over-represented, 23 (82.2%) are very remote, 4 are remote (14.3%), and 1 is moderately accessible (3.5%). Of the 15 LGAs that are over-represented, 9 (60.0%) are very remote, 2 are remote (13.33%), 3 are moderately accessible (20.0%), and 1 is accessible (6.67%). Neither highly accessible area specializes in violent crime and most areas that specialize in violent crime are remote or very remote: 88.4% of the 43 LGAs that specialize in violence and 48.7% of all 78 LGAs. All 12 LGAs that identify as Aboriginal Shires, are very over-represented for violent crime. If we consider the 20 highest over-represented areas for violence, domestic violence drives the specialization in 18 of these LGAs and assault drives the specialization in 15 of the LGAs. Robbery does not drive the specialization for any of these very over-represented LGAs.

Fig. 4a and b compare the results of the crime rate and LQ calculations respectively for *social disorder* between the years of 2008–2019. These two figures also present two very different spatial representations, again highlighting the importance of using alternative measures to understand spatial patterns of crime. Similar to Fig. 3a and 4a suggests that social disorder rates are low save for a few remote and very remote areas. Alternatively, Fig. 4b demonstrates that social disorder specializes in the remote and very remote areas of central and southern Queensland. Though important distinctions in these areas, these few areas do not lead

to overall statistically significant differences in the overall or post-hoc results.

39 LGAs are very over-represented or over-represented for social disorder. Of the 15 LGAs that are very over-represented, 9 are very remote, 3 are remote, and 3 are accessible. Of the 24 LGAs that are over-represented, 11 are very remote, 6 are remote, 3 are moderately accessible, and 4 are accessible. Most areas that specialize in social disorder (very over-represented or over-represented) are very remote (20) or remote (9). If we consider the 20 highest LQ LGAs for social disorder, the LQs of 9 of the 20 LGAs are driven by public disorder, while 5 are driven by mischief and 14 are driven by drugs. Bulloo Shire, which has the greatest specialization of social disorder, specializes in all three subtypes of social disorder.

Next, we look to specific areas to make sense of the spatial patterns and to specific crime types to determine what is driving specialization in these areas. Fig. 5 shows the LQs for six sub-types of property crime including residential burglary (Fig. 5a), commercial burglary (Fig. 5b), theft of vehicle (Fig. 5c), theft from vehicle (Fig. 5d), theft (Fig. 5e), and shoplifting (Fig. 5f).

Fig. 5a reveals that *residential burglary* only specializes in 5 LGAs. Weipa (very remote) is very over-represented for residential burglary. Highly accessible Brisbane and Logan and moderately accessible Cairns and Townsville are over-represented, significantly in the post-hoc results. Fig. 5b indicates that *commercial burglary* specializes in 41 LGAs. Of these 41 LGAs, 17 very remote, 7 remote, 1 moderately accessible, and 3 accessible LGAs are very over-represented for commercial burglary. 5 very remote, 6 moderately accessible, 1 accessible, and 1 highly accessible LGAs are over-represented for commercial burglary. This is a very different pattern than the commercial burglary rate that is low

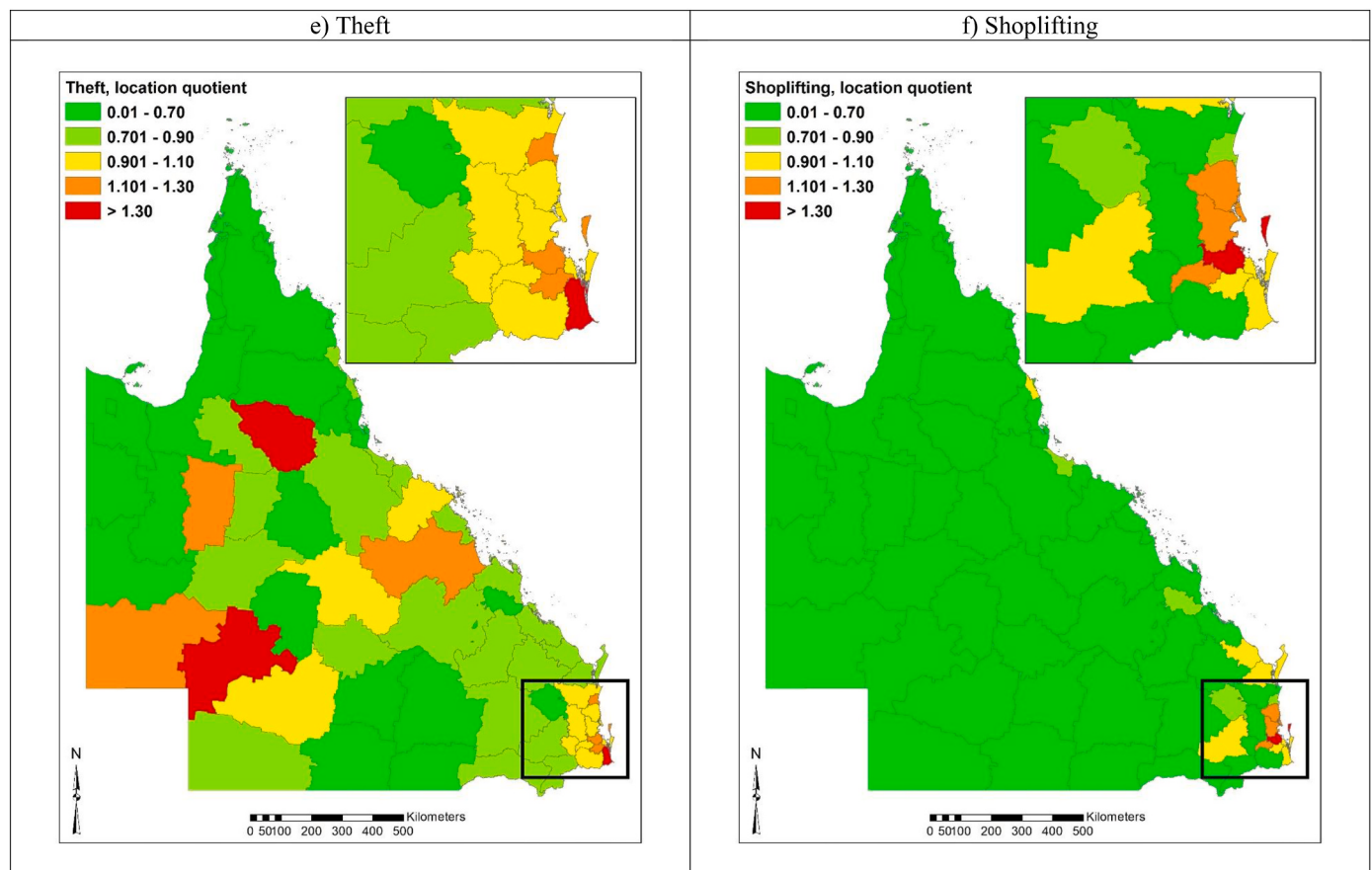


Fig. 5. (continued).

across the entire state of Queensland. The post-hoc analyses do not reveal any statistically significant differences across the ARIA + classifications. This only further shows the importance of the LQ because this crime type would be expected to have greater specialization in areas with more commercial targets like highly accessible areas.

Fig. 5c shows the LQs for *theft of vehicle*. 13 LGAs specialize in theft of vehicle. Of the 5 LGAs that are very over-represented for theft of vehicle, 4 are very remote and 1 is highly accessible (Logan). Of the 8 LGAs that are over-represented for theft of vehicle, 4 are very remote, 1 is remote, 1 is moderately accessible, and 2 are accessible. Fig. 5d indicates the LQs for *theft from vehicle*. 7 LGAs specialize in theft from vehicle with 3 LGAs being very over-represented and 4 LGAs being over-represented. The 3 LGAs that are very over-represented consist of 2 very remote LGAs and 1 accessible LGA. The 4 LGAs that are over-represented consist of 2 very remote LGAs, 1 moderately accessible LGA and 1 highly accessible LGA.

Fig. 5e shows the LQs for *theft*. Theft specializes in 10 LGAs in Queensland. Of the 3 that are very over-represented for theft, 2 are very remote LGAs and 1 is an accessible LGA. Of the 7 that are over-represented for theft, 2 are very remote LGAs, 1 is remote, 2 are accessible and 2 are highly accessible LGAs. Despite this, the post-hoc analyses show that the average levels of specialization are significantly greater in highly accessible and accessible areas. Fig. 5f indicates that *shoplifting* only specializes in 3 LGAs. Shoplifting is very over-represented in Brisbane (highly accessible) and over-represented in Ipswich and Moreton Bay (accessible). These results are confirmed in the post-hoc analyses.

Fig. 6 shows the LQs for 3 sub-types of violent crime including assault (Fig. 6a), robbery (Fig. 6b), and domestic violence (Fig. 6c). Fig. 6a shows that 54 LGAs specialize in *assault*. Of the 39 LGAs that are very over-represented for assault 31 are very remote, 6 are remote, 1 are

moderately accessible, and 1 is accessible. Of the 15 LGAs that are over-represented, 2 are very remote, 4 are remote, 7 are moderately accessible, and 2 are accessible. Remote and Very Remote areas have significantly greater specialization in assault than Highly Accessible, Accessible, and Moderately Accessible areas.

Fig. 6b reveals that 6 LGAs specialize in *robbery*. Of the 3 that are very over-represented for robbery, 2 are highly accessible and 1 is remote. Of the 3 that are over-represented, 1 is moderately accessible and 2 are accessible. Remote and very remote areas have significantly greater specialization in assault than accessible and moderately accessible areas. Fig. 6c details that 57 LGAs specialize in *domestic violence*. The 40 LGAs that are very over-represented for domestic violence include 26 very remote LGAs, 7 remote LGAs, 6 moderately accessible LGAs, and 1 accessible LGA. The 17 LGAs that are over-represented for domestic violence include 1 very remote LGA, 7 remote LGAs, 4 moderately accessible LGAs, and 5 accessible LGAs.

Fig. 7 shows the LQs for 3 sub-types of social disorder including drugs (Fig. 7a), mischief (Fig. 7b), and public disorder (Fig. 7c). Fig. 7a demonstrates the specialization of *drugs* across Queensland. Of the 34 LGAs that specialize in drugs, 16 are very over-represented and 18 are over-represented. 6 of the 16 very over-represented LGAs are very remote, 5 are remote, 4 are moderately accessible, and 1 is accessible. Of the 18 LGAs that are over-represented for drugs, 6 are very remote, 3 are remote, 4 are moderately accessible, and 5 are very accessible. Fig. 7b highlights the LQs for *mischief*. 21 LGAs specialize in mischief of which 3 are very over-represented and 18 are over-represented. 2 of the 3 very over-represented LGAs are very remote and 1 is accessible. For the 18 LGAs that are over-represented, 7 are very remote, 4 are remote, 4 are moderately accessible, and 3 are accessible. Fig. 7c represents the LQs for public disorder. 56 LGAs specialize in *public disorder*. 43 LGAs are very over-represented and 13 are over-represented. The 43 very over-

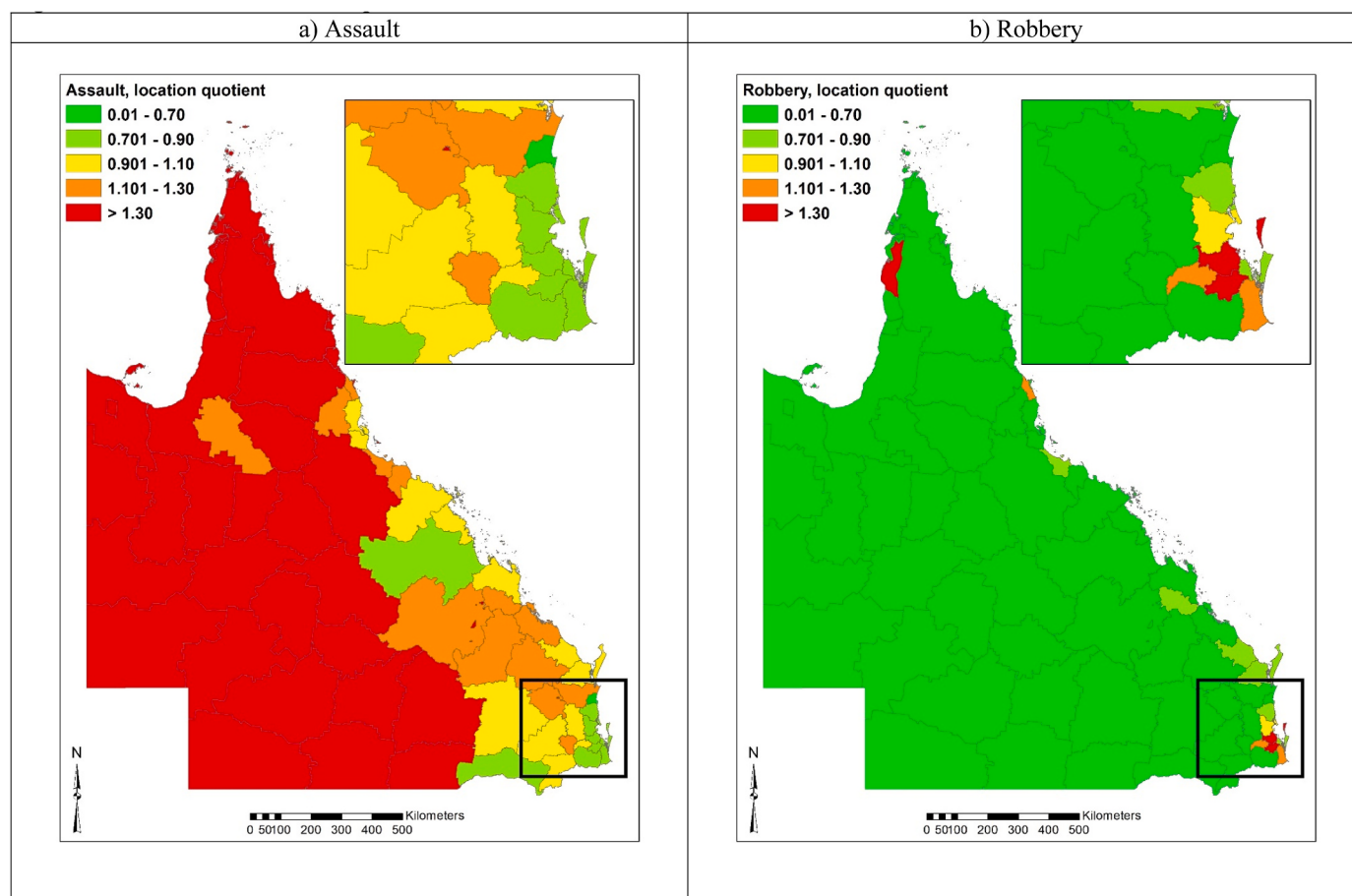


Fig. 6. Violent crime location quotients.

represented LGAs consist of 30 very remote LGAs, 9 remote LGAs, 2 moderately accessible LGAs, and 2 accessible LGAs. The 13 over-represented LGAs consist of 2 very remote LGAs, 3 remote LGAs, 6 moderately accessible LGAs, and 2 accessible LGAs. The post-hoc analyses indicate that very remote areas have significantly greater specialization than accessible and moderately accessible areas.

5. Discussion

Our study examined the specialization of crime by LGA across the state of Queensland, Australia between the years 2008–2019. We sought out to answer 5 questions: 1. Do the findings regarding rural specialization of crime extend to the international context, 2. Do these patterns of specialization change when we look at a longer time frame – i.e. an average of 12 years of data? 3. Do these findings change when different forms of rurality are considered? 4. Which specific crime types are driving this specialization? And 5. Are there other crime issues that may specialize differently, such as social disorder? Answering these questions allows us to better understand rural and remote crime patterns and help to inform policy and crime prevention strategies.

First, we found that the difference between crime rates and LQs in rural and urban areas is somewhat maintained in the Queensland context. Save for a few remote areas, violent crime demonstrated the expected opposite pattern for crime rates and LQs found in previous research. Violence rates in rural and remote areas were generally low, but violence specialization in these same areas was quite high. As such, places with low risk of victimization, generally, would have people being more likely to be victims of *violent* crime if they are victimized. This is an important finding as it demonstrates that, at least in Canada

and Australia, violent crime is specializing in rural areas. Both countries have a history of violent colonization, social injustice, and intergenerational trauma (Monchalin, 2016; Cunneen and Tauri, 2016). We would expect similar findings in New Zealand and the United States, but further research is needed.

Interestingly, rates of property crime are generally low across Queensland, save for a few remote areas, suggesting that property crime rates are low despite rural or urban geographies. This counters the findings by Carleton and colleagues in British Columbia, Canada (2014) and raises questions about how property crime specializes across the urban-rural divide in other countries. However, consistent with their findings, the results for the LQ demonstrate specialization (or over representation) of property crime in highly accessible (urban areas). Similar to violent crime, social disorder shows different spatial patterns when comparing crime rates to LQs. Rates of social disorder are generally low, aside from a few northern remote (rural) areas, while most remote and very remote (rural) areas are very over-represented for social disorder when using LQs. These findings support the need to explore and use multiple forms of analysis when attempting to understand spatial patterns of crime. In particular, they emphasize that the use of crime rates alone may not be the best way to compare crime across very different geographies such as rural and remote areas, but that this difference may be limited to violent crime and social disorder (Hodgkinson, 2022).

Second, we examined the spatial patterns of crime across a longer time frame than previous studies. While averaging the rates and LQs across 12 years may have reduced the magnitude of some of the specialization, it also allowed us to control for the potential impacts of demographic or policy changes over time. Furthermore, it provides

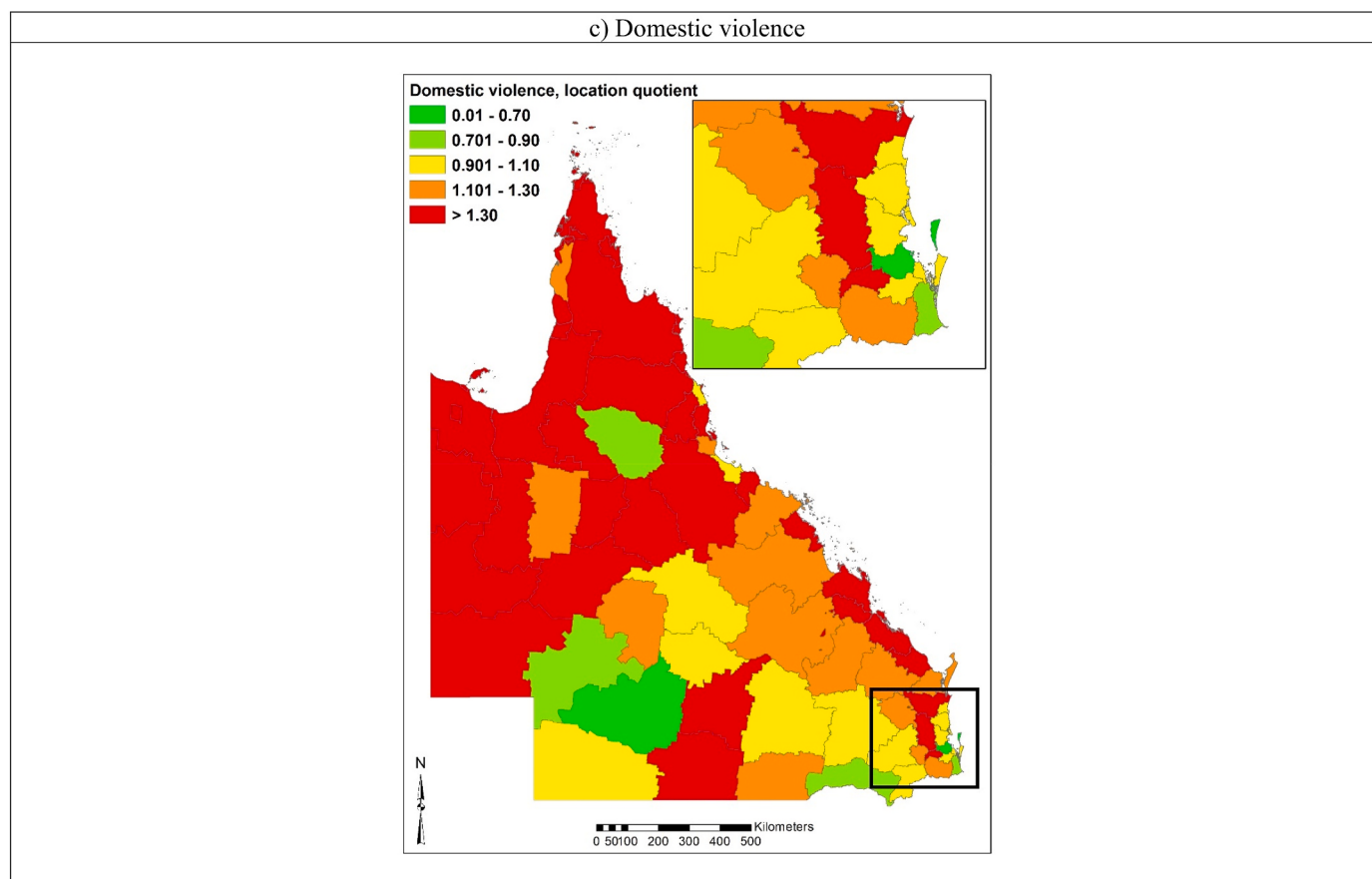


Fig. 6. (continued).

support to the conclusion that the patterns presented here are generalizable for these areas.

In order to answer the third and fourth research questions, we examined the types of crime that drove specialization for violent crime, property crime, and social disorder and considered each of these specific crime types across different levels of remoteness. Property crime occurs in accessible and highly accessible (urban) areas. High property crime LQ LGAs are driven by residential burglary, theft of vehicle and theft from vehicle. However, when we look at the LQs for these crime types, the area types are more diverse. For example, residential burglary specializes in accessible, moderately accessible, and highly accessible areas along the coastline of Queensland. According to opportunity theories including the routine activities approach and rational choice theory (Cohen and Felson, 1979; Clarke and Cornish, 1985), this is an expected finding considering the number of targets in these areas, and the likelihood that some of these coastal communities have higher rates of unoccupied vacation homes that lack capable guardianship. Similarly, shoplifting specializes in highly accessible and accessible areas, again where there are arguably more shopping centres and, thus, targets for this crime type.

Counterintuitively, commercial burglary specializes in predominantly remote areas, an unexpected finding considering the expected lack of suitable targets in remote areas. Further qualitative investigation is required here to identify the specific form of commercial burglary: for example, is this standard commercial burglary (crime in a rural area) or something specifically rural that is categorized as commercial crime (rural crime)? Likewise, while theft specializes in the expected highly accessible and accessible areas of Queensland, it also specializes in a few very remote areas as well. Again, this is unexpected as the number of targets in these areas should be very low. We found similar results for theft of and theft from vehicle, suggesting specialization in highly

accessible and accessible areas of Queensland, but also specialization in a few remote and very remote areas.

Vehicle theft has generally declined in the last 20 years across the world as a result of mandatory electronic immobilizers (Hodgkinson et al., 2016). These immobilizers make it impossible to turn over the engine without the vehicle key. While only conjecture, as further study of the demographics of these areas is necessary, a few explanations of theft from, and theft of, vehicle are possible. One, it is possible that the vehicles in these remote and very remote LGAs are older and do not have the mandatory electronic immobilizers or additional security measures that were implemented in Australia in 2001 (Kriven and Ziersch, 2007). As such, they are easier to steal. Two, residential burglary in the highly accessible and accessible areas is being used to access keys to steal newer and more valuable vehicles. A recent study by Hodgkinson et al. (2022) in Brisbane, Australia found a significant increase in the spatial co-occurrence of residential burglary and vehicle theft, suggesting this may be a viable explanation for the difference in spatial patterns of theft of and theft from vehicle. However, further research is needed to better understand these patterns.

In this study, we found that violent crime generally specializes in remote and very remote LGAs. High violent crime LQ LGAs are driven by domestic violence and assault. Robbery does not drive the specialize of violent crime, more broadly. Robbery specializes in accessible and highly accessible areas save for one remote, and one very remote LGA. Again, considering opportunity theories would suggest that people need to come together in time in space for a crime to occur, robbery is highly dependent on greater numbers of potential offenders and suitable targets. As such, denser and more accessible areas are expected to specialize in robbery.

Alternatively, assault and domestic violence specialize almost exclusively in remote and very remote LGAs, despite these areas having

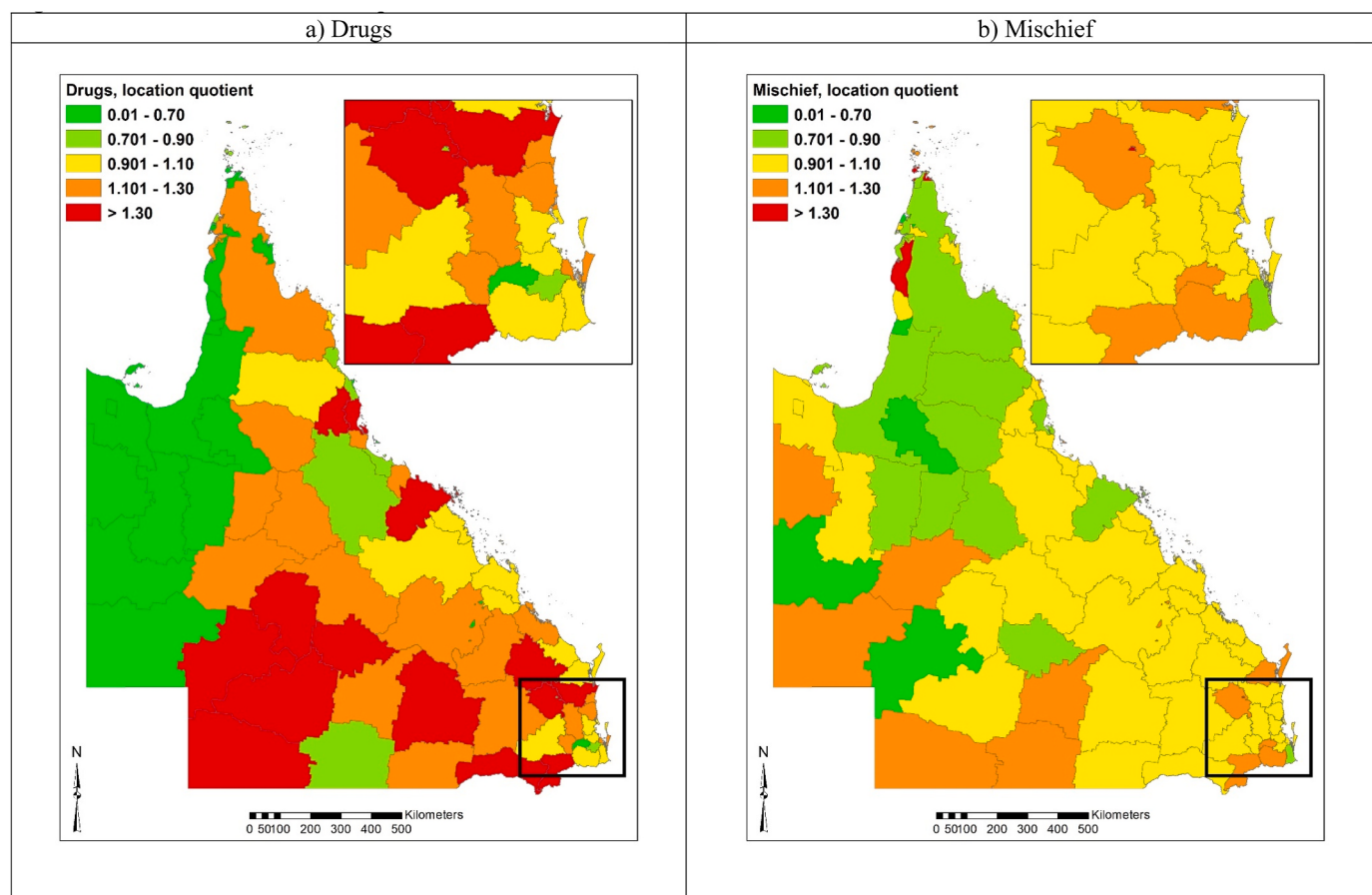


Fig. 7. Social disorder location quotients.

low violent crime rates. This is consistent with the rural criminological literature that is increasingly finding rural and remote areas are often much more violent (Hogg and Carrington, 2006; Barclay et al., 2007). There are a couple of potential explanations for these spatial patterns. For assault, authors suggest the lack of access to police or other forms of formalized justice may encourage more personal and violent ways of settling disputes (Pinker, 2011). It may also be a product of rural and remote cultures (Nisbett and Cohen, 1996).

Domestic violence is known to be higher in the rural and remote parts of Australia. Authors have found this specialization is related to isolation and a lack of support services for victims, as well as fears about reporting to local police who may be personally connected to the offender or their family (Peek-Asa et al., 2011; Harris, 2016). Interestingly, in Queensland, efforts to reduce and prevent domestic violence through the “Not Now, Not Ever” recommendations were not experienced equally, and despite extensive investments in services and policing resources, many of the rural and remote areas continued to experience high rates of domestic violence (Hodgkinson and Harris, 2021). Our findings confirm ongoing over-representation of domestic violence in remote and very remote LGAs of Queensland and highlight the need to use crime specific analysis in identifying areas that may require additional supports for prevention and reduction of violence.

Fifth, and finally, in our study, we examined the specialization of social disorder, as this has yet to be examined closely in the literature. Social disorder specializes in mostly remote and very remote areas. High social disorder LQ LGAs are driven by public disorder and drugs. Mischief and drugs specialize across a range of area types and do not appear to have a clear spatial pattern. Again, further research is necessary to ascertain which local factors may be consistent across these

different geographies that contribute to the specialization of drugs and mischief in these LGAs.

Unexpectedly, public disorder specializes in very remote and Indigenous areas. Public disorder is defined as drunkenness, vagrancy, and other behaviours that occur in public and are deemed problematic. Public disorder is a relatively new category of crime in Queensland and was put in place to increase control of anti-social behaviour, particularly around night-time districts and business areas (Beattie, 2003; McGrady, 2003). It was introduced as part of reforms to the Vagrants Act (2004) in order to tighten laws around public nuisance behaviour. As such, we would expect to see this crime type specialize in accessibly and highly accessible areas with large business and night-time economies, such as Brisbane and the Gold Coast, or Cairns. However, the opposite specialization is found here.

One of the concerns that was raised when this offence was introduced was that it could potentially negatively impact Indigenous peoples, as the vagueness of the law created a “catch-all” crime type (QLA Clark, 2003). These kinds of anti-social behaviour laws have proven a means to more punitive policies in areas like England and Wales (Wooff, 2016). Furthermore, in Canada, that also has a high density of Indigenous peoples in rural and remote areas, like Australia, a similar crime type “mischief”¹¹ has been shown to account for 30% of all police-reported crime in Indigenous communities, as compared to 11% in non-Indigenous communities (Allen, 2020). As such, the police have a high level of discretion in applying these kinds of crime types.

¹¹ In Canada, the crime type “mischief” includes a range of anti-social behaviours such as vandalism and destructive or reckless behaviour.

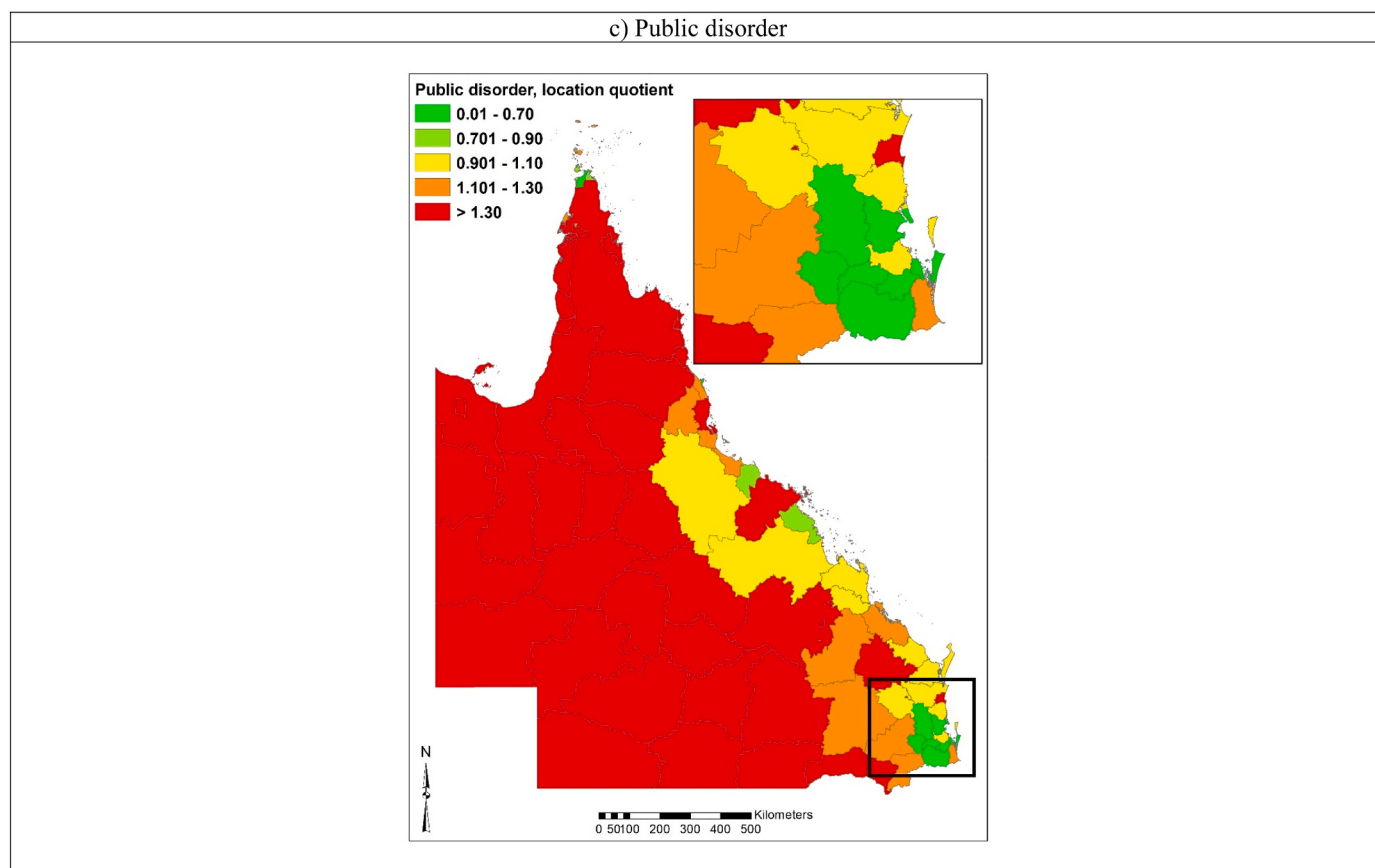


Fig. 7. (continued).

Considering the disproportionate number of Indigenous peoples living in remote and very remote areas of Queensland where this crime types specializes, these findings suggest that the concerns voiced about the introduction of this crime type are warranted and that the Queensland Police Service may be problematizing certain groups (Cunneen and Tauri, 2016) and over-policing these LGAs using this crime type. This is a troubling finding and requires further investigation.

Our findings suggest that supports for violence prevention are needed in remote and very remote areas, that policy for property crime prevention should be tailored to the crime type, and that vague crime types like social disorder, require further specification and monitoring to ensure they are not simply used to over police particular populations. Furthermore, while we used a consistent form of measurement for rurality/accessibility (ARIA+) that was appropriate for our unit of measurement (LGAs) within our study site (Queensland, Australia), attempts to standardize measures for rurality internationally, including the rural-urban continuum proposed by Ceccato and Abraham (2022) may contribute to further generalizability of these findings.

6. Limitations and future directions

The study is limited in a few ways. We are unable to speak to crime types that are under-reported or rare, such as sexual assault or homicide. While these crime types are simple to calculate, their low numbers would not contribute to our understanding of patterns of crime specialization and would unnecessarily highlight certain LGAs as problem areas. Considering the ways in which the CSI has been used by media sources to problematize a small community in Canada (Hodgkinson, 2022), we are hesitant to repeat these mistakes. In addition, we are unable to address exactly “why” certain area types specialize in particular crime types.

Furthermore, we were unable to compare rates and LQs to a harm or

severity index as was done in previous research (Carleton et al., 2014; Hodgkinson, 2022). This would allow us to speak to the differences across all three measures in understanding crime trends across regions to inform crime prevention policy. While a harm index has been introduced as another possible measure in Australia (see Ransley et al., 2018), it has yet to be officially adopted.

More generally, we are reliant on police-recorded data. While this provides important insights into police activity across regions, it does not address issues of underreporting across all crime types. A review of the rural criminology literature finds that underreporting remains an issue in rural areas (Abraham and Ceccato, 2022). As such, self-report data and victimization surveys are useful next steps to better understand patterns of crime across urban, rural, and remote areas (Hodgkinson, 2023).

Future research should also compare social disorder in other contexts and explore census level predictors of specialization. In the international context, Queensland demonstrates similar patterns of property and violent crime specialization in these areas and sometimes in unexpected ways (e.g. commercial burglary and public disorder). Further investigation is needed to understand the predictors of specialization, in order to better separate the rural versus urban divide for crime specialization and census level data would help contribute to this analysis.

7. Conclusion

Our study examined a number of questions regarding crime specialization across geographies in the state of Queensland, Australia.

We found that Queensland demonstrates similar patterns of property and violent crime specialization when compared to Canadian research. However, property crime rates across remote areas are much lower than expected. Furthermore, social disorder appears to specialize in remote and very remote areas of Queensland. When examining specific crimes, particular crime types are driving crime specialization in certain areas in unexpected ways. For example, commercial burglary and public disorder specialize in remote and very remote areas despite a lack of targets and a lack of night-time economies and dense business areas. These findings suggest that specialization in these areas may have more to do with police activity and discretion in these areas, rather than actual crime occurrences. Further investigation is needed to understand the demographic predictors of these patterns of specialization, in order to better separate the rural versus urban divide for violence, property, and social disorder crime specialization. Our study adds to the growing literature on rural criminology, by providing clear spatial and temporal trends of crime in rural and remote areas a large state in Australia and contributes to potential crime prevention policy by clarifying the need for different types of resources and strategies to address different types of crime across diverse geographies.

Author statement

Tarah Hodgkinson, PhD is responsible for conceptualization, data curation, formal analysis, methodology, validation, visualization, project administration, writing, and reviewing.

Natasha Martino, MA is responsible for investigation, writing, reviewing, and editing.

Declaration of competing interest

None.

Data availability

The data that has been used is confidential.

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