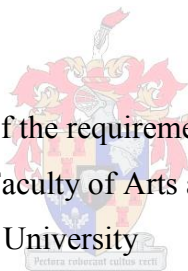


POLICE AREA STRUCTURE AND CRIME DYNAMICS: INVESTIGATING THE CITY OF TSHWANE MUNICIPALITY

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AUTHOR'S DECLARATION

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ABSTRACT

The impact crime has on neighbourhoods are an ever present feature in modern cities around the world. Neighbourhood structure and socio-economic conditions contribute to criminal activities, and may lead to increasing crime densities. An understanding of the distribution of crime in space can aid in an understanding of such relationships, and thus contribute to proactive policing and crime prevention strategies. The main aim of this study is to analyse the spatial patterns of six types of crime and to determine if there is any evidence of social disorganisation theory and routine activities theory in the police areas in Tshwane. This will be done through density calculations using methods such as Location Quotients of Crime (LQCs) and crime density calculations. Correlating the results with selected neighbourhood characteristics will then test social disorganisation theory and routine activities theory. Results from the study indicate that crime densities differ across police areas within Tshwane, but that the contact crimes are more prevalent in areas with poor socio-economic conditions. The correlation results indicate that there are a link between areas with low social control areas and the social disorganisation theory. Similarly results indicated that population density correlated with crime in general, which is in agreement with the daily routine theory. The findings from this study could inform the Municipality's crime fighting strategy in terms of resource distribution.

Keywords and phrases: Neighbourhood characteristics; Tshwane; location quotients; crime density; property crime; social disorganisation theory; routine activities theory; crime dynamics; police area; apartheid; contact crime

OPSOMMING

Die impak van misdaad op woonbuurte is 'n alomteenwoordige eienskap van moderne stede om die wêreld. Die struktuur van woonbuurte en sosio-ekonomiese omstandighede dra by tot kriminele aktiwiteite en kan tot 'n toename in misdaadigheid lei. Om die verspreiding van misdaad in 'n sekere gebied te verstaan kan help om die verband tussen bogenoemde faktore te verstaan en so tot proaktiewe polisiëring en misdaadvoorkomingstrategieë by te dra. Die hoofdoel van hierdie studie is om die ruimtelike patrone van ses verskillende soorte misdade te ontleed en vas te stel of daar enige bewys is van die sosiale wanorde-teorie en die roetine-aktiwiteitsteorie binne die polisie-areas in Tshwane. Dit word deur middel van digtheidsberekeninge gedoen deur metodes soos die Liggingskwosiënt van misdaad (Location Quotients of Crime – LQCs) en misdaadigheidsberekeninge te gebruik. Deur die resultate met die geselekteerde kenmerke van woonbuurte te korreleer word die sosiale wanorde-teorie en roetine aktiwiteitsteorie getoets. Resultate van die studie dui aan dat misdaadigheid van polisie-areas binne Tshwane verskil, maar dat kontakmisdad meer algemeen in woonbuurte met swak sosio-ekonomiese toestande voorkom. Die korrelasie-resultate dui aan dat daar 'n verband tussen areas met lae sosiale beheergebiede en die sosiale wanorde-teorie bestaan. Eweneens het resultate aangedui dat bevolkingsdigtheid met misdaad in die algemeen korreleer. Dit is in ooreenstemming is met die daaglikse roetine-teorie. Die bevindinge van hierdie studie kan ter inligting dien om die Munisipaliteit se misdaadbestrydingstrategie ten opsigte van hulpbronverspreiding te verbeter.

Tref woorde en frases: Woonbuurtkenmerke; Tshwane; liggingskwosiënte; misdaadigheid; eiendomsmisdad; sosiale wanorde-teorie; roetine aktiwiteite; misdaaddinamika; polisie-area; apartheid; kontakmisdad.

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CONTENTS

	Page
1. INTRODUCTION.....	1
2. LITERATURE REVIEW	4
2.1 Neighbourhood structure and crime.....	4
2.2 Social disorganisation theory	5
2.3 Routine activities theory	7
3. DATA AND METHODOLOGY.....	8
3.1 Study area and data.....	8
3.2 Methods	10
3.2.1 Location Quotients of crime (LQC)	10
3.2.2 Crime density	11
3.2.3 Correlation analysis	11
4. EMPIRICAL RESULTS AND DISCUSSION	12
4.1 Location quotients of crime.....	13

4.2	Crime density	18
4.3	Comparison between LQC and Crime density calculations	22
4.4	Correlation analysis	22
5.	CONCLUSION	23
6.	POLICY IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS	24
	REFERENCES	26

TABLES

		Page
Table 1	General crime distribution in City of Tshwane	11
Table 2	Correlations between crime densities and police area characteristics	23

FIGURES

	Page
Figure 1	Concentric Zone model2
Figure 2A	LQC for assault with intent to do grievous bodily harm.....14
Figure 2B	Location quotients of common assault15
Figure 2C	Location quotients of aggravated robbery16
Figure 3A	Location quotients of burglary at residential premises.....17
Figure 3B	Location quotients of theft of motor vehicle and motorcycle.....18
Figure 3C	Location quotients of theft out of or from motor vehicle.....18
Figure 4A	Density of assault with intent to inflict grievous bodily harm by police area.....20
Figure 4B	Density of common assault by police area20
Figure 4C	Density of aggravated robbery by police area20

Figure 5A	Density of burglary at residential premises by police area	21
Figure 5B	Density of theft of motor vehicle and motorcycle by police area.....	22
Figure 5C	Density of theft out of or from motor vehicle by police area.....	22

APPENDICES

ABBREVIATIONS AND ACRONYMS

	Page
Central business district (CBD).....	14
Closed-circuit television (CCTV).....	6
Geographic information systems (GIS).....	9

Location quotient of crime (LQC).....	3
National development plan (NDP).....	2
New South Wales (NSW).....	1
South African Police Services (SAPS).....	2
Statistics South Africa (Stats SA).....	7

1. INTRODUCTION

Crime is a forever present feature of all modern cities, but not all neighbourhoods are affected equally. Serious crimes, ranging from residential burglary to homicide, are strongly patterned in time and space, forming crime hotspots (Short et al. 2010). According to the social disorganisation theory, which focuses on the relationship between socio-economic circumstances of communities and prevalence of crime, neighbourhood structures determine how much crime is experienced in the neighbourhood. Sociologists believe that neighbourhood characteristics such as socio-economic status, social control and residential stability are important determinants of crime in a neighbourhood. A number of studies agree that crime results from social stress and that crime rates are affected by both demographic and socio-economic factors (Sampson & Groves 1989, Wong 1989, Zhang & Peterson 2007, Kruger & Landman 2008). Geographers on the other hand are of the view that crime is unevenly distributed across different geographic scales, for example countries, regions, cities, and neighbourhoods (Zhang & Peterson 2007). Crime is therefore shown to have both social and geographic dimension.

Another theory closely linked to the measurement of criminal activities is the routine activities theory. This theory focuses on how the structure and activities in a neighbourhood encourage criminal behaviour. According to this theory, three elements are required for crime to occur, namely, a motivated offender, a suitable target, and an absence of a capable guardian (Branic n.d. Ontario Ministry of children and youth 2010, Tewksbury & Mustaine 2010, NSW 2011). Occurrence of crime depends on the offender's assessment of the situation, although in some cases the offender is not as rational as it is generally thought to be the case; the possibility of being caught is often disregarded while making a decision to commit crime (Ontario Ministry of children and youth 2010).

South African cities and towns were, to a large extent, shaped by planning practices that were a result of apartheid policies. An apartheid city is often characterised by the spatial dislocation of the poor, which results in long and costly commuting patterns. This often leaves commuters vulnerable to victimisation (Kruger 2005). Communities are physically separated by vacant land, with wide disparities in living levels and quality of life between different communities. Many residents are excluded from the amenities and economic opportunities offered by the city (Kruger 2005).

A typical South African city is still characterised by features of an apartheid city. It takes the form of a concentric zone model as shown in Figure 1 below. In the centre is the central business district (CBD) which is characterised by mixed land use, grid-patterned streets, and very compact form. Adjacent to the CBD are residences for entry level workers followed by middle class residences,

also known as suburbs. The outer circle, the commuter zone, consists of townships which were previously reserved for black workers. Townships resulted from the Group Areas Act (1950) which ensured that blacks were removed from ‘white towns’, but at the same time able to commute to their places of work in the city (Kgari Masondo 2008).

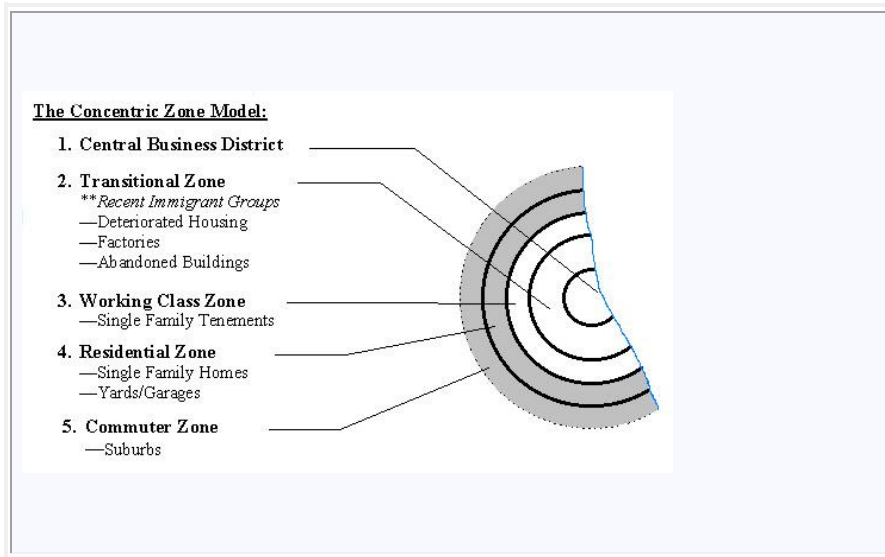


Figure 1: Concentric Zone model - This image was borrowed from Carlin Wong’s review of *Clifford R. Shaw and Henry D. McKay: The Social Disorganization Theory* for CSISS Classics

South Africans’ perceptions of crime reflect the fact that crime is a major issue in the country (Smit 2013). Most cities and towns in South Africa were shaped by planning practices that were a result of apartheid policies. They are still characterised by white affluent neighbourhoods not far away from the city, with townships excluded from amenities and economic opportunities further away. This often leaves commuters vulnerable to victimisation (Kruger 2005). Since 1994, South Africans have a choice of where to live, but socio-economic factors still have an influence on where people live. Middle class blacks are now moving to what was previously regarded as ‘white suburbs’. Some of the affluent South Africans, both black and white are now choosing to live in gated communities in search of liveability, because these are perceived to be safer than other areas – there is a common perception that crime is committed by ‘outsiders’ (Van de Wetering 2002). Since the abolition of apartheid laws in 1994, the country is also experiencing mushrooming of informal settlements, which are often unkempt and crowded.

Although there has been a reduction in serious crimes over the last few years (total crime levels in South Africa has decreased by 21% between 2003 and 2012), the fight against crime is still a key priority of the South African government (Smit 2013). An understanding of the distribution of crime in space can help in developing crime prevention strategies. Hipp (2010) posits that neighbourhoods with more racial or ethnic heterogeneity, residential instability, and economic

disadvantage, have lower levels of formal and informal social control and therefore higher levels of both property and violent crime. The South African Police Services (SAPS) maintain that assaults, for example, are largely a social phenomenon and occur mostly in localities not covered by traditional policing like patrols (Bruce 2011). To decrease these crimes considerably, communities need to change their way of life (Bruce 2011). The South African National Development Plan (NDP) requires that causes of crime trends be analysed to inform strategy. In South Africa, crimes are reported according to police areas, where each police station services a number of suburbs depending on the vastness of the area serviced – in the City of Tshwane Municipality (Tshwane), for example, one police area serves 2 to 10 suburbs.

“There has been a growing consensus among policy makers that crime is not only a security issue but has deep social and economic roots and consequences” (Republic of South Africa 2011: 356). For the response to crime to be effective, a holistic approach to community safety is required, which takes the causes of crime into account and respond to specific triggers or causal factors. Coordinated effort, and high levels of analysis of crime patterns and trends need to be undertaken to inform policy responses and ensure sustainability; increasing the numbers in the police service is only a short term solution. The NDP suggests the following factors to be considered in the long term plan: underlying root causes of crime (poverty, inequality, unemployment, motivation to engage in criminality); lack of social cohesion; opportunities and motives (availability of targets) (Republic of South Africa 2011). Identification of the root causes would assist in identifying relevant agencies that can contribute to interventions.

As much as a criminal justice system is a necessary condition for effectively promoting safety and security, it is not adequate on its own; more is required for sustainable and effective solutions to crime and insecurity. Achieving a safe and secure society calls for an integrated approach to make safety and security a reality for all citizens. Crime rates are usually higher in cities than rural areas, and within cities violence is frequently concentrated in poorer communities (Petesch 2013). Tshwane municipality consists of mainly urban areas and is still vastly segregated with respect to race, with the black population mainly residing in the north western and north eastern parts while the White population occupies the affluent eastern and southern suburbs.

The main aim of the study is to investigate the spatial patterns of selected contact/violent crimes and property/property-related crimes within the official municipal boundaries of Tshwane Municipality for the year 2011 in order to establish what type of the selected crimes was dominant in different police areas of the Municipality. The study also analyses the relationship between these crime categories and the neighbourhood characteristics in the municipality to see whether there was any

evidence for the social disorganisation theory and routine activities theory. Location Quotients of Crime (LQCs) and crime densities are used as indicators of neighbourhood crime levels/intensity, and to show relative distribution of crimes in neighbourhoods across the municipality.

This paper consists of four parts; firstly it will provide an overview of crime and neighbourhood characteristics and crime theories, in particular the social disorganisation theory and the routine activities theory. Secondly the methodology will be discussed, indicating how the research utilises location quotients of crime and correlation analysis to explore the relationships between crime density and neighbourhood socio-economic characteristics, and the dominance of six types of crime (assault with intention to do grievous bodily harm, common assault, robbery with aggravated circumstances, burglary at residential premises, theft of motor vehicles, and theft out of motor vehicles were selected). The findings of the study are expected to provide an understanding of spatial profiles of crime in Tshwane, as well as evidence (or lack thereof) of social disorganisation theory and routine activities theory.

2. LITERATURE REVIEW

This section of the paper provides an overview of literature relating to the physical structure of a neighbourhood and its relation to criminal activity. Another aspect in this section will be the discussion of two important theories related to this study, namely the social disorganisation theory and the routine activities theory. These theories follow the positivist approach where the causes of crime are to be found in the way the physical environment in which people live and interact socially creates the conditions for criminal behaviour. They seek to locate the causes of (deviant) human behaviour within some form of social structure that exists external to the individual.

2.1 Neighbourhood structure and crime

Classic ecological theories of crime argue that it is the transitory period when urban neighbourhoods move towards concentrated disadvantage that they exhibit the highest levels of crime and delinquency (Tita et al. 2006). Rising crime rates may also induce urban flight out of high crime neighbourhoods, thereby causing changes in neighbourhoods. Liska and Bellair (1995), too, found that over time, violent crime rates resulted in changes in the racial composition in a number of cities in the United States. In South Africa this is apparent when the affluent blacks move to the previously white suburbs and gated communities in an attempt to escape from crime in what was previously known as black townships, where crime rates are perceived to be high due to concentrated disadvantage. Not only does crime alter the makeup of neighbourhoods through "white flight," but issues of safety may be even more likely to affect the decisions of where movers decide to locate in the first place than to bring about moves."

“Apartheid is South Africa’s strongest spatial determinant, representing the ‘pinnacle of artificial geographical confinement’, serving to displace and hide perceived problems (e.g. poverty)” (Spinks 2001:4). According to the ecological theories, the physical and social structure of neighbourhoods plays a part in determining the distribution of crime in a place. Crime is therefore expected to be distributed unevenly across a city such as Tshwane, which is made up of different types of neighbourhoods. Although one has to look at different crime types to better understand the distribution of crime in any place, one criminal event can sometimes lead to another, for example a robbery can escalate to murder; this implies that various criminal activities do not necessarily occur in isolation (Smit 2013).

Local movement was also found to be beneficial in terms of ‘eyes in the street’ although large scale movements presented high risk of crime (Hillier & Sahbaz 2008). According to Hillier and Sahbaz (2008) other recent studies have not succeeded to find any association between higher population densities and crime. Hillier and Sahbaz (2008) suggest that features of environments that relate to crime risk seldom work on their own but are interdependent with other features, social as well as spatial and physical. “... the relation between crime and spatial design may not pass through the intervening variable of community formation” (Hillier & Sahbaz 2008: 27).

Cozens (2008) suggested homogenous residential environments exhibit lower rates of crime than areas with mixed uses, challenging the ‘mixed-use equals safety’ assumption held by New Urbanists. Residential burglary has been found to be more frequent in properties close to commercial areas (Talen 1999, Cozens 2008). It was also found that burglaries are more likely to be found in mixed-use sites (Cozens 2008). Land use patterns influence the routine activities of the community and potentially influence opportunities for crime.

According to Spinks (2001), dense areas are perceived as having more “eyes on the streets” (e.g. crime witnesses, bystander intervention), than the quiet streets of suburbs and other sparsely built areas. Spinks (2001) argues that ‘natural surveillance’ is facilitated by networks of unconscious voluntary controls perpetuated by strangers in busy areas, thus promoting feelings of safety. There is therefore a belief that a dense spatial design can encourage citizens to acquire mutual responsibility. On the contrary, results of other studies on social sustainability show a negative correlation between high density and neighbourhood pride, safety, and environmental quality – people prefer to live in a more rural setting with larger gardens (Bramley et al. 2009).

2.2 Social disorganisation theory

The social disorganisation theory states that neighbourhood structures determine how much crime is experienced in the neighbourhood. Social disorganisation is the consequence of a community's

inability to realise common values and to solve the problems of its residents, resulting in the breakdown of effective social control within that community (Wong 2001). The theory claims that socio-economic stresses such as poverty, unemployment and racial issues prohibit social cohesion, resulting in an increase in crime levels (Zhang & Peterson 2007).

According to this theory, neighbourhood characteristics such as socio-economic status, social control and residential stability are important determinants of crime in a neighbourhood. Clifford Shaw and McKay, the pioneers of the social disorganisation theory based it on Burges' concentric model of a city. This theory originated in the early 1900's, and suggested that the concentric circles formed as a result of natural processes as more wealthy and important groups left the inner city to avoid the existing social disorganization (Shaw and McKay 1942 in Wikipedia). The theory links crime rates to neighbourhood ecological characteristics; the main principle being that place matters – where a person lives is an important factor shaping the likelihood that that person will become involved in criminal activities.

According to John Hipp (2010), social disorganisation theory conceptualised the city as an ecology in which residents moved to more desirable neighbourhoods, and as a result certain neighbourhoods became characterised by a high level of social disorganisation and high levels of crime and delinquency. He posits that if residential mobility outcomes are made in response to crime, then crime itself may play a role in how neighbourhoods change; this possibly reciprocal relationship between neighbourhood structural characteristics and crime rates then implies a vicious cycle for such neighbourhoods, a cycle in which the residential mobility of the most disadvantaged residents may play a significant role (Hipp 2010). Cullen and Agnew (2011) posit that criminality is not on a result of individual traits per se, but it is about community regulation (or the lack thereof).

Sampson and Groves (1989) made a hypothesis that low economic status, racial heterogeneity, family disruption and residential mobility lead to social disorganisation of the community, thereby increasing crime rates. They described social disorganisation as the inability of the community to realise common values and maintain social control. In their study, Sampson and Groves (1989) used socio-economic status, residential stability, family disruption, heterogeneity of community composition, and urbanisation to measure social disorganisation. Kruger & Landman (2008) are also in agreement that urbanisation and poverty, and wide income disparities are relevant measures of social disorganisation because they are believed to be limiting access to education, training, employment, and overall services that facilitate personal, economic and social development. According to a study by Kruger and Landman (2008), research results have shown that crime is more prevalent in urban and disadvantaged areas.

Sampson & Groves (1989) found that low socio-economic status (lack of money and resources) and family disruption were positively correlated to crime rates, while residential stability was negatively correlated to crime levels. They also posit that two parents provide better supervision than single parents. In their testing of the theory they found communities who could not control teenage groups to experience higher crime rates, while those with higher network density had increased ability to control delinquency, which is in agreement with the social disorganisation theory. A study on 125 United States metropolitan areas found that violence was more in urban areas marked by socio-economic inequality, where there was a wide gap between African Americans and whites (Cullen & Agnew 2011). Having said this, Sampson and Groves (1998) regarded the social disorganisation as not only speaking to ability of the community to achieve common values, but also to community processes that are able to produce offenders.

The above discussion implies that in addition to the effect that neighbourhood structural characteristics might have on crime, crime may well affect these structural characteristics. Tita, Petras and Greenbaum (2006) also agree that characteristics correlated with local levels of crime include poverty, racial composition, residential instability, and levels of home ownership.

The broken windows theory, related to the social disorganisation theory, suggests that neighbourhoods with higher levels of incivilities (that is, physical or social disorder) send a signal to more serious offenders of an inability to proactively respond to more serious events (Hipp 2010). This implies that neighbourhoods with more social and physical disorder will have increasing levels of crime over time. This theory posits that such disorder is perceived by potential offenders as a sign of lack of guardianship in the neighbourhoods, and it can therefore be expected that increasing levels of disorder would lead to more crime. This is in line with the routine activities theory, which is discussed in the next section.

2.3 Routine activities theory

The routine activities theory, which was originally formulated by Cohen and Felson in 1979, is based on three elements: the motivated offender, suitable target, and the absence of a capable guardian (Branic n.d. Ontario Ministry of children and youth 2010, NSW 2011, Tewksbury & Mustaine 2010). A crime will therefore only be committed if a potential offender believes that a target is suitable and that a capable guardian is absent. A suitable target may be a weaker human being, an attractive property, etc. while a capable guardian could be police patrolling, neighbours, a closed-circuit television (CCTV) camera, etc. A potential offender is always on the look-out for opportunities and sufficient rewards as motivation to commit crime. Crime is results from interaction between motivation, opportunity, and presence of a target, coupled with lack of

guardianship (Ontario Ministry of children and youth 2010). Branic (n.d.) identified five factors that influence crime rates, namely, demographics (shopping, involvement in sports, eating out, etc.), social activities, alcohol and drug abuse, economic status, where lower economic status areas are seen to also lack guardianship and structural aspects (everyday movements – employed people being always away from home on weekdays). These routine activities and travel routes form the ‘awareness space’ of the offender (Hillier & Sahbaz 2008). Routine activities theory says that for a crime to take place there must be a motivated offender, a suitable target and the absence of capable guardians. It also argues that having too many people in spaces creates the anonymity that criminals need to access their victims, and so dilutes the ability of residents to police their own environment. Crime can then be expected to be less in low density, single use environments with restricted access to strangers, where inhabitants can recognise strangers as intruders and challenge them. High population densities and high rates of unemployment would mean that there will constantly be people loitering around the neighbourhood, making it difficult for residents to be able to distinguish between the regular residents and the would be criminals.

The above discussion shows that the social disorganisation theory and routine activities theory were tested. Social and economic factors such as social disorder, socio-economic status, education, employment, residential stability used to investigate crime correlates and to test the theory. Routine activities theory suggests that crime occurs when the would be criminal sees a potential target (vulnerable person or valuable property) and perceives the environment to be void of capable guardianship, or the population density so high that he/she may not be easily recognised.

3. DATA AND METHODOLOGY

3.1 Study area and data

The crime data used in this study was the total count of crime incidents reported to, or detected by, the SAPS and subsequently recorded as crimes for Tshwane Municipality during the 2011 South African financial year. Tshwane is the second largest municipality in the Gauteng Province and is among the six biggest metropolitan municipalities in South Africa. The Municipality has a population of approximately 2.9 million people which translates to 911 536 households according to the 2011 census (City of Tshwane 2013). Results from the Victims of Crime survey conducted by Statistics South Africa (Stats SA) and the crime statistics from SAPS show that Gauteng Province is consistently leading in high incidents of different categories of crime in the country. According to these surveys, in 2011 the province experienced the highest incidences of crime nationally (about 21% violent crimes, 25% property crime, 27% house breaking, 26% home robbery, and 38% car theft). Towns and townships that form part of the Tshwane Municipality's area include Pretoria,

Centurion, Akasia, Soshanguve, Mabopane, Atteridgeville, Ga-Rankuwa, Winterveld, Hammanskraal, Temba, Pienaarsrivier, Crocodile River and Mamelodi. A number of these towns and/or townships are serviced by a police single police station, thereby forming a police area. Tshwane Municipality has a total of 35 police areas which are composed of about 195 towns and townships/suburbs in total. According to the City of Tshwane Municipality Household survey (2008), although there has been some integration in the municipality, the apartheid legacy is still evident in the racial distribution of the municipality. The results of the survey showed that the majority of the Black population resided in the north-western (96%) and north-eastern (81%) regions while the south and eastern regions were mainly White. Less than 1% of households in the municipality were child-headed while female-headed households made up 35%. Only 18% of the Tshwane residents had education level less than matric/grade 12 (Tshwane 2008).

The complete data file consisted of 29 crimes classified into seven categories, namely, contact crimes (murder, sexual crimes, attempted murder, assault with intention to do grievous bodily harm, common assault, common robbery, and robbery with aggravated circumstances), contact-related crimes (arson, malicious damage to property), property-related crimes (burglary at residential premises, burglary at non-residential premises, theft of motor vehicles, theft out of motor vehicles, and stock theft), crimes heavily dependent on police action for detection (illegal possession of firearm, drug-related crime, and driving under the influence of alcohol or drugs); other serious crime (all theft not elsewhere classified, commercial crime and shoplifting); crimes not elsewhere recorded (culpable homicide, public violence, crimen injuria, neglect and ill-treatment of children, and kidnapping). In this dataset, robbery with aggravating circumstances was further broken down into carjacking, truck hijacking, robbery at residential premises, and robbery at non-residential premises. The SAPS crime statistics are affected by the rules governing the recording of data. The system and definitions used by SAPS are standard across all police stations.

The focus of this study will be on the following contact and property-related crimes: assault with intention to do grievous bodily harm, common assault, robbery with aggravated circumstances, burglary at residential premises, theft of motor vehicles, and theft out of motor vehicles were selected, since these crimes made up the predominant types of crime in Tshwane (about 47% of the total crime count). The first three types can be classified under contact crimes as they require the victim to be present at the time of perpetration while the latter three are classified as property-related crimes; they affect property, but occur in the absence of the victim.

The South African Census 2011 data was used to source information on characteristics of communities residing in different police areas for purposes of correlation analysis. The data was

obtained from the Census 2011 conducted by Stats SA, the National Statistics Office. The choice of variables was guided by attributes that are used in literature to measure social disorganisation, namely, social control (population density, percentage of female-headed households); socio-economic status (percentage unemployed, household median income, percentage education grade 12 or higher); and residential stability (percentage in residence for 10 years and longer, percentage owner-occupied homes).

3.2 Methods

Three different measures were used in the study, firstly LQCs to determine the relative concentration of crime, secondly, crime density to determine the dominant types of crime, and correlations to establish the relationships between crime prevalence and police area dynamics.

In a previous study crime rate, which is the number of crime incidents in a given area as a proportion of the population at risk, has been used to measure frequency of crime at different geographic levels (Zhang & Peterson 2011). However, one problem that was found with this measure is that at lower geographical level, standardisation by population becomes meaningless because neither the victim nor the criminal necessarily come from the same area where the particular crime occurs (Zhang & Peterson 2011). The use of crime rates, according to Zhang & Peterson (2011) does not take into consideration the influence of geographic and demographic context. For reasons stated above, both LQC and crime density calculations were used to map crime distribution.

3.2.1 Location Quotients of crime (LQC)

The LQC is an indicator that measures the frequency of a crime type in a small area (in this case police area) relative to the frequency of the same type of crime in the bigger study area (in this case the municipality). When interpreting the results for LQC, $LQC=1$ would mean that the police area is no different to the rest of the municipality with respect to frequency of a particular type of crime. $LQC>1$ suggests that the police area has a relatively higher concentration of a specific type of crime in comparison to the municipality while a $LQC<1$ means that the particular police area experiences a relatively lower concentration of a specific type of crime in comparison to the municipality. The LQC therefore indicates whether a specific crime is disproportionately high or low in a particular police area, i.e. whether the particular police area is a hotspot for the type of crime in question. Location quotients were calculated for each of the selected crimes to show the relative concentration of the type of crime in a police area in comparison to the municipality and crime maps were produced based on these to give an “at a glance picture” of crime distribution across police areas in the municipality and to show the relative distribution of different types of crime

across police areas in the Municipality. MS Excel was used to calculate location quotients and geographic information systems (GIS) software (ArcMap 3.10.1) was used to produce thematic maps.

Equation 1, which was used in Zhang & Peterson (2007), was used to calculate location quotients.

$$LQC_i = \frac{C_{in}}{C_{tn}} \left/ \frac{\sum_{n=1}^N C_{in}}{\sum_{n=1}^N C_{tn}} \right. \quad \text{Equation 1}$$

Where: LQC_i is the location quotient of crime i for police area n

i is the type of crime

n is the individual police area

N is the total number of police areas in the municipality

C_i is the count of crime i in each police area

C_t is the total count of crime incidents in each police area.

3.2.2 Crime density

Overall crime density and densities of individual crimes were calculated to establish the dominant types of crime across police areas in the Municipality. Crime density was calculated by dividing the number of crime incidents in a police area by the police area in square kilometres. Crime density focuses on the location where a criminal act occurred rather than on the victim's or criminal's location, and this is what law enforcement authorities and the public are interested in (Zhang & Peterson 2007). The results therefore give an indication of the intensity of each crime type by geographic location, unlike crime rates which focus on the population.

3.2.3 Correlation analysis

Correlation analysis was used to explain the relationship between the selected types of crime and community characteristics in the study area thus checking for evidence of social disorganisation theory and routine activities theory. Crime density was used as the measure of crime. SAS software was used to run correlation tables between densities of individual crimes and the population characteristics based on the three social disorganisation attributes. The selected census variables were the following, firstly for social control population density, percentage of female-headed households were used; secondly for socio-economic status percentage unemployed, household median income, percentage with education > or = grade12 and lastly for residential stability

percentage in same residence for 10 years or longer and percentage of owner-occupied homes were used. Correlations of population density and crime densities were used to test evidence of routine activities theory.

4. EMPIRICAL RESULTS AND DISCUSSION

The study investigated the spatial patterns of selected contact/violent crimes and property/property-related crimes in Tshwane to establish what type of the selected crimes was dominant in different police areas of the Municipality and to establish the relative concentration of different types of selected crimes by means of LQCs. The relationships between the different crime categories and the community characteristics were also analysed to see whether there was any evidence for the social disorganisation theory and routine activities theory. An understanding of crime prone locations and the characteristics of the communities in these police areas would contribute to crime fighting strategies in the Municipality.

The total count of the selected contact and property-related crimes in Tshwane in 2011 was 74402 (Table 1). Of these crimes, the most common type of crime across police areas in the Municipality was burglary at residential premises (29%). This was followed by theft out of or from motor vehicle and common assault both at just over 16%. Assault with intent to inflict grievous bodily harm, robbery with aggravating circumstances, theft of motor vehicle and motorcycle constituted 15.1%, 11.8% and 11.6% of the total crimes respectively. When looking at the areas in more detail, out of all 36 police areas in the Municipality, the top 5 leading areas in terms of counts crime are Wierdabrug with 5709 crimes (7.7%), Sunnyside with 4711 crimes (6.3%), Pretoria Central with 4627 (6.2%), Brooklyn with 4253 crimes (5.7%), and Temba with 4191 crimes (5.6%). Dube, Welbekend, Laudium and Kameeldrift on the other hand have the lowest crime counts with each of them contributing less than 1% of the total crime in the Municipality.

Table 1 General crime distribution in City of Tshwane

Type of crime	Count	Percentage
Assault with intent to inflict grievous bodily harm	11215	15%
Common Assault	12067	16%
Robbery with aggravating circumstances	8757	12%
Burglary at Residential premises	21409	29%
Theft of motor vehicle and motor cycle	8618	12%
Theft out of or from motor vehicle	12336	17%
Total	74402	101%

Note: The percentages do not add up to 100% due to rounding.

4.1 Location quotients of crime

The location quotients of crime (LQC) were calculated for each of the selected crimes (based on crime counts) at police station level to show the relative concentration of the type of crime (i) in a police area (n) in comparison to that type of crime in the Municipality. The majority of the selected types of crime, are shown to have disproportionately higher concentration of crime in general than the Municipality as a whole, they also show similar patterns of concentration across police areas. There are however selected crimes that show differences, both in concentration and in patterns; these will be highlighted in the results and analysis section. The general concentration of burglary at residential premises was in agreement with the results in Table 1, which showed this type of crime to be the most common in the Municipality; most police areas were shown to have a relatively higher concentration of this crime. Lower concentrations were shown for a few areas in the north-western parts of the Municipality, namely Dube, Loate, Temba, Rietgat and Pretoria North, as well as Sunnyside, Pretoria Central, and areas in the immediate east and west of the city centre. Mabopane, Atteridgeville and Silverton were shown to have LQCs equal to 1.

Starting by looking at the contact crimes, assault with intent to inflict grievous bodily harm for Pretoria Central showed LQ equal to 1, which means that it is no different from the Municipality average. See Figure 2A for grievous bodily harm. This crime type was seen to have lower concentration in areas immediately surrounding the city centre ($LQC < 1$), with lower concentrations also reaching up to the suburbs of the north (Pretoria North and Sinoville), the west (Pretoria West and Hercules), the south (Wierdabrug, Boschkopf), and the east (Silverton). Areas further away from the city centre on the other hand were shown to have LQC values greater than 1, suggesting that these areas have disproportionately higher concentration of assault with intent to inflict grievous bodily harm compared to the Municipality as a whole. These areas include townships and suburbs in the northern parts of the Municipality (Mabopane, Ga-Rankuwa, Soshanguve, Akasia, etc.), traditional settlements and rural areas to the north-east and far east (Hamanskraal, Temba, Cullinan and Bronkhornspruit), and some suburbs to the west and south-west (including the townships of Atteridgeville).

Showing quite a different pattern of concentration from assault with intent to inflict grievous bodily harm, common assault showed $LQC > 1$ in areas to the far east of the Municipality (Cullinan, Ekangala and Bronkhornspruit), and in Mamelodi as seen in Figure 2B on LQC for common assault. Similar relative concentration was shown for some of the western parts of the Municipality, which include townships in the north, and Pretoria North, as well as Pretoria West and Laudium. Police areas in the west that showed LQC of less than 1 were Rietgat and Akasia in the north-west, and Erasmia and Atteridgeville in the west. Pretoria Central and Sunnyside were also shown to have

a disproportionately higher concentration of common assault relative to the Municipality average. Areas across the middle of the Municipality from the north right down to the south, including the immediate east of the central business district (CBD) were shown to have lower concentration of common assault than the Municipality average.

Relatively higher concentration of robbery with aggravating circumstances in relation to the Municipality average was shown for the north-western townships, including Temba, Ga-Rankuwa and Mabopane, and suburbs of Akasia; see Figure 2C for aggravated robbery. Similar high concentration was shown for Pretoria Central and Sunnyside at the city centre and Welbekend in the south. Areas immediately north and immediately east and far east of the city centre were found to have proportionally higher concentration of robbery with aggravating circumstances than the Municipality average. Hammanskraal, Soshanguve, Silverton and Wierdabrug (in the south) were shown to have location quotients of 1 for this crime.

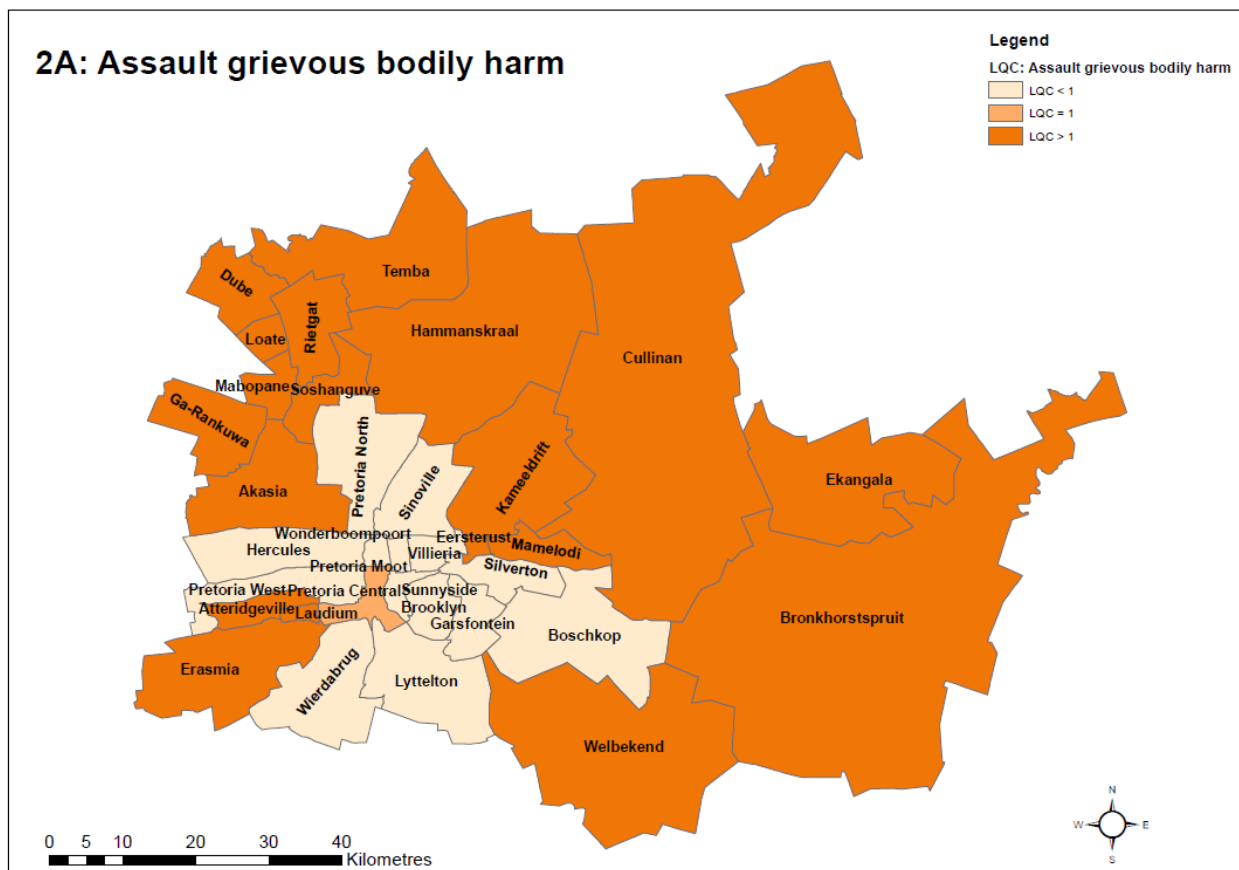


Figure 2A LQC for assault with intent to do grievous bodily harm

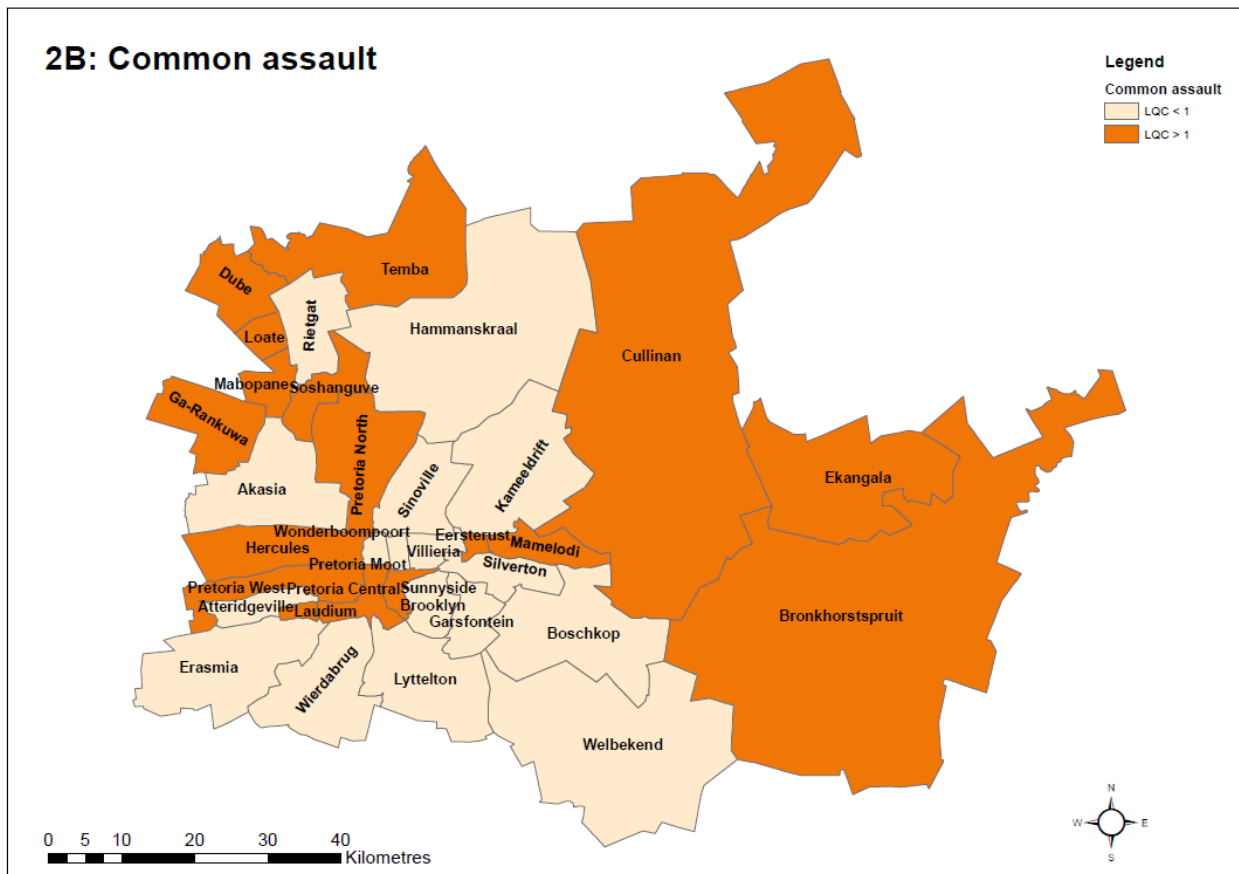


Figure 2B LQC for common assault

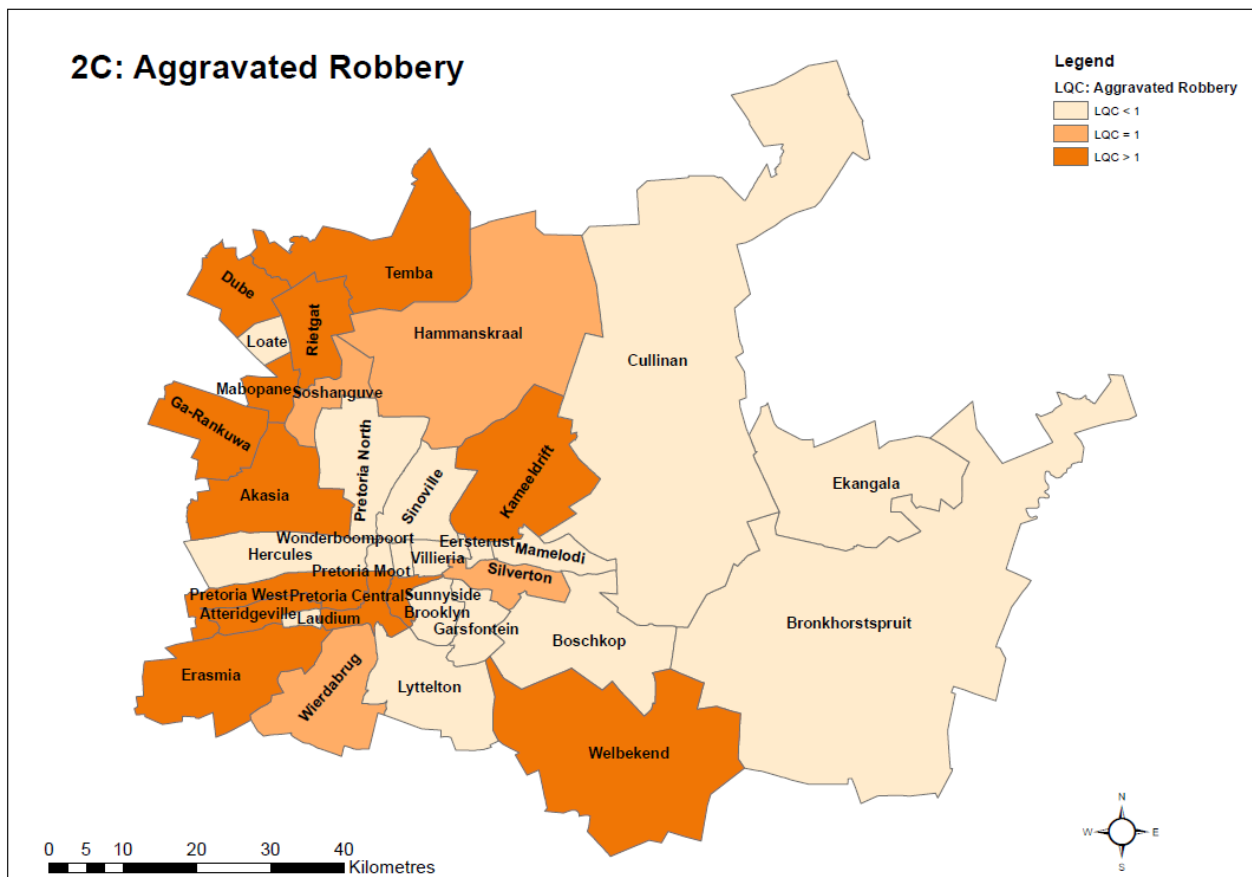


Figure 2C Location quotients of aggravated robbery

The pattern of the three contact crimes was such that the suburbs in the north west of the municipality showed high concentration for contact crime in general, while suburbs of the far east showed high concentration of both types of assault. Robbery was shown to be highly concentrated in the CBD and the suburbs of the south. The CBD was also seen to have high concentration of common assault while the suburbs in the south showed high concentrations of assault with intent to inflict grievous bodily harm. In general, robbery with aggravated circumstances showed a different pattern from the two types of assault. The former was shown to be highly concentrated in and around the CBD while the latter were concentrated further away from the CBD. High concentration of contact crimes in and around the CBD might be aggravated by high population densities as many people do their shopping and others work in this area. More police visibility could assist in discouraging the potential criminals by providing guardianship.

When focussing on the non-contact crimes, the general pattern was such that motor vehicle-related crimes showed a similar pattern, with high concentration in the CBD and surrounding suburbs. High concentration of burglary at residential premises was shown to be in all areas except in the CBD, the western and north western suburbs. This could be due to many people being at work during weekdays and there is therefore an absence of guardianship in residential areas.

Burglary at residential premises showed high concentration in most areas of the Municipality (Figure 3A). Areas in the far eastern parts of the Municipality were shown to have high concentration of both types of assault, as well as burglary at residential premises. The north-western areas on the other hand were shown to have high concentrations of all contact crimes. The concentrations of contact crimes were shown to be generally low in the CBD and surrounding areas.

The pattern for theft of motor vehicle and motorcycle showed relatively higher concentration in Pretoria Central, Sunnyside, and areas immediately surrounding the Pretoria CBD up to and including Pretoria North and Sinoville in the north of CBD, Hercules and Pretoria West in the west, Brooklyn and Garsfontein in the east, as well as Lyttleton in the south of the CBD. These patterns are shown in figures 3B and 3C. Akasia, Kameeldrift and Wierdaburg were shown to have LQC equal to 1. The general concentration of theft of motor vehicle and motorcycle was found to be highest in the CBD and decreasing as one moves away from the CBD. Results for theft out of or from motor vehicle showed a similar pattern as theft of motor vehicle and motorcycle, i.e. highest concentration in and around the city centre and lowest in the city outskirts.

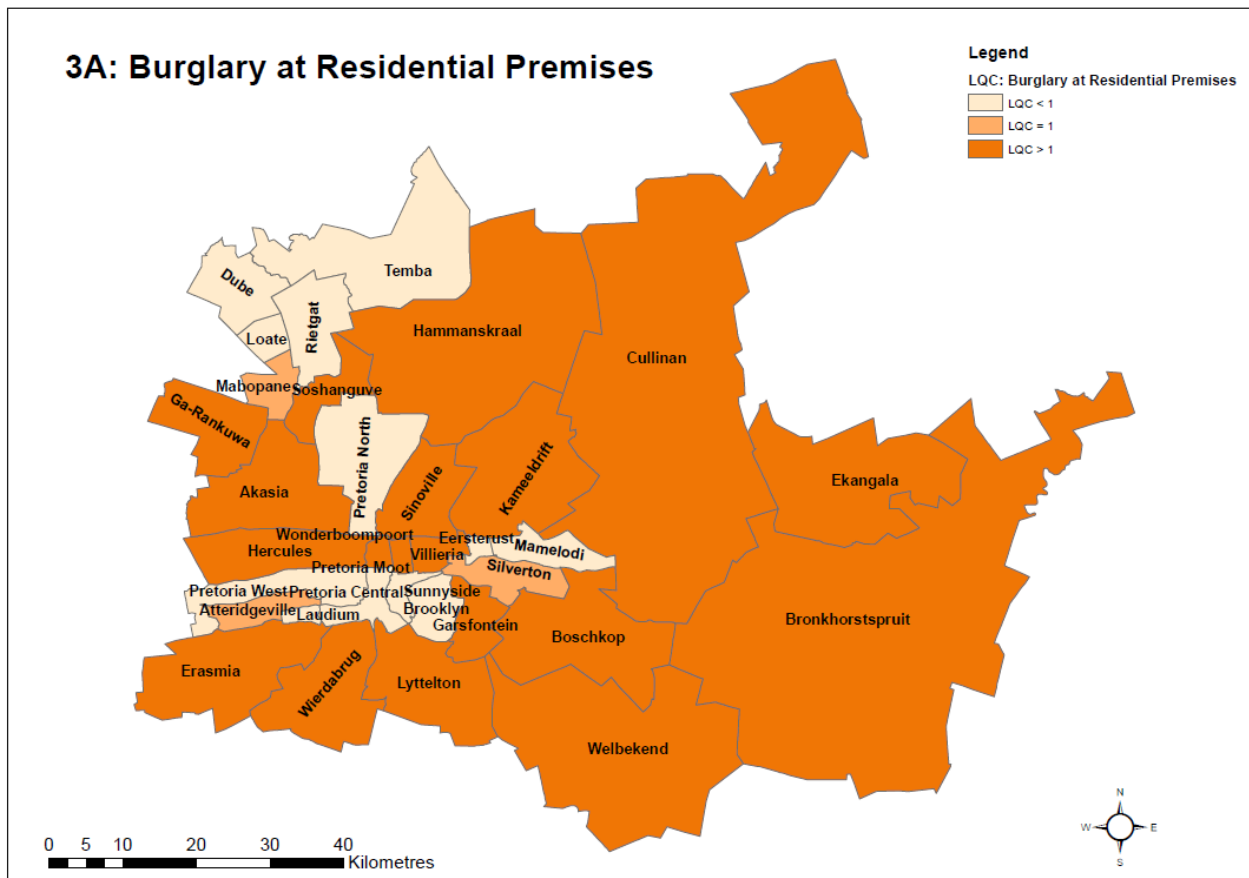


Figure 3A LQC for burglary at residential premises

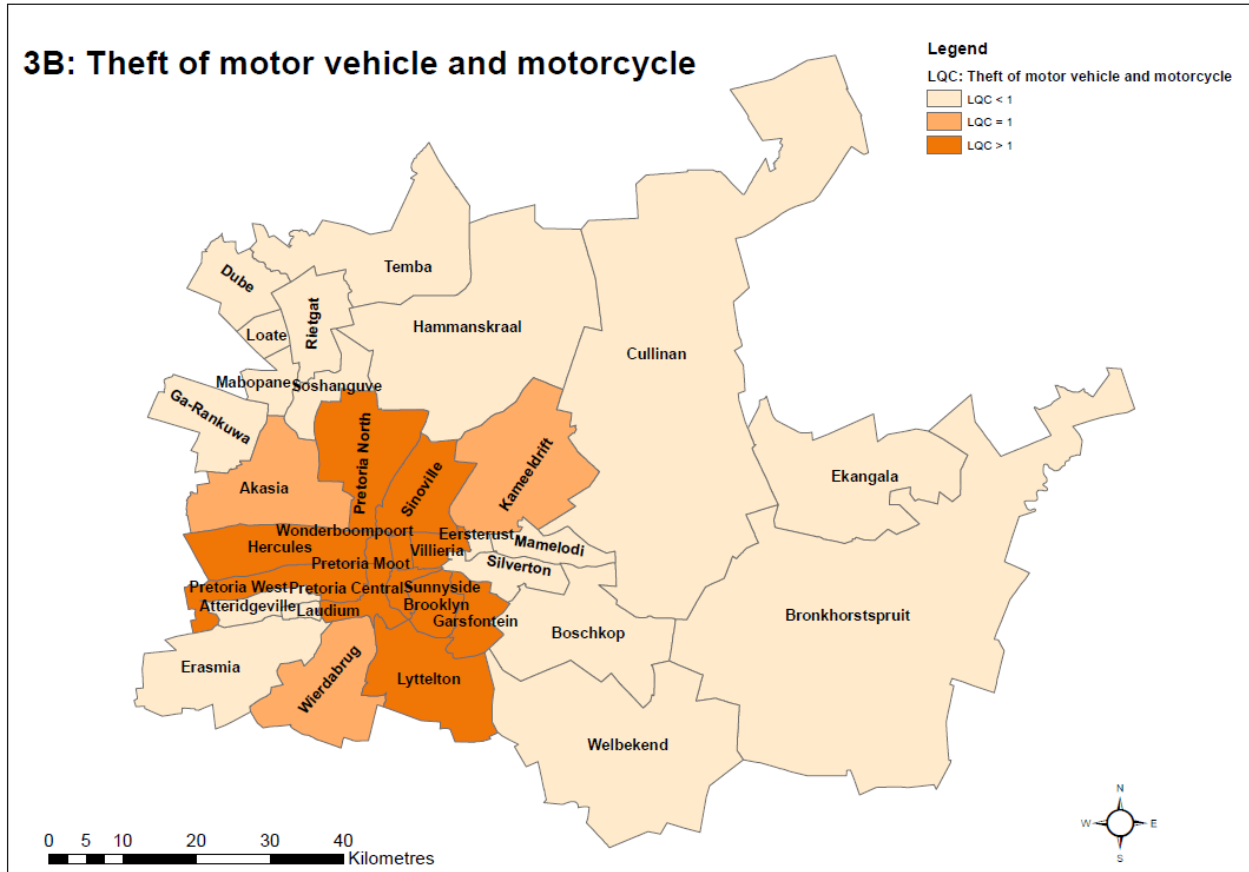


Figure 3B LQC for theft of motor vehicle and motorcycle

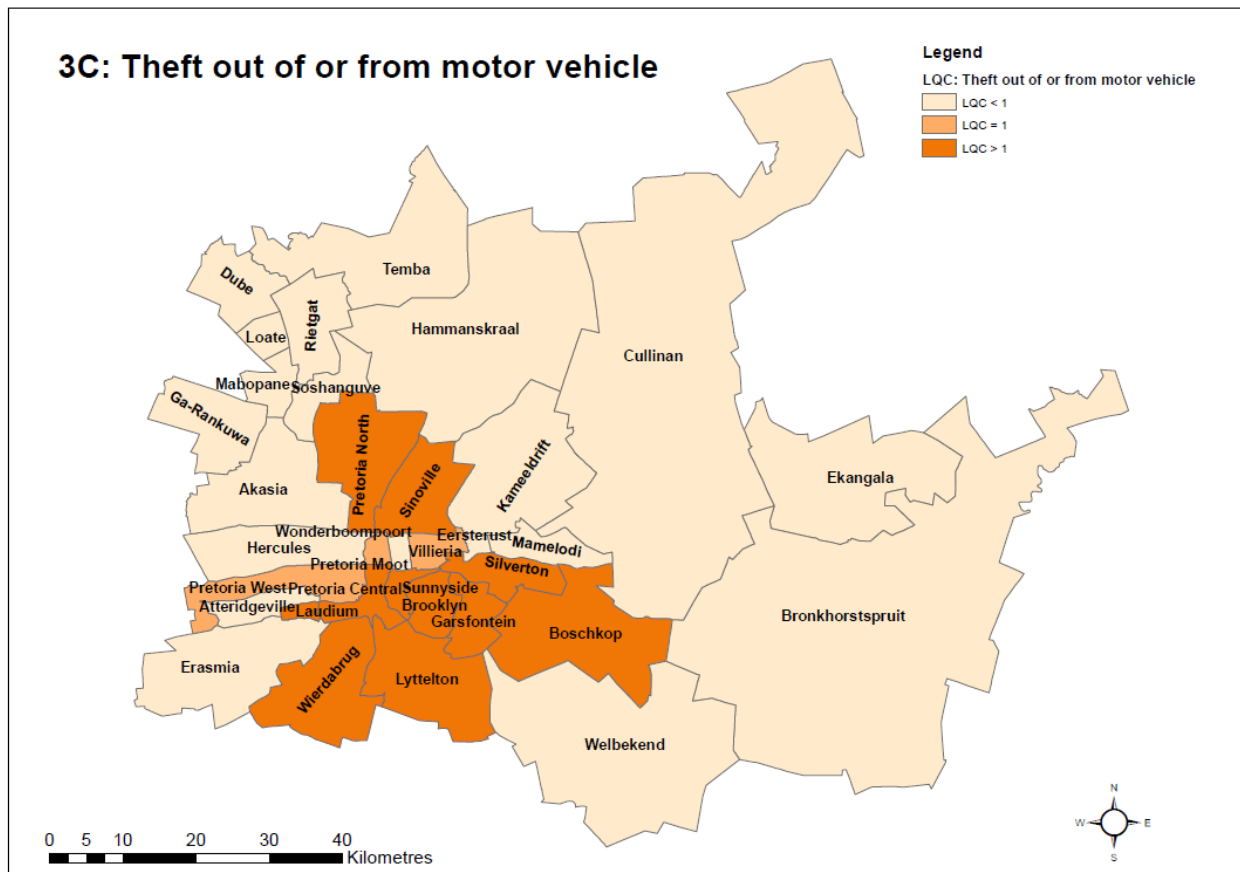


Figure 3C LQC for theft out of or from motor vehicle

4.2 Crime density

The results for overall crime density in Tshwane showed that crime in general was concentrated in the following areas: Sunnyside (239 crime incidents per square km), Pretoria Central (117 incidents), Mamelodi (99 incidents), Brooklyn (94 incidents), Eesterus and Pretoria Moot each 88 incidents per square km. These six areas (out of 35 police areas) shared more than a quarter of the total crime reported to the authorities in the Municipality. These are areas in and around the CBD. Areas with the lowest crime densities were Welbekend, Cullinan, Bronkhornspruit, Hammanskraal and Kameeldrift; and together their share of the total crime in the Municipality was 7.5%. The areas that were shown to have the lowest overall crime densities are areas of the Municipality that are mostly rural.

Figures 4A, 4B, and 4C show density results for contact crimes. They all showed dominance in the city centre (Sunnyside and Pretoria central) and surrounding townships (Atteridgeville, Eesterus, Laudium and Mamelodi) as well as Loate in the north of the Municipality. These areas together share just under 66% for assault with intent to inflict grievous bodily harm, 54% for common assault and 55% for robbery with aggravating circumstances in the municipality. These crimes were least dominant in Cullinan, Welbekend, Bronkhornspruit, Boschkop, Hammanskraal and Kameeldrift, which are mostly rural and to the far north and far east of the Municipality. Like those

for assault with intent to inflict grievous bodily harm, the densities for common assault showed this crime to be dominant in Sunnyside and Pretoria Central areas, which are in the CBD, as well as Mamelodi, Eesterus and Laudium, which are immediately next to the CBD. Loate in the far north west of the municipality was also shown to have dominance of common assault. Again similar to assault with intent to inflict grievous bodily harm, areas with lowest densities with respect to common assault are areas furthest from the city centre, namely Welbekend, Cullinan, Hammanskraal and Bronkhorstspuit in the far east of the municipality. Robbery with aggravated circumstances showed similar results as common assault and assault with intent to inflict grievous bodily harm for both high and low concentration areas.

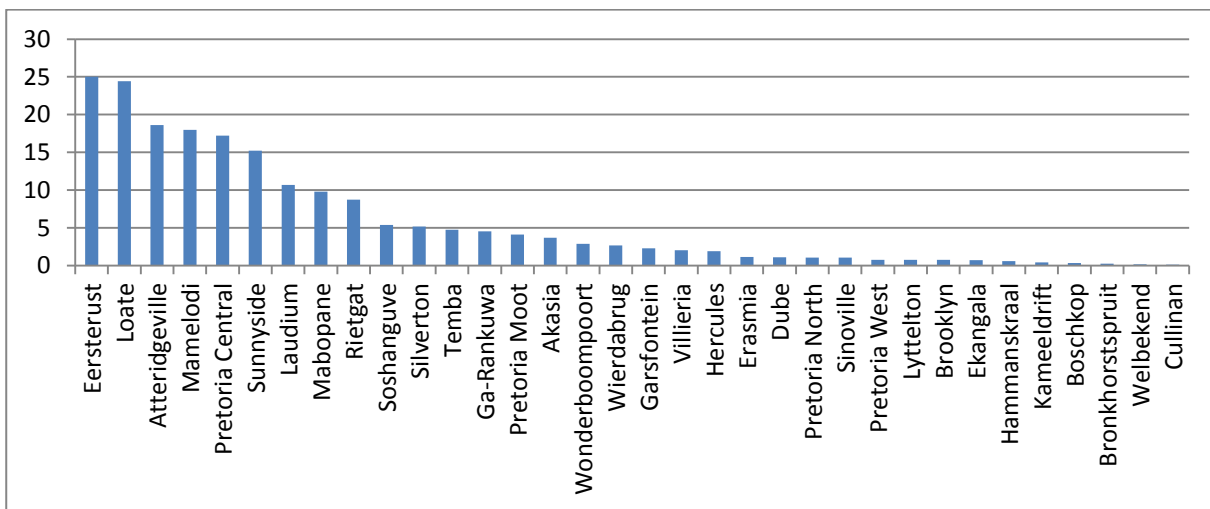


Figure 4A Density of assault with intent to inflict grievous bodily harm by police area

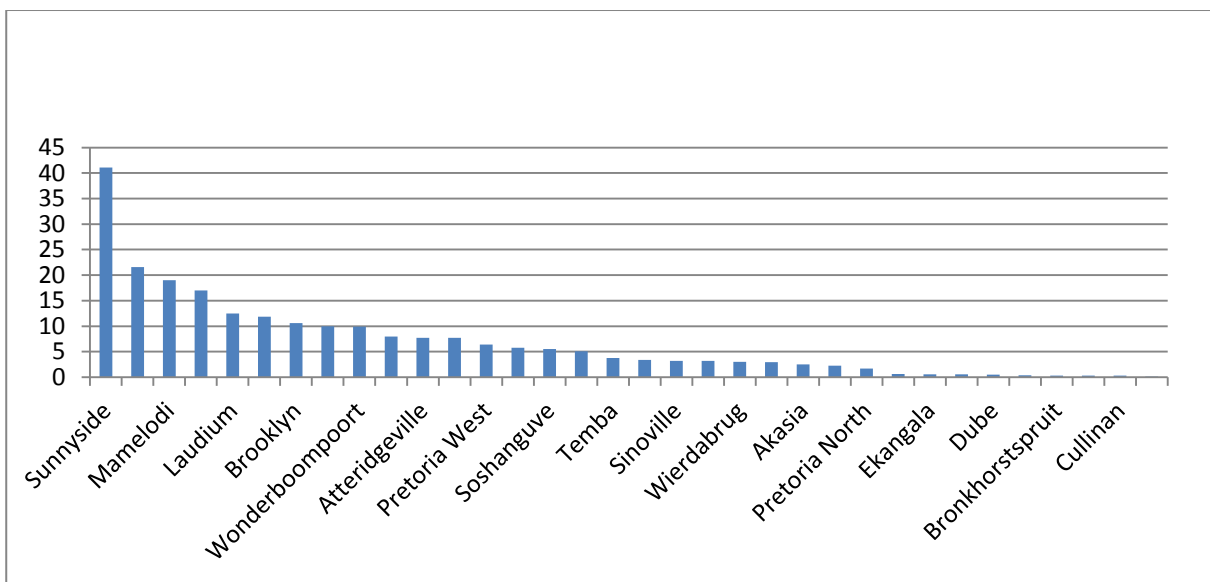


Figure 4B Density of common assault by police area

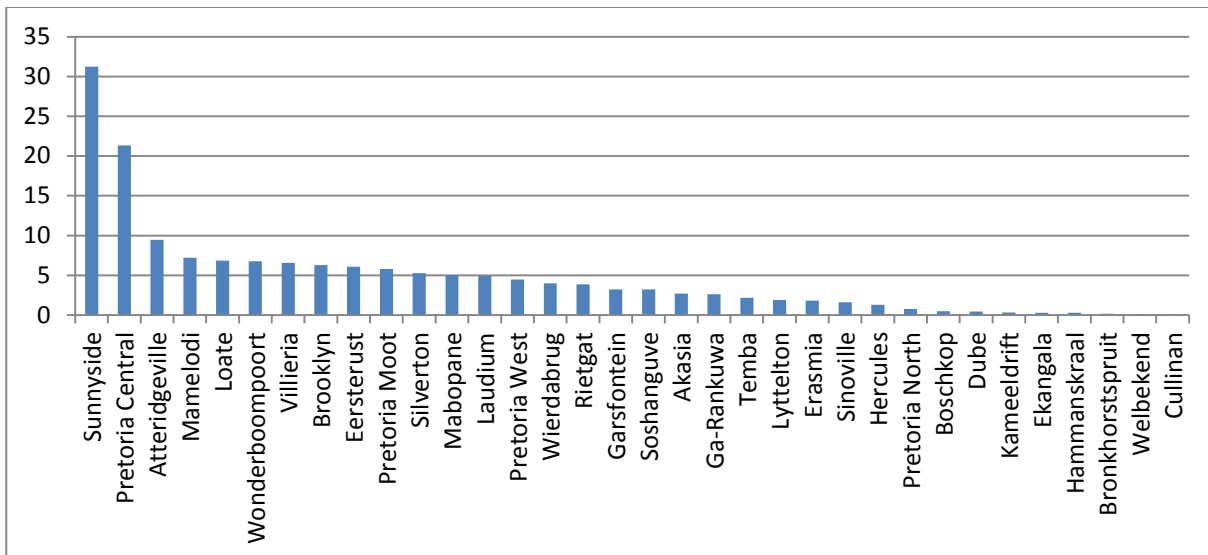


Figure 4C Density of aggravated robbery by police area

Figure 5A shows burglary at residential premises to be the most common type of crime in the Municipality, with many areas showing densities of more than 20 incidences per square kilometre than other types of crime. Six areas (Sunnyside, Brooklyn, Pretoria Central, Wonderboompoort, Eersterust and Villieria) were shown to have densities of more than 20 incidences of burglary at residential premises, with Sunnyside alone having 48 incidences. These are areas around the CBD, although Pretoria Central itself was shown to have a relatively lower density of 7 incidences per square kilometre.

Theft of motor vehicle and motor cycle was found to have a similar distribution as theft out of or from motor vehicle. These two crimes were shown to have high densities in Sunnyside, Pretoria Central, Brooklyn and Wonderboompoort. Theft of motor vehicle and motor cycle was also found to have high densities in Pretoria Moot and Villieria, while theft out of or from motor vehicle was dominant in Garsfontein. Although these two motor vehicle-related crimes were shown to have similar distributions, the densities for theft out of or from motor vehicle were shown to be higher than those of theft of motor vehicle and motor cycle. The highest densities for theft out of or from motor vehicle were found to be 62 in Sunnyside, 32 in Brooklyn and 29 in Pretoria Central while theft of motor vehicle and motor cycle were found to be 42 in Sunnyside, 28 in Pretoria Moot and 21 in Pretoria Central.

Comparing the densities for contact crimes to those of non-contact crimes, both categories of crime showed dominance in and around the CBD (Pretoria Central and Sunnyside). Contact crimes were also found to be most dominant in previously black townships (Mamelodi, Loate, Eersterust, Atteridgeville) and Laudium, while non-contact crimes, which are also property-related, were shown to be dominant in the previously white suburbs, currently occupied by the elite residents (e.g. Brooklyn, Villieria, Garsfontein, Pretoria Moot and Wonderboompoort).

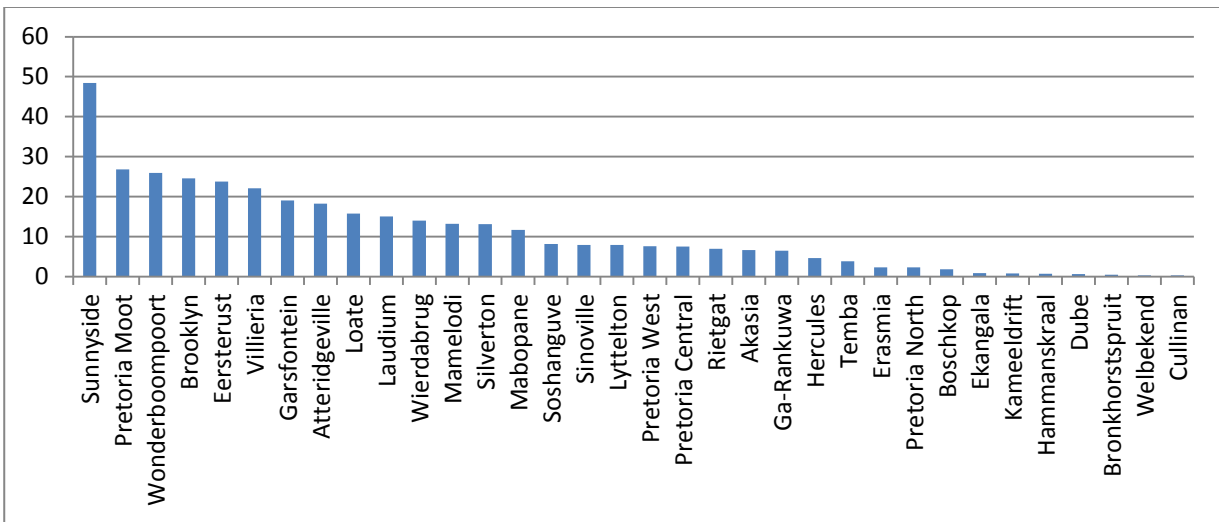


Figure 5A Density for burglary at residential premises

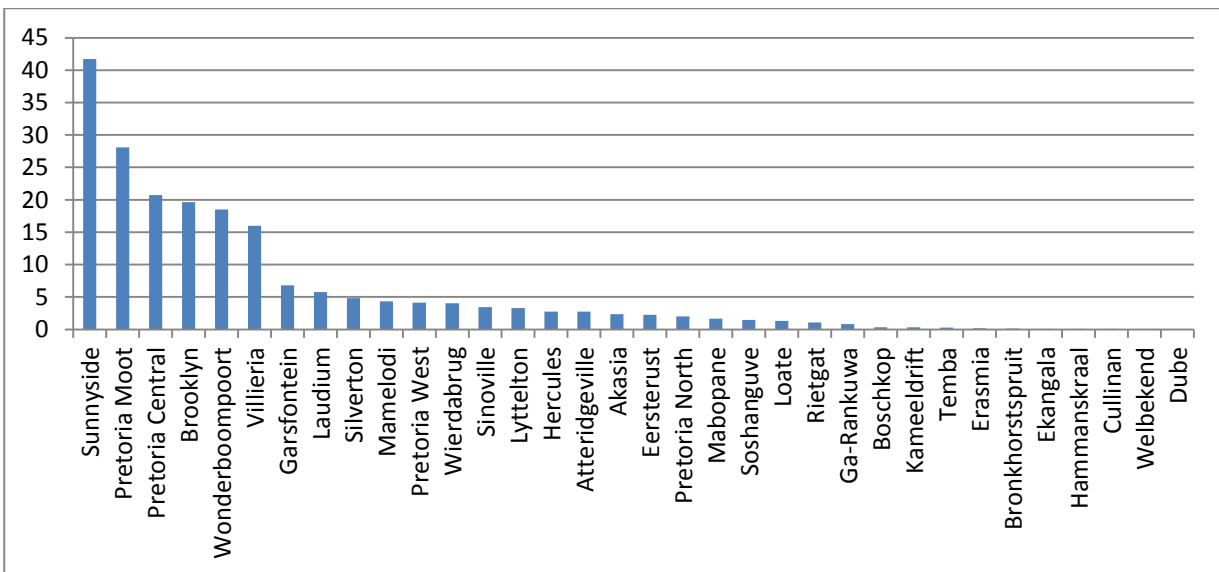


Figure 5B Density for theft of motor vehicle and motor cycle

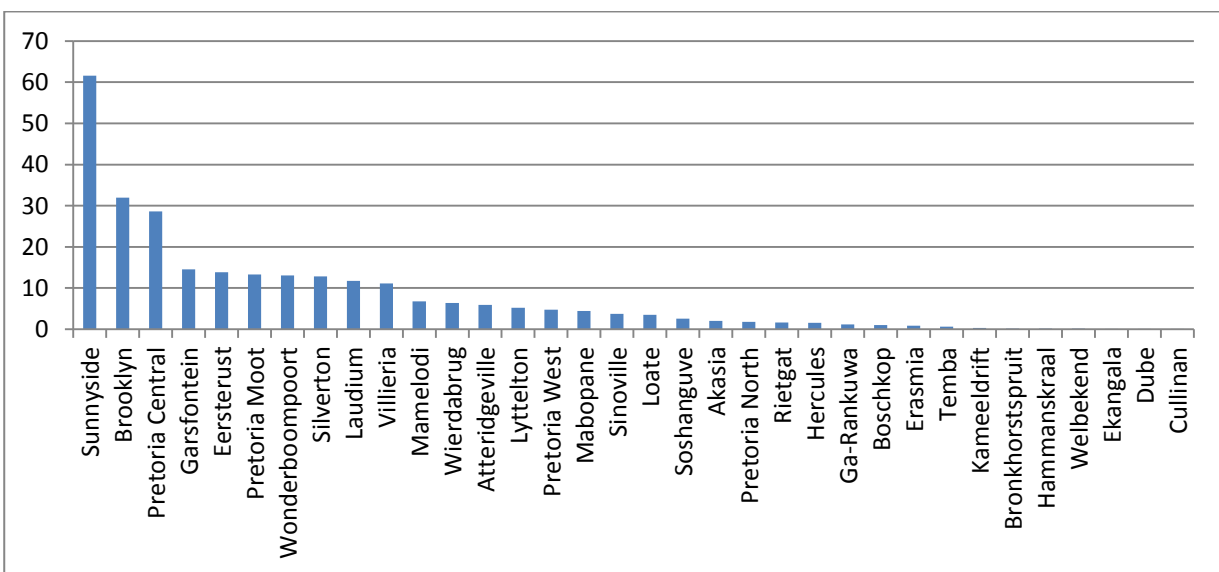


Figure 5C Density for theft of motor vehicle and motor cycle

4.3 Comparison between LQC and Crime density calculations

Property-related (non-contact) crimes were most dominant in Sunnyside, Brooklyn, Pretoria Moot, Villieria, and Wonderboompoort; these, with the exception of Sunnyside, are some of the affluent areas in the Municipality. Contact crimes on the other hand crimes were most dominant in Pretoria Central, Sunnyside, and Loate, Eesterus and Mamelodi which are some of the previously black townships. The results of both LQC and crime densities showed that most crimes were highly concentrated in the CBD. The two measures also showed that property-related crimes were concentrated in more affluent suburbs like Brooklyn, Pretoria Moot and Villieria while contact crimes were dominant in and around the CBD and previously black townships like Mamelodi, Loate and Atteridgeville. The general concentration of contact crimes in less affluent areas suggest signs of social disorganisation while the dominance of property crimes in more affluent areas suggest signs of the routine activities theory – affluent areas represent attractive targets for potential criminals.

4.4 Correlation analysis

Correlation results will be reported on by looking at the three categories used to measure social disorganisation. Firstly, looking at social control, by correlating all types of crime with population density and percentage female-headed households, secondly socio-economic status, correlating all types of crime with percentage unemployed, household median income, percentage with education > or = grade12, and lastly for residential stability, correlating all types of crime with percentage households in same residence for 10+ years, percentage owner-occupied homes. The correlation results are shown in Table 2.

The correlations results for social control showed positive correlations between both variables and all types crime, however correlation between percentage female-headed households and crime showed to be weak, while the those for population density were shown to be strong positive with assault with intent to do grievous bodily harm, common assault and burglary at residential premise, and medium strength with aggravated robbery. This suggests that crime is dominant in densely populated areas and in areas and where most households are headed by females. This finding agrees with the social disorganisation theory as applied by Sampson & Groves (1989) where they state that family disruption, such as having a single parent only are more likely to lead to less stability in an area. The medium to strong positive correlations between all types of crime and population density suggest evidence of routine activities theory, which states that high population densities determine perceptions of potential offenders on the possibility of profiting from committing crime.

Looking at residential stability variables, the percentage of owner-occupied homes and percentage of residents that have occupied the same home for 10 or more years are both negatively correlated

with all types of crime. Length of stay in the same residence however had a weak positive correlation with assault with intent to inflict grievous bodily harm. According to the social disorganisation theory high residential mobility is associated with high levels of crime (Sampson and Groves 1989). These findings are in line with the social disorganisation theory.

Correlations of crime densities with socio-economic variables showed positive correlations between median income and high education with most crime types; the exception is assault with intent to inflict grievous bodily harm. Unemployment results showed weak positive correlations with contact crime, and weak negative correlations with non-contact, property-related crimes. These results partly disprove social disorganisation theory. Median income also showed weak positive correlations with all types of crime except for grievous assault, which showed a weak negative correlation. According to the theory, crime is dominant in areas where the population is unemployed, and has low education status and income levels. As seen in Hillier and Sahbaz (2008), for a crime to take place there must be a motivated offender, a suitable target and the absence of capable guardians. This finding may disprove the social disorganisation theory, but it agrees with the routine activities theory - affluent areas are seen as suitable targets by potential criminals.

Table 2 Correlations between crime densities and police area characteristics

	Burglary at residential premises	Common assault	Grievous assault	Theft of motor vehicle and motorcycle	Aggravated robbery	Theft from or out of motor vehicle
Percentage of female-headed households	0.24	0.38	0.38	0.22	0.37	0.30
Population density	0.61	0.66	0.82	0.28	0.50	0.36
Percentage of owner-occupied homes	-0.21	-0.48	-0.15	-0.50	-0.54	-0.53
Percentage in residence for 10+ years	-0.11	-0.19	0.25	-0.39	-0.33	-0.41
Household median income	0.24	0.02	-0.28	0.29	0.08	0.23
Education > or = grade 12	0.56	0.40	-0.14	0.70	0.47	0.65
Percentage unemployed	-0.11	0.10	0.40	-0.23	0.05	-0.14

5. CONCLUSION

The research used LQCs to map prevalent types of crime across police areas and crime densities to analyse the dominant types of crime in different police areas of the Municipality, and to investigate the relationship between police area characteristics and crime. LQC results showed similar crime patterns for motor vehicle related crimes. These crimes were found to be disproportionately concentrated in the city centre and surrounding areas. The LQC results showed contact crimes to be disproportionately concentrated in the rural parts of the Municipality as well as in formerly black townships. Densities for the same crimes were shown to be dominant in the CBD and Sunnyside.

LQCs for burglary at residential premises also showed contradicting results to densities of the same crime. The LQC map for burglary at residential premises was explicitly different from that of the other crime types. Crime density figures showed low concentration of crime in areas that are mostly rural. Another striking contradiction was seen between LQC maps for contact crimes and density figures for the same crimes - LQC maps showed high concentrations of these crimes in areas in the far east while the same areas were shown to have the lowest densities. A clear example of some of the contradiction between crime density and LQC results was seen in the case of burglary at residential premises. Seven areas were found to have density of less than 1 incidents of burglary per square kilometre but only 1 of these seven areas was found to have LQC less than 1. The other six areas were shown to have high prevalence of burglary at residential premises.

Correlation analysis was used in this study to investigate the relationship between crime and socio-economic and demographic characteristics of the police areas in order to prove or disprove the social disorganisation theory. The social control variables were found to be positively correlated with crime density and residential stability variables were found to be negatively correlated with crime density, which proves in agreement with social disorganisation theory. Contrary to expectation, though, high education and income had positive correlations with crime. This disproves social disorganisation theory. It may nevertheless show that criminals see the areas as attractive targets, proving routine activities theory. This theory is also proven by the positive correlations of population density with crime densities.

6. POLICY IMPLICATIONS, LIMITATIONS AND RECOMMENDATIONS

Important policy implications can be raised from the findings made in this research. Firstly, crime densities, unlike crime rates can help improve the fight against crime in that they provide a picture of crime dominance – it speaks to the geographic location of crime rather than the population affected. People are involved in different daily activities and in the case of any crime incidence it cannot necessarily be said whether the offender/victim live in the same area where the crime took place, but it can definitely be established where (geographic location) the crime occurred. In order to deal with crime the law enforcement agencies will want to know where to direct the efforts. Secondly, LQCs can give an indication of what types of crime are concentrated where, and this could inform the Municipality's crime fighting strategy in terms of resource distribution. Lastly, population density and disparity in terms of education levels was shown to be highly correlated with crime – strategies and efforts for spatial planning and integration would be of assistance in the endeavour towards crime control.

For future studies, access to crime data at lower geographic levels could yield more accurate results and thus a higher resolution picture of crime across neighbourhoods. Future studies could also look into comparison between municipalities in the country. A comparison could also be made between results from official SAPS data and subjective experience of people residing in the same study area.

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