

Towards a standardised approach in cross-national spatial crime research: A case study analysis

Gretha Groeneveld

Department of Geography, Geoinformatics and Meteorology

University of Pretoria

Supervisor: Prof GD Breetzke

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DECLARATION

I, Gretha Groeneveld, declare that the dissertation, which I hereby submit for the degree Doctor of Philosophy at the University of Pretoria, is my own work and has not previously been submitted by me for a degree at this or any other tertiary institution.

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Date: _____

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EXECUTIVE SUMMARY

The lack of a standardised approach in cross-national spatial crime research limits the creation of consistent, reliable and valid knowledge regarding the spatial dimension of crime and crime causation across contexts. This begs the question: what is the most appropriate or 'correct' methodological approach to follow in order to measure crime and its causation in any context? This question is initially answered by undertaking a spatial analysis of crime in Khayelitsha, South Africa. Khayelitsha (the primary study site) is home to one of the most deprived, marginalised, crime-ridden and socially disorganised communities, not only in South Africa but in the world. A largely ineffective police force together with unchecked and informal policing structures, unreliable and uncertain political support have contributed to unmanageable crime. Subsequently, there is a desperate need to generate valid empirical knowledge and an understanding of crime patterns as they relate to the social and economic environment.

This study uses social disorganisation as a guiding framework to gain a more thorough theoretical understanding of crime and the ecological characteristics that can affect it within the context of Khayelitsha. The central tenets of the theory, that describe the level of social disorganisation of a place, include socio-economic deprivation, family disruption, residential mobility, racial heterogeneity and urbanisation. These characteristics are however notoriously difficult to quantify and the choice of variables used to represent the central tenets of the theory are often inconsistently interpreted. In the first part of the study, I demonstrate how the numerous ways in which these characteristics can be operationalised continuously yield conflicting results, which raises questions regarding its applicability in a developing context. In the analysis, three separate sets of variables, consistent with social disorganisation theory, are tested using regression modelling, to illustrate these inconsistencies. Results are shown to vary in significance and predicted associations across almost all the individual variables representing the same structural neighbourhood characteristics.

This raises the question of appropriate definitions and descriptions of variables together with the suitability of various combinations of variables used as proxies for concepts synonymous with social disorganisation theory. The findings also refutes any assumption that different sets of variables applied as proxies for the same tenets of social disorganisation would perform similarly and bring into question results from the plethora of prior local and international research that have used the social disorganisation theory as a framework to guide the selection of variables in spatial crime analysis.

As a solution, in the second part of the study, I propose the use of standardised variables in spatial crime research using variables informed by the International Organization for Standardization (ISO) indicators. These variables are used to measure social disorganisation in Khayelitsha (in South Africa) and Fort Lauderdale (the secondary and comparative study site in the United States), allowing for a cross-national comparison of the causes of crime in these two contexts. The ISO 37120 indicators, in particular, provide guidelines to create clearly defined, standardised measurements, and consequently consistent indicators comparable over time or space. This is currently lacking in cross-national comparative crime studies applying social disorganisation theory. The indicators promote cross-national information sharing, transparency and open data. Furthermore, this approach offers the benefit of contributing towards the creation of a reliable foundation of globally standardised data, which can assist in building core knowledge, and can be used for comparative knowledge sharing in spatial research of crime.

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CHAPTER 1: INTRODUCTION

1.1 MEASURING THE SOCIO-SPATIAL DIMENSION OF CRIME

Crime is an extremely complex phenomenon to understand and measure (Anselin et al., 2000; Wortley & Townsley, 2016). A seminal study by Weisburd and Piquero (2008) examined the ability of criminologists to explain crime using empirical data and found that despite years of research and myriad publications, measurement techniques such as regression analysis have still left much about crime unexplained. According to Sullivan and McGloin (2014) researchers studying crime often use sophisticated modelling methods to measure complex concepts, while using flawed data, instead of using accurate and valid input data as the basis of reliable research.

This study involves an examination of the socio-spatial dimension of violent crime in Khayelitsha, South Africa, one of the five largest slums in the world (World Economic Forum, 2016). Crime is rampant in Khayelitsha and there is a desperate need to generate valid knowledge and gain an empirical understanding of crime patterns as they relate to the social and economic environment. The question is, however, what is the most appropriate or 'correct' methodological approach to measure crime and its causation in this unique context?

Theories concerned with crime and place focus mainly on the role of the environment and the opportunities it provides for the perpetration of criminal behaviour (Wortley & Townsley, 2016). Environmental criminology has an ecological focus which explicitly considers factors in the environment that facilitate the development of criminal motivation and the creation of opportunities for crime (Bernasco & Block, 2009; Kurland et al, 2014; McCord et al, 2007). These factors include characteristics of the social, economic and physical environments in which offences take place with the assumption being that all factors have the potential to explain differences in the distribution of crime. While the hypothesis is that the environment in which a crime occurs plays a significant

role in influencing its distribution, these theories also attempt to identify future crime opportunities based on past patterns. The identification and explanation of crime patterns could ultimately inform law-enforcement agencies and policy makers involved with the management of crime (Anselin et al, 2000; Ratcliffe, 2010).

Environmental criminology is a school of thought that includes a number of spatial theories of crime that are concerned with explaining crime patterns in terms of the surrounding environmental influences (Wortley & Townsley, 2016). Within this group of theories, the social disorganisation theory (Shaw & McKay, 1942) is one of most influential, specifically regarding the socio-economic environment. The theory focuses on the extent to which the socio-economic characteristics of neighbourhoods create social disorganisation and, as a result, increase the likelihood of crime. Other approaches, including the routine activities theory (Cohen & Felson, 1979) and crime pattern theory (Brantingham & Brantingham, 1993) focus more on the circumstances under which criminal events occur, specifically the interaction between offenders, victims and particular places and the role of these in the perpetration of crime incidences.

The focus of this study is however on the social disorganisation theory. The theory was developed by Shaw and McKay (1942) and continues to be one of the prominent place-based theories of crime, despite being developed almost a century ago. For almost 80 years the theory has been applied and tested extensively by a great number of researchers, resulting in an abundance of knowledge to engage with. However, most of this research has been confined to the developed world and the theory has only recently begun to be applied to crime examinations in the developing world. Ironically it is in the latter context that crime rates are disproportionately high (United Nations, 2015b) and knowledge regarding crime causation is desperately needed.

The basic premise of social disorganisation theory is that higher levels of socio-economic deprivation, family disruption, residential mobility and ethnic heterogeneity will increase levels of social disorganisation and, consequently the risk of crime within an area. This has been demonstrated in a variety of developed (Andresen, 2006; Bruinsma et al, 2013; Kingston et al, 2009; Law & Quick, 2013; Polczynski Olson et al, 2009; Porter & Purser, 2010; Weijters et al, 2009) and developing world contexts (Breetzke, 2010b; da Silva, 2014; Escobar, 2012; Swart et al, 2016; Yahaya et al, 2013; Zhang et al, 2007). The results yielded when testing these complex social processes in different spatial locations are, however, often conflicting, and more so in the developing world. While the contextual differences undoubtedly contribute to inconsistent results,

the focus of this study is on the considerable number of discrepancies that exist with regards to the definition and application of measures commonly used to represent the central tenets of social disorganisation theory. Importantly, this is not only limited to studies in the developed versus the developing world, but within these contexts too.

The social disorganisation theory has its historical antecedents in the developed world, and therefore, understandably most knowledge emanates from studies conducted in this context. However, the question inevitably arises about its relevance in other less developed contexts. In the developing world researchers are inclined to adapt social disorganisation theory to their unique context and, while the measures they use correspond to those recorded in the literature pertaining to the developed world, they often introduce other more nuanced measures of social disorganisation suitable to their local social conditions. Indeed, several researchers have argued for the need of a broader selection of variables to make provision for the alternative causes of crime in the developing world (Arias & Montt, 2017; de Melo et al, 2017; Escobar, 2012). This contributes to significant variations in the applications and operationalisation of the theory. Moreover, it also complicates the issues of the 'correct' and scientifically sound manner by which to measure social disorganisation in the developing world more broadly, and in places like Khayelitsha, specifically.

1.2 IN NEED OF A STANDARDISED APPROACH IN SPATIAL CRIME RESEARCH

When testing social disorganisation theory, researchers tend to focus on the extent to which the central tenets of social disorganisation (socio-economic deprivation, family disruption, residential mobility and ethnic heterogeneity) impact crime and delinquency in neighbourhoods. The measurement of social disorganisation therefore requires the quantification of these multifaceted concepts. The choice of variables used to represent a central tenet of the theory largely depends on the discretion of researchers, and the different interpretations of social disorganisation variables pose a great obstacle to the identification of consistent predictors of crime across international contexts. For example, the concept of socio-economic deprivation can be defined simply as economic deprivation or poverty (Polczynski Olson et al., 2009; Strom & MacDonald, 2007) or by using broader concepts such as social deprivation or concentrated disadvantage

(Lockwood, 2007; McCall & Nieuwbeerta, 2007). These latter concepts often also include related economic and social factors such as education, employment status and the provision of social security grants. Poverty too has been operationalised in several different ways, including the percentage of the population living below the poverty line (Martinez et al., 2010; Roh & Choo, 2008), low family income (Law & Quick, 2013; Nieuwbeerta et al., 2008), median household income (Porter & Purser, 2010), mid- and high household income (Sun et al., 2004) or households where the head of a household earns no income (Ceccato et al., 2007).

The first part of this study explores the inconsistent definitions of the main tenets of social disorganisation and illustrate that these inconsistencies can impact the results of analysis. In a context such as Khayelitsha, where sound empirical knowledge is desperately required, this limits the ability of researchers to benchmark, compare and validate results across contexts. On the other hand, a standardised approach to the operationalisation of social disorganisation theory can contribute to the identification of robust and consistent predictors of crime. Standardised variables can contribute to the creation of reliable and valid knowledge in order to find a generalised explanation of social disorganisation and crime rates globally.

In the second part of the study, I use International Organization for Standardization (ISO) 37120 indicators, which form part of a worldwide initiative to promote and implement sustainable development and to provide a universally agreed upon framework to be used, as a basis to guide variable selection when testing the theory.¹ Standardised variables based on the ISO allow for comparison of spatial crime research in vastly differing contexts. In this study two sets of exactly the same standardised variables informed by ISO indicators are constructed to examine and compare the causes of crime in two vastly different contexts, namely Khayelitsha (in South Africa) and Fort Lauderdale (in the United States).

It is crucial, in contexts like Khayelitsha to be able to validate theoretical findings in order to tap into knowledge generated from previous international research. However, the confirmation of the applicability of social disorganisation theory in contexts outside of the developed world is particularly difficult because of the inconsistent findings of previous research. This raises a credibility issue in global spatial criminology.

¹The ISO is an independent and non-governmental organisation which develop and publish international standards.

1.3 AIMS AND OBJECTIVES

The main aim of this research is to outline a standardised approach in cross-national spatial crime research by focusing specifically on variable selection.

The objectives are:

- to compare the application and testing of social disorganisation theory in the developed and developing world contexts;
- to highlight the diverse ways in which characteristics of social disorganisation theory have been measured and operationalised;
- to highlight the inconsistent findings reported in the different world contexts;
- to investigate the spatial causes of crime in Khayelitsha by applying and testing the social disorganisation theory;
- to test the hypothesis that the inconsistent operationalisation of characteristics of social disorganisation would result in inconsistent findings in this context;
- to undertake a cross-national comparison of crime in two diverse international contexts (Khayelitsha (developing context) and Fort Lauderdale (developed context)), while using ISO-informed standardised variables, in order to determine the potential of using such variables to test social disorganisation theory;
- to highlight the need for a standardised approach in studies measuring and testing social disorganisation and crime;
- to demonstrate the advantages of using standardised measures in studies of social disorganisation.

1.4 STUDY AREAS

Khayelitsha: Primary study area

The township of Khayelitsha is located approximately 30 kilometres south-east of Cape Town at the nearly southernmost tip of South Africa. In South Africa ‘townships’ are

formerly racially segregated neighbourhoods inhabited mainly by non-White residents.¹ They are synonymous with the former apartheid spatial planning policy of racial segregation and as a result are most often characterised by rudimentary infrastructure, including informal housing, limited formal roads, a lack of service delivery, often widespread malnutrition, poor or non-existent health systems, poor education in ill-equipped and overcrowded schools and high levels of unemployment (Cole, 2013). Despite apartheid, and concomitant racial segregation being abolished over 25 years ago, townships such as Khayelitsha continue to be grossly under-resourced and inhabited predominantly by non-White residents.

Crime is rampant in Khayelitsha. The township is among the most violent in the country with a homicide rate consistently over 80 per 100 000 residents, almost double the national average (Crime-Hub, 2018), and over 40 times higher than in Europe and 16 times higher than in the US (Liem et al., 2011). Khayelitsha has one of the highest rates of sexual violence in the world outside a conflict zone (Luthy-Kaplan, 2015), with one in three children under 18 likely to be a victim of rape and sexual assault (Inter-Ministerial Committee, IMC). Trust in the police is low (O'Regan & Pikoli, 2014), a consequence of apartheid-era policing where the former South African Police was more a counter-insurgency force used to fight political enemies than a bastion of law and order (Super, 2016). The continued mistrust in police has resulted in a surge in mob justice and violent vigilantism incidents since democracy, exacerbated by an increase in gangsterism (Freeman & McDonald, 2015). Khayelitsha thus presents a unique context for this study as it desperately requires crime reduction and prevention interventions informed by sound empirical evidence.

Fort Lauderdale: Comparative study area

The city of Fort Lauderdale is situated in the US, on the south-east coast of Florida in the central part of Broward County, approximately 40km north of Miami. A comparison to an international context, specifically in the developed world, was necessary, to enable access to the wealth of knowledge regarding crime prevention that already exist in this part of the world. An exploration of the comparability of differently defined census data (while using the same ISO variables) in two international contexts, was an important component of the study.

¹Under the Population Registration Act (1950) South African citizens were categorised into one of four distinct races, namely 'White', 'Coloured', 'Indian' and 'African' (Posel, 2001).

Although several comparative study areas in the developed world might also have served this purpose, Fort Lauderdale was selected for a number of reasons. First, similar to the case of Khayelitsha in South Africa, socio-economic deprivation as well as crime are consistently higher in Fort Lauderdale when compared to the rest of the United States. For example, the percentage of the population living below the poverty line in Fort Lauderdale is 16.5%, while the national average is 11.8% (United States Census Bureau, 2018). Moreover, the murder rate in Fort Lauderdale is 11 per 100,000 population, more than twice as high as the national rate of five per 100,000 population. These trends are mimicked in Khayelitsha where the township is disproportionately poor and crime-ridden when compared nationally. Second, it was important to select a city in the Global North that is distant and distinct in terms of its history for comparison. Finally, the main spatial theory of crime used in this study – the social disorganisation theory – was developed in the United States and is considered a ‘Western’ theory of crime. It was therefore important to test its usefulness and applicability in a South African context.

1.5 DATA AND METHODS USED

The data used for this study was obtained from several sources.

i) Point-level crime data for the greater Khayelitsha Policing Precinct was obtained from the South African Police Service (SAPS). The dataset contains information pertaining to the location, date and time of occurrence of all crimes in Khayelitsha from 2010 to 2012.

Point-level crime incident data for Fort Lauderdale was obtained from the Fort Lauderdale Police Department. The data set included the location of criminal incidents which occurred between January 2015 and December 2018.

ii) The socio-economic data used in this study was obtained from Statistics South Africa’s census of 2011 (<http://www.statssa.gov.za/>). The spatial unit of analysis used in this study is the small area level (SAL) which is the smallest unit of analysis at which Statistics South Africa legally disseminates spatial information. The socio-economic data used for Fort Lauderdale was obtained from the United States Census Bureau of

2018. The data used was extracted from the American Community Survey (ACS) which forms part of the US decennial census programme. The spatial unit of analysis for Fort Lauderdale is the block group level which is the smallest geographical level at which the ACS data required for this study was available (United States Census Bureau, 2018).

Ideally, it would have been preferable to compare socio-economic and crime data across the two contexts over the same time periods, however data constraints prevented that. The census data for both countries are collected on a decennial basis however the US data is updated annually through the American Community Survey (ACS) programme which provides additional yearly estimates. Therefore, while census data was theoretically available for the same time periods, crime data was not. With the focus on spatial crime causation, and the inter-relationship between violent crime and a series of independent variables representing social disorganisation characteristics, it was preferable to use two respective datasets in which the crime and census data coincide for each context. This limits the ability of direct comparison of crime causation over the exact same time period, but allows for a general comparison to be undertaken using the methods (and taxonomy) I develop later on in the thesis.

A broad objective of the study was to find appropriate or 'correct' methods in which to measure crime and its causation in Khayelitsha. This was illustrated in two parts. In the first part of the study, three separate sets of independent variables, representing the main tenets of the theory, were tested using a number of spatial analysis techniques. The purpose was to evaluate the consistency of the three sets of variables in explaining crime levels. After confirming the inconsistency of the differently defined independent variables, the second part of the study entailed a comparison of standardised variables across two international contexts. A set of standardised ISO variables were then identified and used to evaluate the applicability and consistency of these ISO variables in a comparative study between Khayelitsha (SA) and Fort Lauderdale (US).

Spatial analysis techniques initially used to explore the spatial distribution of violent crime in Khayelitsha, first involved the use of Exploratory Spatial Data Analysis (ESDA) techniques to identify evidence of spatial dependence in the data to be used in subsequent analysis. Second, bivariate correlation analysis was used to test the strength of the relationships between the selected individual variables. Finally,

regression models (spatial and geographically-weighted regression (GWR)) were used to examine the association between crime and the various selected structural neighbourhood characteristics in Khayelitsha. The same method was applied in the second part of the study in the cross-national comparisons with Fort Lauderdale (with the exception of GWR). Regression analysis is one of the most commonly used statistical methods in spatial studies of crime as it enables the user to investigate and model relationships among a dependent variable (crime) and a selection of independent variables.

1.6 CHAPTER OUTLINE

Chapter 1

This chapter provides an introduction and background to the research topic, broadly outlining the research questions. The aims and objectives, study areas and data and methods used are also discussed briefly.

Chapter 2

This chapter compares studies of social disorganisation that have been undertaken in both the developed and developing context and highlight the diverse ways in which social disorganisation theory have been measured and operationalised. The inconsistent findings reported in the different world contexts are also highlighted. The aim of this chapter is to illustrate the diverse ways in which certain concepts and variables typically used to represent social disorganisation theory have been employed in past spatial crime research.

Chapter 3

This chapter provides contextual background and relevant information about the township of Khayelitsha, the geographic focal point of this research. The chapter outlines the political history of Khayelitsha to better understand the unique context of post-apartheid South African cities. Details of the built, social and economic environment of Khayelitsha are provided as well as the levels and magnitude of crime in the township.

Chapter 4

This chapter highlights the various ways in which the structural neighbourhood characteristics, commonly used to represent social disorganisation theory, are defined and operationalised. In the analysis different combinations of independent variables (representing the main tenets of the theory), are grouped into three separate variable sets. These are tested in spatial regression models, while using the same regression specifications, to better understand the causes of crime in Khayelitsha. In doing so, the chapter demonstrates the subjectivity of model performance based on variable selection. The main aim is to demonstrate that there are numerous inconsistencies in the operationalisation of the central tenets of the theory and that the selection and different combinations of variables commonly used to represent social disorganisation can impact overall model performance as well as the associations and significance of the variables themselves in predicting crime.

Chapter 5

This chapter outlines theoretical background pertaining to international policy on urban safety and sustainable development initiatives. This is done in order to motivate for the opportunity that exist to apply sustainable development standards in studies of social disorganisation. The aim of this chapter is to identify ISO variables that could be used as a basis to guide variable selection in future cross-national comparative spatial crime studies.

Chapter 6

In this chapter the causes of violent crime in both Khayelitsha (developing context) and Fort Lauderdale, Florida (developed context), are examined and compared using ISO-informed standardised variables guided by ISO indicators. Here recommendations are made on the applicability of ISO 37120 standards as guidelines for defining and operationalising variables used to test social disorganisation theory across contexts.

Chapter 7

This chapter provides an overview of all achievements of the study aims and objectives. Finally, based on the results, several implications and recommendations are presented.

CHAPTER 2: LITERATURE REVIEW

The aim of this chapter is to examine studies that have used social disorganisation theory to explain crime and highlight the manner in which the structural neighbourhood characteristics commonly used to represent the theory have been defined and operationalised. There is a large volume of work done in the developed context, but less is known about the utility of social disorganisation theory in the developing world. This chapter focus on the different ways in which social disorganisation has been represented in both contexts.

According to the United Nations (2019) the level of development of a country is a multi-faceted reflection of various economic and social factors. The level of economic development is most often based on measures of per capita income levels, where developed nations have higher income levels and developing nations have lower income levels. There is a clear geographical divide with the developing countries mainly located in Africa, Asia and Latin America and more developed countries based mainly in Europe and North America.

The chapter is structured into three main parts. The first section comprises an overview of the origin and development of social disorganisation theory. The second and third sections focus on the application of the theory in the developed and developing contexts respectively.

2.1 SOCIAL DISORGANISATION: BACKGROUND

The theory of social disorganisation has its roots in the early 1900s, an era of rapid urbanisation, large-scale immigration and urban deterioration in North American cities. In an attempt to explain these urban problems, researchers in the Department of Sociology at the University of Chicago developed the concentric zone model of urban development (Park & Burgess, 1925) which divides cities into several zones or concentric circles. Initially, most new residents were theorised to settle in the central zone or the central business district (CBD). However, over time urbanisation and densification cause this zone to become dominated by businesses and the process is accompanied by dispersion of residents to the outer zones and residential deterioration in the CBD. This dispersion disrupts the structure of the urban community, ultimately leading to social decay or social disorganisation (Bruinsma et al., 2013; Kubrin, 2009; Lowenkamp et al., 2003). Park and Burgess compared the city to a dynamic, ever-changing natural environment where people compete for the scarce resource of space.

Subsequently work of other Chicago sociologists, notably Clifford Shaw and Henry McKay (1942), extended the concentric zone theory by primarily focusing on the extent to which socio-economic characteristics of neighbourhoods (or zones) in the city could influence crime propensity, and specifically juvenile delinquency, in a community. The researchers mapped roughly 20 years of juvenile delinquency records and found a close spatial association of delinquency to areas where poverty, ethnic heterogeneity and residential mobility was prevalent. A strong relationship emerged between the spatial distribution of 12 immigrant groups, including African Americans and delinquency. Furthermore, there was a clear concentration or clustering in the spatial distribution of delinquency, with a tendency to be denser towards the central zone and less dense away from the city centre, as well as concentrations in areas of industrial and commercial land use. Simply put, neighbourhoods with high rates of delinquency were characterised by low homeownership and low-income residents, including non-Whites or foreign immigrants who, as a result of limited financial means would be forced to settle in these poor areas. The spatial distribution of delinquency also showed a significant long-term stability. This persistence of delinquency in neighbourhoods, despite a turnover in the composition of the population, strongly linked the occurrence of delinquency to a specific place as opposed to a specific type of individual.

Shaw and McKay (1942) argued that poverty, ethnic heterogeneity and residential

mobility would result in social disorganisation which would weaken the ability of a community to maintain order and, ultimately result in delinquent behaviour. Residential mobility and high turnovers of residents were hypothesised to have destructive effects on the shared sense of community of residents, thereby affecting social bonds and a system of shared values. Ethnic heterogeneity, the sociologists argued, can limit interaction and communication among residents, constricting strong ties and social networks, and keeping a community from achieving common goals such as crime reduction. Since many of the urban problems started occurring around the same time as large-scale urbanisation and immigration into North American cities, they were also particularly concerned about the role that immigration played in increasing residential mobility and ethnic heterogeneity and the possible adverse impacts that new immigrants might have on the ability of neighbourhoods or communities to remain socially organised.

Their work resulted in the now seminal social disorganisation theory which has since inspired, and been the catalyst of, broader studies examining the spatial distribution of crime. The 1960s and 1970s, however saw a decline in social disorganisation studies, with researchers widely criticising the merit of the theory. Objections mainly revolved around the confusion of the conceptualisation of social disorganisation, including the definition and measurement of community disorganisation, as well as the nature of the relationship between social disorganisation and crime (Bursik Jr, 1988).

The 1980s marked a revival of the theory, with scholars attempting to address the perceived ill-defined connection between social disorganisation and crime. Studies began to focus on the social processes related to community stability, like informal social controls and the community's ability to self-regulate. The premise was that socially-organised communities would have strong moral values and social interaction and bonds among residents and neighbours which, in turn, would enable communities to self-regulate and combat crime. On the other hand, socially-disorganised communities would lack these characteristics and consequently have higher crime rates. The work of Sampson and Groves (1989) in particular contributed substantially to the revival of social disorganisation theory as they introduced measures of informal social control like sparse friendship networks, unsupervised teenage peer groups and low organisational participation within communities which they maintained would mediate the relationship between structural characteristics and criminal behaviour. They extended the original theory and included measures of family disruption and urbanisation in the theory. In terms of family disruption they held that parents are important agents of informal social

control over young people and less parental control would result in more delinquent behaviour of youths. They argued further that the level of urbanisation of communities affects their capacity for social control and hence they measured the level of urbanisation in terms of the location of neighbourhoods in relation to the centre of the city. They tested the structural characteristics of social disorganisation by analysing data collected by the British Crime Survey from 238 neighbourhoods in England and Wales and demonstrated a significant relationship to neighbourhood disorganisation. The results of the study showed that communities close to the centre of the city, with low levels of social controls and high levels of the structural neighbourhood characteristics (namely poverty, residential mobility, racial heterogeneity and family disruption) experience disproportionately higher crime levels.

Bursik and Grasmick (1993) expanded the theory further by addressing the nagging problem of neighbourhoods that have extensive personal networks facilitating informal social controls, but which nevertheless have relatively high rates of crime. They emphasised the need to incorporate measures of formal public resources and services, which are fundamental to the control of crime in a community. They proposed a systemic approach to social disorganisation aimed at explaining the interactions between a community's internal networks and the external world in the process of attempting to regulate behaviour. They reasoned that communities with strong informal social networks between friends and neighbours as well as those with strong broader interpersonal networks of local institutions such as schools and religious institutions, will have an increased ability to access and secure public resources and services by forming connections to the relevant organisations outside the neighbourhood. These resources include community policing and local crime-control initiatives instrumental in limiting levels of crime.

Later Sampson et al. (1997) would introduce the concept of collective efficacy to social disorganisation theory and defined it as mutual trust and solidarity or shared expectations, among community members, combined with the willingness of residents to intervene on behalf of the common good. They advocated collective efficacy as the process which enhances social cohesion and trust in communities, increasing their resiliency against crime. In their study of crime across 343 Chicago neighbourhoods, they found collective efficacy to effectively mediate the relationship between social composition and levels of violence. While the work of Bursik and Grasmick (1993) focused on an *ability* to intervene, collective efficacy emphasises a *willingness* to intervene (Triplett et al., 2005).

The conceptualisation, measurement and operationalisation of social disorganisation has, however, proved to be an ongoing challenge and even more so the mediating factors relating structural neighbourhood characteristics to disorder and subsequently to crime. Social control, informal and formal social ties, and collective efficacy are complex and multifaceted concepts that are particularly challenging to quantify (Kubrin, 2009; Kubrin & Weitzer, 2003; Sampson *et al.*, 2002). According to Markowitz *et al.* (2001) one of the major problems with testing the social disorganisation theory is the difficulty and expense of gathering data on social and informal controls and the mediating effect they have on neighbourhood cohesion. Data related to social experiences in the neighbourhood and interactions and relationships with other residents, usually requires extensive and expensive surveys.

Despite the criticism levelled at social disorganisation theory, it has evolved extensively over the years and continues to contribute to the understanding of the spatial distribution of crime. The most recent revival of social disorganisation theory was triggered by new developments of computerised mapping and spatial analysis techniques (LeBeau & Leitner, 2011). Since the turn of the century the development of geographic information systems (GIS) technology, together with the availability of good quality spatially-referenced crime data and socio-economic data, like census data, has triggered a surge in the spatial analysis of crime (Anselin *et al.*, 2000; Johnson, 2016). GIS studies using social disorganisation as the guiding framework typically use computerised software and statistical methods to analyse geo-spatial crime data. These studies most often aim to identify the impact of structural neighbourhood characteristics like socio-economic deprivation, residential mobility, family disruption, racial heterogeneity and urbanisation on crime levels (Andresen, 2006; Law & Quick, 2013; McCall *et al.*, 2010; Porter & Purser, 2010). The focus of this research is on structural neighbourhood characteristics used to present the central tenets of social disorganisation theory, (which are most often extracted from numerical census data and are relatively straightforward to quantify) as opposed to the more complex mediating factors (such as informal and formal social control and collective efficacy) which are more difficult to represent using the data that is available in South Africa.

2.2 SOCIAL DISORGANISATION IN THE DEVELOPED CONTEXT

The social disorganisation theory originated in the US and for many years research examining and testing the theory was conducted in mostly large cities in the US (Bellair & Browning, 2010; Graif & Sampson, 2009; He et al., 2015; Jain et al., 2010; Jones-Webb & Wall, 2008; Kingston et al., 2009; Lockwood, 2007; Martinez et al., 2010; McCall et al., 2010; Molnar et al., 2008; Nielsen et al., 2005; Peterson et al., 2000; Polczynski Olson et al., 2009; Schnurr & Lohman, 2013; Strom & MacDonald, 2007; Sun et al., 2004; Triplett et al., 2005). Other countries in the developed world soon followed suit with studies using social disorganisation as the theoretical framework being undertaken in Canada (Andresen, 2006, 2012; Charron, 2009; Law & Quick, 2013; Thompson & Gartner, 2014); Britain (Livingston et al., 2014; Lowenkamp et al., 2003; Markowitz et al., 2001); Germany (Oberwittler, 2004); the Netherlands (Bruinsma et al., 2013; Nieuwbeerta et al., 2008; Weijters et al., 2009); Sweden (Ceccato & Dolmen, 2011); and Australia (Jobes et al., 2004; Mazerolle et al., 2010).

Overall, the results of this broad swathe of research have continuously yielded conflicting and often contradictory results in terms of the applicability of the theory in a particular context. Other inconsistencies noted include the ways in which variables commonly used to represent the central concepts of social disorganisation theory are operationalised. The following sections highlight a number of the inconsistent findings as well as outline the diverse ways in which the central tenets of the theory, or structural neighbourhood characteristics related to social disorganisation theory have been measured and operationalised in studies in the developed world.

2.2.1 Socio-economic Deprivation

Socio-economic deprivation has been shown to be one of the most significant and consistent contributors to social disorganisation. Socio-economic deprivation is, however a broad and complex concept which can be defined and measured in a variety of ways. The originators of the theory, Shaw and McKay (1942), focused mainly on poverty as an indicator of deprivation, which they measured using income data. They viewed poverty as more than simply a cause of crime, rather as a more

complex process where poverty increases residential mobility and racial heterogeneity which both in turn increase the likelihood of social disorganisation. Later Sampson and Groves (1989) expanded the concept of deprivation to include 'socio-economic status' which they measured as a combination of education (the percentage of college-educated residents), occupation (the percentage of residents in professional or managerial positions) and income level.

In later studies of social disorganisation the concept of socio-economic status has been operationalised in a number of ways including income levels (Allen & Cancino, 2012; Jobes et al., 2004; Kingston et al., 2009; Lanier & Huff-Corzine, 2006; Roh & Choo, 2008; Van Wilsem, 2004; Weijters et al., 2009); measures of unemployment (Charron, 2009; Graif & Sampson, 2009; Jones-Webb & Wall, 2008; Polczynski Olson et al., 2009); and measures of welfare benefits (Bruinsma et al., 2013; Lockwood, 2007; McCall & Nieuwbeerta, 2007; Thompson & Gartner, 2014). Researchers have also created a myriad of indices of socio-economic deprivation (Charron, 2009; Graif & Sampson, 2009; McCall et al., 2010; Thompson & Gartner, 2014; Weijters et al., 2009). Two pertinent examples from the US include Peterson et al. (2000) and Triplett et al. (2005) who employed poverty, female-headed families and employment status into an index of socio-economic deprivation. Both found a positive association between deprivation and crime.

Regardless of the definition, the overwhelming consensus among researchers in the developed world is that low socio-economic status has a very strong association with crime (Andresen, 2006, 2012; Bruinsma et al., 2013; Charron, 2009; He et al., 2015, 2017; Jones-Webb & Wall, 2008; Kingston et al., 2009; Livingston et al., 2014; Lockwood, 2007; Martinez et al., 2010; McCall & Nieuwbeerta, 2007; McCall et al., 2010; Nieuwbeerta et al., 2008; Peterson et al., 2000; Polczynski Olson et al., 2009; Strom & MacDonald, 2007; Thompson & Gartner, 2014; Triplett et al., 2005; Van Wilsem, 2004; Warner, 2014; Weijters et al., 2009). One particular study by McCall et al. (2010) spanned five decades and included 904 cities in 259 metropolitan areas in 50 states and examined the association between various socio-economic factors and homicide rates. Deprivation levels were measured by variables such as percentages of Black residents, percentages of families living below the poverty level, income inequality and the number of children not living with both parents. The researchers found that high levels of deprivation were strong predictors of homicide rates.

In testing the theory, researchers most often found that other structural neighbourhood

characteristics become less significant when controlling for socio-economic deprivation (Jones-Webb & Wall, 2008; Kingston et al., 2009; Lockwood, 2007; Martinez et al., 2010). For example, Lockwood (2007) hypothesised that African Americans and renters were associated with higher levels of crime in a study in Savannah, Georgia. However, they found that when the level of social disadvantage goes down, the effects of race and housing tenure on violent crime disappear. In their study of the influence of social and economic disadvantage on racial patterns in youth homicide across 155 cities in the US, Strom and MacDonald (2007) found that while increases in disadvantage were associated with increases in homicide rates, the effects were not significantly more pronounced for African Americans youth compared to White youth. Similarly, in a study of homicide risk in 10 American cities, Jones-Webb and Wall (2008) found that the relationship between racial concentration and homicide was reduced after adjusting for higher levels of deprivation, specifically lower levels of educational attainment.

Outside the US, researchers in Canada found overwhelming support for an association between socio-economic deprivation and crime. In these studies socio-economic deprivation includes various combinations of unemployment, education- and income levels (Andresen, 2006), together with the percentage of residents receiving government welfare benefits (Law & Quick, 2013). Thompson and Gartner (2014) used an expanded definition of deprivation in their study of homicide in Toronto which included income-based data and lone-parent households. They found a strong association between their measures of socio-economic deprivation and homicide.

In Europe Van Wilsem (2004) compared 27 Eastern and Western European countries and found that criminal victimisation rates were higher among countries with higher levels of income inequality, while McCall and Nieuwebeerta (2007) found higher levels of economic deprivation, defined as a combination of lone-parent households and household income levels (measured by including reliance on welfare) to be associated with higher homicide rates in 117 European cities in 16 European countries. In Spain Gracia et al. (2009) explored the relationship between neighbourhood social disorder and domestic violence against women. The researchers hypothesised that deprivation would contribute to a climate of tolerance and acceptability of violence against women which in turn would increase the occurrence of partner violence. The results supported their hypothesis, a perception in line with the basic assumption of Shaw and McKay (1942, 1969) that disorder breeds more disorder. In the Netherlands (Nieuwebeerta et al., 2008) and in Germany (Weijters et al., 2009) socio-economic

disadvantage was found to have a strong effect on offender rates when measures of income and lone-parent families were used, while in Glasgow, Scotland, Livingston et al. (2014) found income deprivation to be one of the strongest indicators of local crime rates in social housing areas.

2.2.2 Family Disruption

As a main tenet of social disorganisation theory, family disruption has consistently been shown to be strongly associated with increases in crime rates in developed contexts (Beaulieu & Messner, 2010; Bernburg et al., 2009; Ceccato & Dolmen, 2011; Freisthler, 2004; He et al., 2015; Lanier & Huff-Corzine, 2006; Livingston et al., 2014; McCall & Nieuwbeerta, 2007; McCall et al., 2010; Polczynski Olson et al., 2009; Porter & Purser, 2010; Schwartz, 2006; Weijters et al., 2009; Wong, 2011). Family disruption was not part of the original theory of Shaw and McKay (1942) and was only included in the later study by Sampson and Groves (1989). The latter scholars characterised family disruption as broken marriages (percentage divorce or separated) and/or households with single parents and children. They claimed that two-parent households provide increased guardianship and supervision, and that family or marital disruption could decrease informal social control in a community.

In subsequent studies in the developed world, family disruption is often defined as the percentage of divorced or separated adults or single-parent households (Ceccato & Dolmen, 2011; He et al., 2015; Sampson & Groves, 1989; Weijters et al., 2009). Other researchers have applied a measure of female-headed households by insisting that the absence of a father would increase family disruption through a lack of male role models, reduced social controls or increased poverty (Freisthler, 2004; Lanier & Huff-Corzine, 2006; Polczynski Olson et al., 2009). Family disruption has also been shown to be related to high levels of deprivation (Beaulieu & Messner, 2010; Weatherburn & Lind, 2006; Wong, 2011) with the result that this measure is regularly included in indices of deprivation (Lockwood, 2007; Martinez et al., 2010; McCall & Nieuwbeerta, 2007; McCall et al., 2010; Nieuwbeerta et al., 2008; Peterson et al., 2000; Strom & MacDonald, 2007; Triplett et al., 2005; Weijters et al., 2009).

Care burden, an unconventional measure of family disruption that has previously been used in the developed context (Schwartz, 2006), refers to the proportion of adults in

relation to children of a community, where a disproportionate number of children may contribute to a context of increased strain. In Australia Weatherburn and Lind (2006) included child neglect as a measure of family disruption and defined it as emotional abuse or neglect and found that high levels of child neglect, in combination with other structural neighbourhood characteristics like poverty, ethnic heterogeneity and geographic mobility, had an increased influence on crime. Snowball and Weatherburn (2008) used a measure of 'stolen generation' (the children of Australian Aboriginal descent who were forcefully removed from their families by government agencies and church missions acting under the laws of the time) as a measure of family disruption and found that being a member of the stolen generation was strongly associated with violent crime.

Despite the wide variety of measures employed to operationalise family disruption, results consistently show that family disruption is strongly associated with increasing crime levels. In the US Schwartz (2006) studied the effects of family structure on homicide in 1618 counties and found that father absence, male unemployment, higher levels of teenage pregnancies and a higher care burden adversely affected homicide rates. Lanier and Huff-Corzine (2006) examined the extent to which family disruption (measured by the percentage of American Indian female-headed households with children younger than 18 and no spouse present) impacted American Indian homicide rates and found it to be a significant predictor of increased homicide levels. In Orlando, Florida, Polczynski Olson et al. (2009) also found the percentage of female-headed households to be an important predictor of crime, while Porter and Purser (2010) found that broken marriages (measured as the percentage of the population that are divorced) were notably related to higher crime rates in 48 states across the US. Beaulieu and Messner (2010) assessed the effect of divorce rates on homicide rates across 131 large cities in the US from 1960 to 2000. They created a family disorganisation index in which they combined divorce rates and the percentage of children not living with two parents and they found that the family disruption index had a pronounced effect on homicide rates. Similarly, in a study including 904 US cities, McCall et al. (2010) found areas with higher numbers of divorced males to have higher homicide rates. In Columbus, Ohio, He et al. (2015) examined the association between crime and family disruption (measured as single-parent families) over multiple years and noted the association to be positive and consistent over time.

Outside the US, Wong (2011) tested the reciprocal relationship between family

disruption and crime across 500 municipalities in Canada, using separate measures of divorce and single parenthood. The researcher found that while higher percentages of single parenthood increased crime levels, divorce rates actually had a negative association with crime. This finding demonstrated the impact of using different variables to measure the same concept and of being cognisant of the potential effect of combined measures when analysing their interrelationship with crime.

Studies of family disruption across Europe also show strong positive associations with crime. In Iceland Bernburg et al. (2009) examined the effects of disrupted families on juvenile delinquency, specifically adolescent substance abuse, and found a strong positive association which was evident across neighbourhoods regardless of whether an adolescent resided in a disrupted household or not. Further south in 11 cities in the Netherlands Weijters et al. (2009) found juvenile delinquency to be appreciably affected by the percentage of one-parent families, while in Sweden Ceccato and Dolmen (2011) found divorce rate to be one of the most important social disorganisation variables to explain the variation of both violence and theft. Finally, in Poland Korinth et al. (2017) studied the socio-economic determinants of crime in the province of Pomeranian and found the divorce rate had a marked influence on crime rates in the province.

2.2.3 Residential Mobility

A high turnover of residents in a neighbourhood can compromise community bonds, thereby affecting the formation of long-term relationships among residents and limiting the easy identification of strangers or possible offenders. This, in turn, can potentially lead to an increase in social disorganisation and crime (Bruinsma et al., 2013; Haynie & South, 2005; He et al., 2017; Law & Quick, 2013; Warner, 2014). Although residential mobility was initially linked to ideas of immigration and urbanisation in the initial formation of social disorganisation theory, the concept has changed somewhat to represent issues of stability and mobility. Sampson and Groves (1989) interpreted the concept as residential stability measured by the percentage of residents brought up in the area and residing within a 15-minute walk from their home. Neighbourhoods with less residential stability tended to have higher offending rates. Other measures for residential mobility have included the proportion of households that have not lived in the same house for a number of years (usually between one and five years) (Bruinsma et al., 2013; Haynie & South, 2005; Kingston et al., 2009; Law & Quick, 2013; Roh & Choo, 2008; Thompson & Gartner, 2014; Warner, 2014) as well as the number of

homeowners or renters (Boggess & Hipp, 2010; Lockwood, 2007).

A national study in the US by Haynie and South (2005) examined the association between adolescents who had resided at their current address for less than two years and violent behaviour, and found that residential mobility caused adolescents to exhibit higher rates of violent behaviour compared to less mobile adolescents. In two large cities in the US, Warner (2014) determined that residential mobility, measured as a combination of tenure status and length of residency, decreased informal social control which, in turn, led to increased crime.

Outside the US Law and Quick (2013) examined the association between residential mobility and delinquency in Ontario, Canada and found overwhelming support for the association between the number of residential moves at a one-year interval and delinquency. In Toronto Thompson and Gartner (2014) created a residential stability index by combining measures of low residential turnover and high levels of homeownership and found residential instability to be associated with higher levels of homicide, regardless of a neighbourhood's economic context. In the Hague, Netherlands, Bruinsma et al.(2013) discovered residential mobility to have a consistently strong effect on offender rates, but measures of collective efficacy were found to mediate this relationship. Likewise in Australia, a nation where a disproportionate rate of indigenous Australians are convicted of crime (when compared to non- indigenous Australians), Snowball and Weatherburn (2008) found that residential mobility, measured as the number of times moved, was positively associated with violent crime.

Several other studies have found residential stability and not mobility, in combination with high levels of deprivation to be associated with higher crime levels (Kingston et al., 2009; Lockwood, 2007; Roh & Choo, 2008). In these studies the notion is that the poorest residents cannot afford to move away from high-crime neighbourhoods and, as a result, get trapped in these neighbourhoods with very little hope of escaping. For example, research in Maryland by Schieman (2005) found a strong link between residential stability and neighbourhood disadvantage. Strong social ties mediated the effect somewhat, but the author argued that residential stability in combination with high rates of poverty have a devastatingly negative influence on individuals, effectively isolating them from mainstream social institutions and formal organisations. In Savannah, Georgia, Lockwood (2007) found that the percentage of renters did not predict violence, and reasoned that people who rent were only associated with violent

crime because it is the socially disadvantaged that rent. Both Roh and Choo (2008) (in a suburban setting in Chicago), and Kingston et al. (2009) (in highly disadvantaged neighbourhoods in Denver) found that it is poverty that increases the occurrence of crime, rather than the frequency of household moves. They argued that the poorest neighbourhoods often tend to be more stable in terms of residential mobility since the poorest residents had no choice but to stay in their current residence. In Los Angeles Boggess and Hipp (2010) examined the reciprocal relationship between the rate of violent crime and residential stability and found that neighbourhoods with more violent crime experienced increasing home sales, but that home sales rates did not cause crime to increase. On the other hand, residential stability defined as the percentage of residents renting their homes did have an effect on violent crime, whereas the effect of crime on renter mobility was almost twice as strong as the opposite. They also found that race mediated this effect, since neighbourhoods with large Latino populations and higher residential instability experienced steeper trajectories of violent crime, while residential stability did not reduce violent crime in neighbourhoods that were mostly African American.

2.2.4 Racial or Ethnic Heterogeneity

Shaw and McKay (1942) argued that racial or ethnic heterogeneity can increase crime rates through limiting interaction and communication among residents. While the definitions of racial or ethnic heterogeneity vary considerably, the concept has often been measured as the proportion of different racial groups in an area, with most research finding a positive association between increased heterogeneity and crime, at least in developed-world contexts (Jobes et al., 2004; Jones-Webb & Wall, 2008; Krueger et al., 2004; Lanier & Huff-Corzine, 2006; Law & Quick, 2013; Sampson & Groves, 1989; Sampson & Raudenbush, 2004; Thompson & Gartner, 2014; Trovato, 2001; Zahnw et al., 2013).

Sampson and Wilson (1995) questioned the use of race as a measure of ethnic heterogeneity by drawing attention to racial segregation and the very different ecological contexts in which people of different colour reside. They compared isolated poor Black neighbourhoods to ghettos, contending that residential segregation and inequality resulted in social isolation, limited mobility and increased male joblessness. This resulted in concentration of disadvantage which lead to social disorganization

and crime. They insist on the need to consider the effects of racial segregation (because of enforced political policies) in measures of ethnic diversity. Zahnnow et al. (2013) agreed that the legacy of forced racial residential segregation has affected the spatial configuration of US neighbourhoods, and that this has contributed to, and maintained, inequality. It is therefore difficult to determine the independent effects of race or ethnicity on disorder without considering the political history of the context under investigation. Bursik (2006) noted that historically, while immigrant groups on arrival in new cities initially stayed in the poorest and most crime-ridden neighbourhoods, they eventually moved on to more affluent neighbourhoods, whereas African Americans, most often, had no choice but to stay since their movements were restricted due to legal requirements.

In truth, there is a complex relationship between race and economic context. In Chicago Sampson and Raudenbush (2004) found that the racial and economic context of a neighbourhood shape perceptions of disorder since an increased occurrence of minority groups and poverty causes residents of all races to perceive greater disorder. This was found even after controlling for personal characteristics and independently observed neighbourhood conditions. The authors argued that perceptions of disorder are deep-seated and lie in a history of geographic isolation and marginalisation of ethnic minority groups in urban America. In a nation-wide study of the US Krueger et al. (2004) examined the effect of ethnicity on variations in homicide rates and found that Mexican Americans and Black Americans more often reside in poorer areas with higher percentages of single-parent households and that these areas were associated with much higher levels of homicide when compared to areas where White Americans reside. Similarly in Canada both Law and Quick (2013) and Thompson and Gartner (2014) found positive associations between crime and ethnic heterogeneity. Law and Quick (2013) created an index of the proportional representation of the different ethnic groups in Ontario, while Thompson and Gartner (2014) measured the percentage of Black residents in Toronto neighbourhoods, and both found these measures, together with high levels of economic disadvantage to be associated with high crime levels. However, when Strom and MacDonald (2007) examined data from 155 cities in the US and compared Black to White homicide victimisation rates for juveniles, results revealed that despite the low incidence of White youth homicide, high poverty rates increased the occurrence of youth homicide for both races independently from factors like ethnic heterogeneity and region. Perceptions of different ethnic groups also impact

perceived levels of disorganisation. Sampson and Raudenbush (2004) found that Latino residents, who are often new or recent immigrants, perceived predominantly Black areas to be highly disorganised, more so than those of other ethnic groups, so adding to the perception that African Americans are a stigmatised group.

The adverse effect of racial or ethnic heterogeneity is often explored in studies of minority indigenous populations. In an analysis of Aboriginal mortality in Canada, the US and New Zealand, Trovato (2001) determined that the Maori, Canadian Indigenous and American Indians all experience an elevated risk of homicide compared to the White population. They argued that in spite of improvements in the social and economic conditions of indigenous populations in these countries, these groups have experienced prolonged histories of prejudice and discrimination which is reflected in inequalities in the mortality rates which persist in these societies. In Australia, indigenous Australians are significantly over-represented in prisons (McCausland & Vivian, 2010) and in the criminal justice system generally (Jobes et al., 2004), while Zahnow et al. (2013) found that high proportions of indigenous residents are associated with greater perceived disorder in Brisbane.

The emphasis on immigration in the original study of Shaw and McKay (1942) has also prompted many scholars to include measures relating to the country of origin when operationalising racial heterogeneity. Measures such as the percentage of foreign-born residents or non-citizens have been commonly used in previous research but contrary to expectations, results often find that neighbourhoods with higher concentrations of foreign-born residents or immigrants experience reduced crime (Allen & Cancino, 2012; He et al., 2015, 2017; Krueger et al., 2004; Martinez et al., 2010; McCall & Nieuwebeerta, 2007; Polczynski Olson et al., 2009). Martinez et al. (2010) contends that immigration has been erroneously labelled as a cause of crime, claiming that social disorganisation in cities with high percentages of immigrants is largely a function of economic deprivation. They examined the relationship between crime and immigration in San Diego over a twenty-year period and concluded that an increase in the number of foreign residents actually reduced violence rates. Likewise, Allen and Cancino (2012) found that ethnic heterogeneity, measured as the percentage of foreign-born residents, did not affect crime rates in urban counties in Texas. In Columbus, Ohio, He *et al.* (2015) tested the temporal stability of social disorganisation variables over a period of five years and found the percentage of foreign-born population to be negatively associated with violent crime rates. In contrast, Thompson and Gartner (2014) hypothesised that Toronto neighbourhoods with higher proportions of

residents who are recent immigrants would also have lower homicide rates. They based this assumption largely on supportive immigration settlement policies in Canada, but found the opposite to be true.

Other studies tend to measure racial and/or ethnic heterogeneity in terms of nativity, as opposed to race. For example, in Europe, McCall and Nieuwbeerta (2007) measured ethnic heterogeneity as the percentage of residents who were born in non-European Union countries and found this measure to have very little effect on crime. They maintained that the measurement should be refined since it included many skilled as well as unskilled immigrants, consequently obscuring other important social and economic factors. This tends to be the case when the term 'immigrant' is used as a proxy for racial or ethnic heterogeneity, but it does not allow for the possibility of variation of race or ethnicity within a group of immigrants. When Kubrin et al. (2018) examined the impact of immigrant groups on neighbourhood crime in southern California, they distinguished between the country of origin and race or ethnicity and found considerable variation between the different immigrant groups. They found, for example, that neighbourhoods with immigrants from West Africa had lower levels of crime compared to neighbourhoods with immigrants from East Africa, Middle Africa and Southern Africa. A study in 11 cities in the Netherlands by Weijters et al. (2009) applied a measure of ethnicity based on the countries in which both parents were born and included data on immigrants from Surinam, Turkey and Morocco. Adolescents with one immigrant parent (and one Dutch parent) were more likely to commit crime, but adolescents with two Moroccan parents were less likely to commit crime compared to Dutch adolescents.

Linguistic variability is another measure that has been widely applied as a proxy for ethnic diversity (Awaworyi Churchill & Laryea, 2019; Danielsson, 2016; Graif & Sampson, 2009; Zahnw et al., 2013). These measures include home language spoken (Wickes et al., 2013) or linguistic isolation measured as the lack of English-speaking household members (Varano et al., 2009). Graif and Sampson (2009) measured ethnic heterogeneity by using language diversity in Chicago and found it to be positively associated with lower homicide rates. Like much prior research, the inconsistent way in which this variable has been operationalised can potentially impact the results. For example, Graif and Sampson (2009) found that language diversity was consistently associated with lower homicide rates in Chicago, whereas Awaworyi Churchill and Laryea (2019) found that higher levels of linguistic diversity tended to

reduce crime rates in their study across 78 countries.

2.2.5 Urbanisation

Urbanisation refers to changes in the size and density of urban settlements (Castree et al., 2013) and when it occurs at a pace which exceeds the settlements' infrastructure development it is often associated with social disorganisation and crime (Ompad et al., 2007). In their seminal study Shaw and McKay (1942) noted a distance decay effect whereby crime declined the further a neighbourhood was away from the city centre. They did not include the level of urbanisation per se as a measure of social disorganisation in their study but aligned this concept as playing a central role in influencing other neighbourhood level social characteristics such as poverty, population turnover, racial or ethnic heterogeneity and immigration. Later, Sampson and Groves (1989) included urbanisation specifically as a structural measure of social disorganisation and argued that urban communities have a decreased capacity for social control compared to rural or sub-urban communities. They found the level of urbanisation, measured in terms of distance from the city centre, to have a strong negative effect on social organisation and associated crime rates. A decade or so later Lowenkamp et al. (2003) replicated the Sampson and Groves (1989) study by using the same measures and crime data from the same British Crime Survey. They similarly found that neighbourhoods closer to the inner city experienced higher crime levels, partially because of the effects on local friendship networks and unsupervised peer groups which were more prevalent in the city centre. In the UK, Markowitz et al. (2001) too found that neighbourhoods located closer to the inner city have lower cohesion and higher crime rates.

Measures of the level of urbanisation and its effect on crime rates have however also produced contradicting results. For example, in Sweden Ceccato and Dolmen (2011) compared the occurrence of crime in rural and urban areas and found that more crime occurred in urban Sweden, and that rural municipalities closer to larger urban centres were affected more by greater increases in crime (as well as large changes in population size). A study of rural communities in Australia (Jobes et al., 2004) included six separate communities of different sizes and found that the largest and the smallest communities in the sample had the highest crime rates, so countering the perception that smaller, or less urbanised, communities have less crime. York, Cornwell

and Behler (2015) examined the association between neighbourhood disorder and urbanisation in Chicago and found that sparsely populated non-metropolitan areas had higher levels of disorder and less social cohesion, and motivated that this contradictory finding was likely due to the greater physical isolation of the non-metropolitan residents.

When the level of urbanisation, measured in terms of population density, is included in studies of social disorganisation it is most often found to be associated with higher levels of crime (Hardyns, 2012; Korinth et al., 2017). One study across 117 cities in Europe by McCall and Nieuwbeerta (2007) and another in 904 cities in the US (McCall et al., 2010) both found measures of population density to be associated with higher homicide rates. In The Hague, Netherlands, Bruinsma et al. (2013) included measures of population density, urbanisation and structural density to test social disorganisation theory. In their study structural density referred to building density, for example high concentrations of multi-storey buildings, like high-rise apartments, social housing and also larger families residing in single household units. They argued that an increase in structural density would reduce supervision and guardianship in a neighbourhood, thereby increasing the opportunities for delinquency. Rather surprisingly, they found that higher levels of urbanisation, population and structural density were associated with lower offender rates in the neighbourhoods. They speculated that this could be due to the spatial structure of The Hague which, like other Dutch and European cities, are distinctly different from cities in the US. In the European cities residential land-use is often combined with shopping and entertainment areas, and they urge that unique underlying causes of social disorganisation might be at play in these environments, which should be explored further in comparative research.

The structural neighbourhood characteristics or main components of social disorganisation theory are clearly complex concepts that have been operationalised in diverse ways in studies that have been undertaken in the developed world. It is also evident that the findings regarding the impact of these concepts on crime and social disorganisation are often inconsistent. The following section focuses on the operationalisation of social disorganisation in the developing world, highlighting a number of differences and similarities in terms of the operationalisation of the theory in spatial crime research.

2.3 SOCIAL DISORGANISATION IN THE DEVELOPING CONTEXT

Research using social disorganisation theory to explain spatial crime distributions in the developing world is in its infancy. It is however a growing field of research with the theory being increasingly tested in contexts outside the West, including Latin America (Arias & Montt, 2017; da Silva, 2014; de Melo et al., 2017; Escobar, 2012; Vilalta & Muggah, 2016); China (Chen et al., 2017; Zhang et al., 2007); South-East Asia (Ishak & Bani, 2017; Marzbali et al., 2014; Zakaria & Rahman, 2017); parts of Eastern Europe, such as Turkey (Yirmibesoglu & Ergun, 2007); and in some regions of Africa (Breetzke, 2010a,b, 2018; Demombynes & Ozler 2005; Kassahun, 2005; Lancaster & Kamman, 2016; Leslie et al., 2015; Swart et al., 2016; Yahaya et al., 2013).

One of the major obstacles in conducting spatial crime research in a developing context is a lack of reliable spatial crime data (Breetzke, 2010b; Ceccato et al., 2007; Escobar, 2012; Yirmibesoglu & Ergun, 2007). In South Africa for instance, police precinct-level crime data has only officially been available since 1994 when South Africa became a democracy. This has seriously hampered any attempts to undertake reliable spatial crime research (Breetzke, 2010b). To overcome this problem, developing world researchers often conduct their own crime and victimisation surveys (Leslie et al., 2015; Marzbali et al., 2014; Zhang et al., 2007) or they make use of alternative data sources like health and victimisation data (Yahaya et al., 2013). In China Zhang et al. (2007) used data from a household survey of approximately 2500 households to analyse the risk of household burglary in the city of Tianjin, while Yahaya et al. (2013) made use of data on sexual violence available from demographic and health surveys conducted in six countries, namely Ghana, Liberia, Nigeria, Uganda, Zambia and Zimbabwe, to examine the association between social disorganisation and the sexual abuse of children.

The quality of police-recorded data is also questionable due to police corruption and inefficiency. The manner in which police data is recorded can also compromise its quality and accuracy. According to Bergman (2006), in Latin America there are serious irregularities in the way police officials record crime data, with a lack of standards and guidelines regarding correct procedures resulting in highly unreliable crime data. For example, in São Paulo, Brazil, Ceccato et al. (2007) found that the

location of homicide incidents were recorded as either the place where a victim was found, or the location where the killing took place or where the body was dumped. They also found homicide data to be underestimated since multiple murders often occur (three percent of total annual homicides in Brazil), but the police records refer only to one event instead of the total number of victims. The increasingly informal infrastructure of cities in the developing context also affects the quality of crime incident data. In South Africa more than 50% of the township locations are informal with no formal infrastructure, no roads and no existing street addresses. In this scenario geo-tagging and address matching are not possible with the result that attribute data and records of the spatial location of a crime are often incomplete, incorrectly recorded or even omitted (Breetzke, 2006; Edelstein & Arnott, 2019). Furthermore, crime is notoriously under-reported, especially in deprived communities where police efficiency and trust in the police have been shown to be serious obstacles to effective formal control (Arias & Montt, 2017; Blackmore, 2003; Frimpong et al., 2018; Samara, 2010). Whilst these issues may also be evident in the developed world, they are likely to be less prevalent than in a developing context.

These crime data issues notwithstanding, the testing of social disorganisation theory in developing contexts has thus far yielded conflicting results. This in itself is not surprising considering the history and development of the theory, and when tested in different world contexts researchers often apply local adaptations to adjust to their specific contexts, cultures, and available data sources. The following section reviews research in the developing world with regards to the definition, measurement and operationalisation of structural neighbourhood characteristics used to measure levels of social disorganisation in neighbourhoods.

2.3.1 Socio-economic Deprivation

Similar to developed world studies, socio-economic deprivation has been found to be a particularly significant contributor to social disorganisation and associated crime in the developing context. The operationalisation of this multifaceted concept can however differ vastly in developing contexts where poverty and deprivation are rife. Measures of deprivation in those contexts can provide an indication of a complete lack of resources and services or absolute deprivation as opposed to relative deprivation which refers more to a lack of lifestyle and activity amenities. For example, in São Paulo, Brazil, Ceccato et al. (2007) included households where the head earns no income and the

percentage of slum housing (or favelas) in their measurement of socio-economic deprivation and they found that both factors are causally linked to homicide rates. In Bogota, Colombia, a country with one of the highest crime rates in Latin America, Escobar (2012) applied various measures of socio-economic deprivation as predictors of homicide rates. These included the proportion of the population experiencing hunger, the percentage of the population who are illiterate, the unemployment rate, the percentage of female-headed households and, the percentage of households without phone service (to measure isolation). She contended that these measures more realistically represented socio-economic deprivation in Colombia and found that it positively predicted homicide. de Melo et al. (2017) investigated the relevance of social disorganisation theory in a Brazilian urban context in the city of Campinas and included several variables not typically used in developed-world studies, namely the percentage of households without exclusive bathrooms, public lighting and paved roads, and households with accumulated garbage and open sewers. All these measures were found to be positively associated with crime.

Several studies in Africa have focused on vulnerability, specifically of females, when examining the association between socio-economic deprivation and violent crime against women. In a nationwide study in Ghana Cofie (2016) found that abused women are more likely to live in poverty and in communities with high levels of unemployment, while Wrigley-Asante et al. (2016) examined sexual crimes in low-income urban communities of four cities in Ghana and found a close association between socio-economic deprivation and sexual crimes. They stressed the detrimental effect of poor housing, specifically dense overcrowding and high room occupancy rates, on increasing the exposure and vulnerability of females to sexual crimes. In Kenya, Winter and Barchi (2016) examined the relationship between access to sanitation and violence against women and found a strong association, specifically regarding the lack of access to private, safe sanitary services. Ndikaru (2016) identified the causes of crime in four slums in Nairobi, Kenya, and found that elevated levels of youth unemployment and poverty, measured as the lack of essential services and household goods, were the main determinants of crime.

Numerous studies in South Africa, have found a direct relationship between various measures of socio-economic deprivation and crime. For example, Blackmore (2003) detected income and unemployment as having an unusually significant effect on crime such that poverty acts as a motivation for engaging in criminal activities or as an

alternative way of earning a living. In Tshwane, Breetzke (2010b) used the type of dwelling, the availability of water and toilet facilities, refuse or rubbish removal, and energy or fuel for lighting, heating or cooking as measures of deprivation and found them to be the primary determinants of higher rates of violent crime in the city. The measure of unemployment was found to have a reciprocal association with crime, where unemployment led to crime, but that an increase in crime also led to increased unemployment. In Johannesburg Swart et al. (2016) found that socio-economic deprivation measured as a combination of low income, unemployment and low education, was related to an increase in homicide. Their results showed a strong link with low educational attendance, contributing to the high levels of violence and homicide among young people. They also showed that the majority of crime occurred in a small number of neighbourhoods, particularly in the predominantly Black townships on the periphery of the city. These peripheral urban areas established under the apartheid government of South Africa were reserved for non-Whites, and became the racially-segregated residential townships which continue to feature extreme poverty, unemployment, poor and often informal housing, limited services and facilities, and overcrowding.

2.3.2 Family Disruption

In the developing world family disruption have most often exhibited strong positive associations with crime. Researchers in Latin America (Escobar, 2012; Vilalta & Muggah, 2016) and Africa (Demombynes & Özler, 2005; Swart et al., 2016; Yahaya et al., 2013) have found a direct relationship between family disruption (measured as the number of female-headed households) and homicide. In Mexico City, which has an exceptionally high prevalence of female-headed households, Vilalta and Muggah (2016) found this variable to be the main predictor of violence in the city. As in the developed context, marital status and/or the percentage female-headed households are also often employed to operationalise family disruption.

For example, in Maseru, Lesotho, Obioha and Nthabi (2011) studied the linkage between marital status of parents and incarcerated juvenile delinquency. They included single, separated, married and deceased parents in their measure of family disruption and found that juveniles who come from these broken families were far more likely to engage in criminal behaviour when compared to youths from stable families. In a regional study of sub-Saharan Africa, Yahaya et al. (2013) found a very

strong relationship between communities with female-headed households and reported child sexual abuse.

In South Africa the laws and policies of the former apartheid government had detrimental and long-lasting adverse effects on the family structure, especially in non-White communities. The results of research examining the impact of family disruption on crime in the country is, however, conflicting. For example, both Demombynes and Özler (2005) and Doolan et al. (2007) found a positive association between the percentage of female-headed households and violence, however Breetzke (2010b) found family disruption, measured as the father being dead or estranged, to be noticeably non-significant in relation to crime in Tshwane. The author explained this anomaly by highlighting the alternative meaning of the variable in the South African context where the migrant labour system during apartheid forced male breadwinners to work far away from their families for prolonged periods. As a result of male absence, many Black households were classified as female-headed households, although the male was not deceased or absent per se as would be assumed in the international context. When Swart et al. (2016) tested social disorganisation theory in Johannesburg, they combined the percentage female-headed households and the percentage divorced and found that this measure of family disruption was negatively associated with crime. They also included the percentage of child headed households, a measurement rarely employed in any context. They maintained that it must be included because of the large proportion of South African children living in households without parents, partly due to the HIV and Aids pandemic and the consequential high rates of adult mortality. Their measure of family disruption was found to be significantly but negatively associated with homicide. They reasoned that compared to men, women in South Africa tend to use more of their income for basics like food, health care and education, and therefore they may actually be better guardians of youth so resulting in less social disorganisation.

2.3.3 Residential Mobility

Variables used as proxies for residential mobility in a developing context are similar to those used in the developed world. For example, in Campinas, Brazil, de Melo et al. (2017) used tenant occupation as a measure of mobility and found it to be positively associated with violent sexual crime. They argued that this was consistent with

the expectations of the theory, partially because the (similar) variable definition was comparable with the North American context. Low percentages of homeowners and high percentages of renters have been found to be associated with high crime rates (Breetzke, 2018; Haefele, 2011; Lancaster & Kamman, 2016), together with shorter residential stays measured as the percentage of households that have not lived in the same residence for a number of years, ranging between one and five years (Breetzke, 2010b; Cofie, 2016; Yahaya et al., 2013).

The notion that increased immigration and urbanisation impact residential mobility and consequently on social disorganisation and crime is particularly relevant in the developing world where the influx of migrants is common and increasing at an alarming rate (Arias & Montt, 2017). In Turkey Ergun et al. (2003) examined how migration influenced social degeneration in 32 heterogeneous districts in Istanbul between 1994 and 1998 and found that settlements with mixed societies experienced an increase in crime. Surprisingly, while the neighbourhood characteristics of the older districts exhibited better living conditions and service provision, the crime rates were still found to be higher. An explanation is that strong social bonds are formed among the new community members since migrants in new settlements generally migrate as groups from the same areas, while a mixed population and less social restraint in the older districts may cause crime rates to increase.

In developing contexts large numbers of people are often forced to move due to conflicts or wars, with consequent large-scale displacements of people (Arias & Montt, 2017; Escobar, 2012). In a study in Colombia, Escobar (2012) included a measure of forced displacements as a proxy for residential mobility and found a direct relationship with homicide rates. Arias and Montt (2017) examined social disorganisation in impoverished areas of Bogota (Colombia), Lima (Peru) and Santiago (Chile). They specifically looked at internal and external migration in the three cities and found that Bogota, in particular, experienced significant and ongoing migration as a result of conflicts. The rural migrants benefit in terms of relative safety and security when they move to the city, but their numbers, combined with the fact that they receive government benefits amid extensive community poverty, results in long-term tensions with their neighbours. In Lima the effects of migration were relatively limited with new residents experiencing economic hardship but not necessarily social exclusion. In Santiago where a large degree of collective efficacy exists among established residents who have lived in the city for an extended period, the small number of recent

foreign migrants experienced a certain degree of animosity from the long-term inhabitants who perceive the migrants as outsiders.

A study by Zhang et al. (2007) in Tianjin, China, found that increased length of residence decreased the risk of burglary owing to increased social cohesion. However, in some instances, new residential developments or housing estates experienced less crime, usually because of better security measures. In urban China crime has been on the increase since the implementation of political and economic reform policies in the late 1970s. The economic reform has also brought about economic inequality between rural and urban areas, causing large-scale migrations to urban areas where demands for labour continue to grow. Due to restrictions imposed by China's household registration system, large numbers of migrating workers comprising people who may work in the cities but are not allowed to reside there, have subsequently appeared. When Zhang et al. (2007) measured the effect of migrant concentrations on burglary, the results showed no overall effect. Contrastingly, in a large metropolitan city on the south-eastern coast of China, Chen et al. (2017) studied the effect of the migrant population on crime and found that areas with more migrants tended to have more burglaries, especially when the migrants are from other provinces.

Similar to the current situation in China (and not dissimilar to the historical patterns of racial segregation in nations like the US, Canada and Australia) in South Africa during the apartheid era the majority Black African population was forced to reside in designated areas and they often travelled long distances to work. Although the laws enforcing racial residential segregation have subsequently been abolished, the pattern of circular labour migration persists, with large numbers of labour migrants residing temporarily in the city while returning periodically to their rural households (Collinson et al., 2003). In need of affordable accommodation, the labour migrants often live in the poorest parts of the cities, specifically in informal settlements. In line with social disorganisation theory, the high levels of residential mobility may reduce the levels of informal social control and social trust which in turn may increase criminal activities. When testing social disorganisation theory in Tshwane, South Africa, Breetzke (2010b) found residential mobility, measured as the percentage of residents that moved during the previous five years, to be one of the primary determinants of the rates of violent crime. In contrast, Swart et al. (2016) found that the same measurement was not significantly related to homicide rates in neighbouring Johannesburg. One explanation for this is the authors' use of different data sources. While Breetzke (2010b) used

crime data recorded by the South African Police Services, Swart et al. (2016) used mortality data from the National Injury Mortality Surveillance System. The latter researchers further argued that this non-significant result might be due to the large-scale urbanisation triggered at the end of apartheid, but in this case the destination was to the affluent neighbourhoods of Johannesburg, with the wealthier middle- and upper-class flocking to the economic hub of Sandton. Many of these new and affluent residents choose to reside in new residential developments in the form of enclosed housing estates with high levels of security. The result is a reduction in crime. A study across all police precincts in South Africa by Lancaster and Kamman (2016) included tenure status as a measure of residential mobility and they found the increased percentage of people renting their properties had a significant effect on the 10-year average murder rate per precinct.

2.3.4 Racial or Ethnic Heterogeneity

In the developing context the variables used to operationalise racial or ethnic heterogeneity most often include measures based on race, language or country of birth, similar to studies undertaken in the developed context. However, the results of studies examining the effect of ethnic or racial heterogeneity on crime patterns in the developing context differ considerably. For example, de Melo et al. (2017) and Escobar (2012) found measures of racial heterogeneity not to be significant regarding their association with crime in Latin America. According to Gilbert (2017) Latin American neighbourhoods are less segregated than those in North America and South Africa where racial-residential segregation is commonly associated with poverty and deprivation and hence social disorganisation (Jones-Webb & Wall, 2008; Lockwood, 2007; Strom & MacDonald, 2007). In Bogota, Colombia, Escobar (2012) found a measure of the percentage of residents belonging to an ethnic minority not to be significant in relation to homicide. She argued that measures of racial heterogeneity are not commonly applied to examine the occurrence of crime in Colombia because the concept of racial diversity tends to be less controversial in Colombia compared to the US. Moreover, the population of Bogota is largely homogeneous in terms of race, where only two per cent of the residents belong to a minority group.

China is similarly homogeneous regarding race and the measures of diversity often tend to focus on the presence of immigrants or foreigners instead of the different races

in a community (Chen et al., 2017; Zhang et al., 2007). The results of most of these studies show no significant association between crime and ethnic diversity (Chen et al., 2017; Xiong, 2016). In Malaysia, a country with a multi-ethnic, multi-religion and multi-lingual population, Marzbali et al. (2014) examined patterns of social cohesion among the different ethnic groups in a high-crime neighbourhood and found that multiracial communities were not generally associated with lower levels of social disorganisation. On the other hand, Zakaria and Rahman (2017) measured ethnic heterogeneity as the percentage of non-citizens in their study of crime in different districts of Malaysia and found that the greater the percentage of non-citizens the greater the rate of violent crime rate.

South Africa, known colloquially as the 'Rainbow Nation', is a multilingual and ethnically diverse country. There are eleven official languages with some 80% of the population speaking an African language as their home language. The country is still racially divided, largely because of the controversial history of spatial racial segregation previously forced upon the people by the apartheid government (Durrheim, 2005). Since the abolition of apartheid in 1994, non-Whites are no longer forced to reside separately outside the main urban centres, but racial segregation remains a fundamental divide in the South African society, partly because of the high levels of income inequality that limit economic advancement and inhibit racial desegregation (Christopher, 2001). Similar to countries in the developed world, such as, Canada, the US and Australia, in South Africa where race is synonymous with enforced political residential segregation it is difficult to separate the concepts of race and deprivation when determining their effects on crime.

Roughly 96% of the prison population in South Africa are non-White (Ward et al., 2012) and young Black men are most likely to be victims of crime (Ratele, 2013). Demombynes and Özler (2005) found a high positive relationship between racial heterogeneity (measured as the percentage of different race groups) and all types of crime at the police precinct level across the country. However, Breetzke (2010a) could find no single variable that was significantly associated with crime across all of the race models, indicating no one cause of crime in suburbs stratified by race. A strong overall association was nevertheless found between African immigration and increasing crime rates.

Consistent with findings in the developed context, several studies in South Africa have reported disproportionately high levels of crime in neighbourhoods where the Black

African population was formerly forced to reside, so-called 'township' areas. This confirms the difficulty of separating the independent effects of race on crime without considering the effects of race-based residential segregation. In Johannesburg Swart et al. (2016) measured racial heterogeneity using the percentage Black residents and found that neighbourhoods with higher concentrations of Black residents had higher crime rates. Similarly in a later study in Tshwane Breetzke (2018) examined the concentration of urban crime and found violent and sexual crime to concentrate in Black African neighbourhoods.

2.3.5 Urbanisation

Large-scale urbanisation occurred much later in cities in the developing world than in the developed world, mainly due to the rapid industrialisation in the 19th century in Western Europe. In the developing world, recent rapid urbanisation is driven by several factors, including population growth (Tacoli et al., 2015), displacement caused by conflict (Arias & Montt, 2017; Escobar, 2012), and poverty (Malik, 2016). Migrants seek better opportunities in urban areas, but these large-scale movements of population from rural to urban centres have detrimental effects that could increase the risk of crime (Arias & Montt, 2017; Muggah, 2012). Researchers in developing countries such as Malaysia (Ishak & Bani, 2017; Soh, 2012), the Philippines (Sanidad-Leones, 2006), India (Malik, 2016), Pakistan, (Ashiq, 2015), Turkey (Yirmibesoglu & Ergun, 2007) and South Africa (Blackmore, 2003) have investigated the linkage between urbanisation and crime with most of their studies showing a significant and positive association between increased levels of urbanisation and crime. Gaviria and Pagés (2002) studied patterns of crime victimisation in 18 Latin American cities over a three-year period and found that victimisation rates were higher in larger cities and that rapid urbanisation was associated with considerable increases in crime. Indeed, the risk of falling victim to crime was twice as high in a city of more than one million inhabitants than in a city of less than 20 000 inhabitants. It is noteworthy that victimisation rates changed little once the one million threshold was surpassed.

According to the United Nations (2015a) new migrants usually settle in substandard or illegal housing in open spaces and on the periphery of cities in the developing world. These informal settlements, also called slums or favelas, occur all around the world but are prevalent in the developing world. People living in these informal settlements experience increased deprivation, discrimination and socio-economic exclusion and,

combined with the absence of basic services and overcrowding, often experience high levels of social disorganisation and crime (Mitlin & Patel, 2014). While measures of the distance from the city centre have been applied in studies in the developed world, such a measure of urbanisation would quite likely produce skewed results in large parts of the developing world where the poorest areas tend to exist on the periphery of cities (United Nations, 2015a). Consequently, several studies in the developing context have tested measures of the quality of housing, specifically slum or informal housing structures as measures of urbanisation and found that these variables exhibit significant and positive associations with crime (Ceccato et al., 2007; Lancaster & Kamman, 2016; Swart et al., 2016; Yirmibesoglu & Ergun, 2007).

Africa has the highest rate of urbanisation in the world, mainly because of its alarming overall rate of population growth (Tacoli et al., 2015). Large-scale unplanned urbanisation is a dilemma comparable with unemployment, deprivation, insecurity and crime that erode the socio-economic benefits that urbanisation can bring (Cobbinah et al., 2015). South Africa is no exception with its cities being among the most unequal and spatially segregated in the world. The abolishment of apartheid in 1994 triggered large-scale unregulated urbanisation to the major urban centres accentuating the segregated space even more with informal housing continuing to grow as people increasingly migrate from rural areas in search of better urban opportunities (Turok, 2014). Blackmore (2003) studied crime across South Africa and noted the degree of urbanisation to be a critically significant determinant of almost all types of crime in the country, while Sherriff et al. (2015) compared urban with rural mortality rates in two provinces of South Africa and established homicide to be significantly more prevalent in the urban areas.

Other measures of urbanisation such as population density have often been used in the developing world context with mixed results (Da Silva, 2014; Demombynes and Özler, 2005; Escobar, 2012; Lancaster & Kamman, 2016; Yirmibesoglu & Ergun, 2007). In Istanbul, Turkey, Yirmibesoglu and Ergun (2007) analysed the spatial distribution of crimes in 32 districts and found that the crime rates were higher in districts with rapid population increases, greater numbers of households and higher population densities. However, in Bogota Escobar (2012) found population density to be negatively associated to homicide rates. In South Africa Demombynes and Özler (2005) found population density to be positively associated with property crime levels. The examination of Lancaster and Kamman (2016) of the associated risk of murder with selected demographic characteristics in police precincts in Johannesburg, revealed that population density and the number of households living in informal dwellings significantly affect the murder rate.

2.4 CHAPTER SUMMARY

This chapter has highlighted the results of research in both the developed and developing world in which social disorganisation has been the guiding theoretical framework. The review is not exhaustive but highlights the general trends and findings in the literature regarding the spatial distribution of crime in the two vastly different developmental contexts.

The variables used to measure the same structural characteristic of social disorganisation theory are markedly different in the two contexts. For example, in the developed context the measures applied as proxies for socio-economic deprivation often involve level of education (Jones-Webb & Wall, 2008; Porter & Purser, 2010; Sun et al., 2004), level of employment (Lowenkamp et al., 2003; Martinez et al., 2010) and indicators of welfare benefits provided by the state (Bruinsma et al., 2013; Lockwood, 2007; McCall & Nieuwebeerta, 2007; Thompson & Gartner, 2014). In the developing context, however, the proxies for socio-economic deprivation often include measures of household facilities and the provision of local government services like potable water supply, sanitation services, refuse removal as well as sources of energy used for cooking, lighting and heating (Breetzke, 2010b; de Melo et al., 2017; Escobar, 2012; Zakaria & Rahman, 2017). Scholars in the developing context have also included context-appropriate variables not commonly applied in the developed context, for example the population experiencing hunger due to lack of money (Escobar, 2012) or public illumination and paved roads (de Melo et al., 2017). In the developed context racial heterogeneity has been proven to play a significant role in the occurrence of crime. In contrast studies in developing contexts have exhibited fundamentally different outcomes. For example, the effects of ethnic or racial heterogeneity on crime in Latin America and China have been shown to be mostly non-significant (Chen et al., 2017; de Melo et al., 2017; Escobar, 2012; Xiong, 2016). The reason for this is usually given as racial homogeneity in these countries.

A considerable number of discrepancies were also highlighted regarding the ways in which the structural neighbourhood characteristics of social disorganisation theory are defined and operationalised. Importantly, these discrepancies are not limited to studies situated in the developed compared with those in the developing world, but also *within* the two contexts themselves. For example, a variety of variables can be used to measure socio-economic deprivation, namely data pertaining to either income, education, employment or service delivery. Information related to household moves or tenure status

can represent residential mobility. Similarly, family disruption can be measured using either marital status or the gender of the household head, while ethnic heterogeneity can be measured using racial or linguistic variability or be based on the country of origin. Researchers have to use their discretion to choose any combination of the above variables to represent the main tenets of social disorganisation in their research.

The various independent variables applied as proxies for the central tenets of social disorganisation theory have also been shown to affect the results regarding their relationship with crime. For instance, when ethnic heterogeneity has been measured as the proportion of different racial groups in an area it has most often been found to increase crime rates (Krueger et al., 2004; Lanier & Huff-Corzine, 2006; Law & Quick, 2013; Sampson & Raudenbush, 2004; Thompson & Gartner, 2014), whereas measures of immigration have most often been found to reduce crime rates (Allen & Cancino, 2012; He et al., 2015; Martinez et al., 2010). Researchers have frequently combined several variables in indices representing one or more of the central tenets of social disorganisation (Lockwood, 2007; McCall et al., 2010; Nieuwbeerta et al., 2008; Strom & MacDonald, 2007; Triplett et al., 2005; Weijters et al., 2009). Besides the likelihood that combinations of variables can disguise the effect of the individual variables, the lack of consistency regarding the combinations or groupings of variables makes comparisons with other research findings difficult, if not impossible.

These issues raise questions regarding the most appropriate way to define and measure social disorganisation theory, particularly in the developing context? And how should these variables be operationalised? More specifically, how should social disorganisation be measured in Khayelitsha, one of the most deprived and marginalised communities in South Africa and indeed the world. The next chapter provides contextual background regarding the township of Khayelitsha, and details the extreme levels of crime in this unique South African environment. In the following chapters the notion that the variability in operationalising social disorganisation would result in inconsistent findings is tested in Khayelitsha. Thereafter a possible solution to this problem is proposed by using variables defined according to ISO standards, to test social disorganisation and crime across two diverse international contexts (namely Khayelitsha and Fort Lauderdale).

CHAPTER 3: STUDY SITE

3.1 BACKGROUND

The township of Khayelitsha – ironically meaning *new home* in isiXhosa – was artificially established in 1983 under the former apartheid government of South Africa. The apartheid government aimed to strictly control the urbanisation of the majority non-White population by regulating and restricting land ownership (Cole, 2013; Du Plessis, 2014). By enforcing the Group Areas Act of 1950 the racial composition of geographic areas was prescribed, justifying the subsequent enforced racial segregation of South African cities (Dugard, 1980). Under the Bantu Homelands Citizenship Act of 1970 the government established 10 ‘independent’ homelands within the borders of South Africa. These homelands were located far from major urban centres and non-White South Africans were only allowed to be legal citizens of these homelands, designated to them based on their particular racial group. Non-White South Africans could only reside outside the homelands in cities as temporary urban citizens and under the condition that they were formally employed. They then had to work as foreign labourers on temporary work permits, and were forced to regularly go back to the homelands to renew their work permits (Dugard, 1980). The brutally enforced pass laws required non-Whites to carry identification documentation at all times to prevent any unauthorised migration or settlement, in effect creating a cheap and highly controlled and mobile workforce (Jürgens et al., 2013; Turok, 2014).

As a result, non-White South Africans were geographically marginalised and, for a long time, remained largely hidden from the White population and the rest of the world (Jürgens et al., 2013; Ugur, 2014). In the country’s urban areas, the White neighbourhoods were situated favourably close to the city centre and in attractive localities, while other peripheral localities were officially designated to be occupied by the majority non-White population (Cole, 2013; Turok, 2014). These peripheral neighbourhoods were often referred to as ‘townships’, a term that originated during the

apartheid era. These so-called townships had a distinct dormitory character (O'Regan & Pikoli, 2014; Turok, 2014) with the temporary citizens periodically migrating back to the rural homelands where they had their primary and legal residence.

Khayelitsha is one such township created during apartheid mainly for the Black African population. The design of Khayelitsha is typical of the apartheid era and characterised by rudimentary infrastructure, very few recreational and green spaces, limited commercial and transport services and substandard housing (Brunn & Wilson, 2013). During the first phase of the construction of the township in 1983, small tin huts were erected on one thousand plots of 170 m² each. Only one tap was provided to be shared between four plots and one bucket toilet per house (Cole, 2013; O'Regan & Pikoli, 2014). The township was originally intended to be home to approximately 120 000 people. However, due to the failed attempts of the government to effectively control and enforce the influx of migrants, by 1985 the population had already mushroomed to over 150 000 residents (O'Regan & Pikoli, 2014). As the population continued to grow, large numbers of people were accommodated in temporary shelter, including tents or temporary shacks (Seekings, 2013).

The socio-spatial design of Khayelitsha was opposed by various parties. The Chamber of Commerce argued primarily against its location with respect to access to the city and the lack of services (Cole, 2013). It was also criticised by scholars at the time, notably prominent town planners Professors David Dewar and Vanessa Watson from the University of Cape Town. They strongly opposed the plans for the township and warned of excessive construction costs with regards to the transportation of building materials and the provision of services as a result of the township being located approximately 30 kilometres from Cape Town. Moreover, they predicted a disastrous future for the township and warned that Khayelitsha had very little chance of becoming a viable, sustainable living environment, while lacking the necessary residential, recreational and commercial elements (O'Regan & Pikoli, 2014). The isolated nature of the township restricted not just the settlement patterns of the residents, but also their movement. With very few employment opportunities, residents were forced to commute long distances on a daily basis to and from work. This created not only additional financial costs to an already deprived community, but also detrimental social costs as a result of parents being forced to be absent for long periods of time from their homes, leaving children unsupervised, resulting in the destruction of family and community life (Cole, 2013).

More than 25 years into democracy the legacy of apartheid's spatial planning policies continues to haunt artificially created townships such as Khayelitsha. Rapid urbanisation and the concomitant inability of local government to respond to the growing migration have resulted in the township gradually devolving into an increasingly informal and underserviced area, with population numbers far exceeding the number originally planned for (Ugur, 2014). There are still few recreational and retail infrastructures available in the township and few formal job opportunities. Residents are still required to commute long distances in order to access employment and retail nodes. Khayelitsha remains a peripheral and isolated township which has not become integrated into greater Cape Town (Brunn & Wilson, 2013).

The World Economic Forum (2016) recently classified Khayelitsha as one of the five biggest slums in the world.¹ According to the United Nations (2015a) slums are characterised by low-quality housing, overcrowding, poor facilities and vulnerable or hazardous living environments. Khayelitsha is also growing at an alarming rate of approximately two per cent annually (Statistics South Africa, 2001, 2011). There is increasing concern that this unplanned growth has significant implications for the township in terms of its long-term sustainability, despite various government interventions and relief efforts.

3.2 LOCATION

Khayelitsha is situated approximately 30 km south-east of Cape Town (34.0-34.07 degrees South, and 18.63-18.72 degrees East) in the Western Cape province of South Africa (see Figure 3.1). The township is bordered by False Bay (the Indian Ocean) in the south, the Coloured townships of Mitchells Plain in the west and Macassar to the east.

¹The other slums include Kibera in Nairobi, Kenya, Dharavi in Mumbai, India, Neza in Mexico City, Mexico and Orangi Town in Karachi, Pakistan.

The national highway (N2) forms the northern border and a wetland provides a barrier and limits further development towards the north-eastern side of the township. The Khayelitsha census suburb covers approximately 40 km². The largely inhabited area consist of 28 sub-places, and 583 census small areas, which covers roughly 26 km². A sub-place is the second lowest spatial division or place category for census data and are akin to suburbs, while the census small area level (SAL) are the smallest geographical unit at which Statistics South Africa legally disseminates spatial information.

A railway line runs lengthwise through Khayelitsha and there are four railway stations located in the township (see Figure 3.2). Rail services are, however, often suspended due to vandalism, leaving commuters frustrated and reliant on taxi services which are more expensive (Hadders, 2019). It is also important to note that the taxi industry in South Africa is largely informal, unregulated and plagued by violence (Dugard, 2001). In a location like Khayelitsha taxis do provide a much needed opportunity of entry into the labour market which requires very low levels of skill.

The flat stretch of land on which Khayelitsha was constructed forms part of an extensive dune and wetland system which was levelled to create space for the new township (see Figure 3.2). The dunes and wetlands are most pronounced in the north-eastern parts but are visible throughout the township, now populated with low-income housing and sprawling informal settlements. Khayelitsha is prone to seasonal flooding in the winter months of May to September. The dunes also tend to shift and cause unstable conditions for residents. During the dry summer months (October to February) these areas experience strong winds the effects of which are exacerbated in Khayelitsha because of the initial flattening of the protecting dunes, so causing further physical hardship and damage to poorly constructed homes (du Plessis, 2019; Goodness & Anderson, 2013).

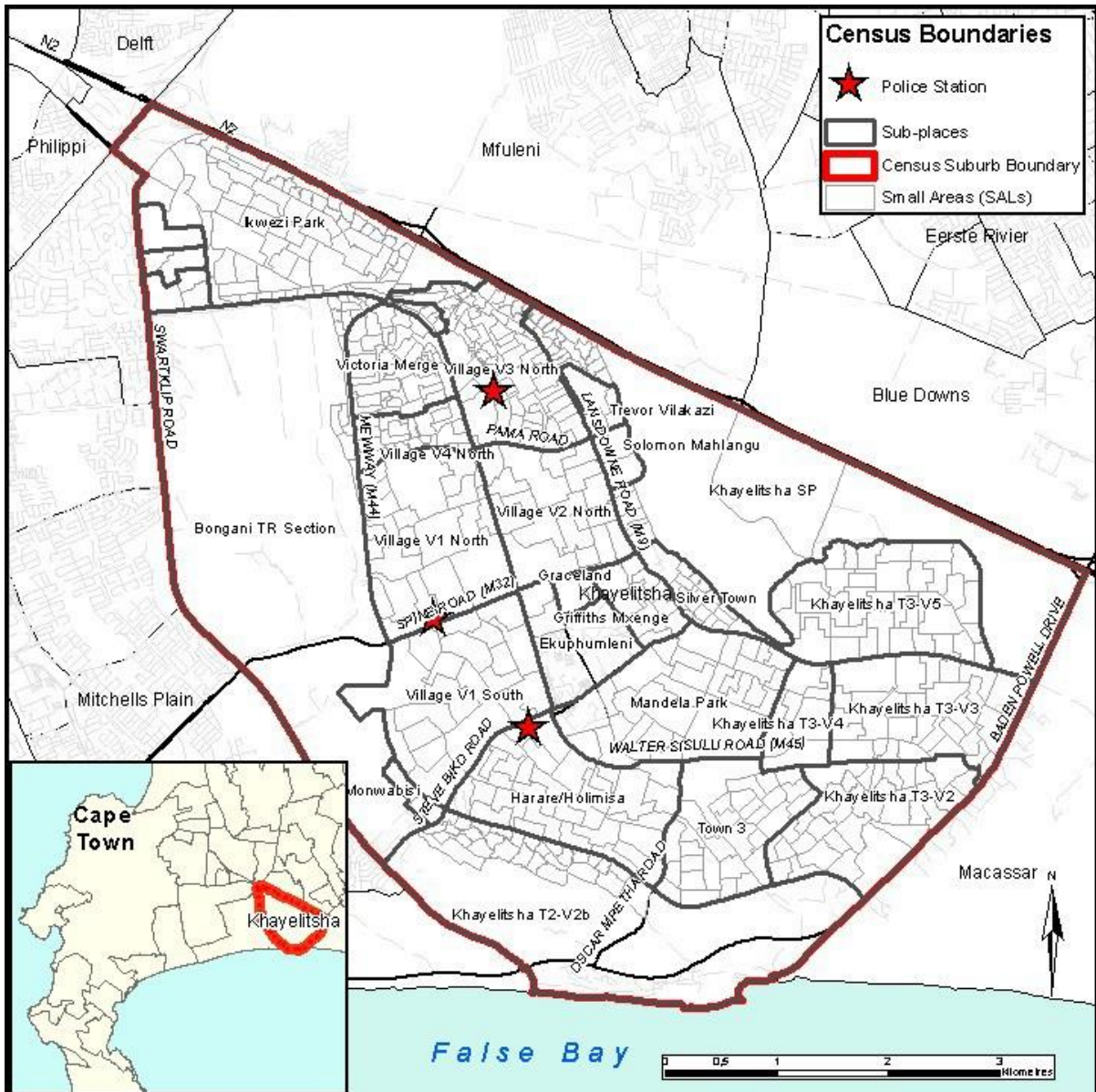


Figure 3.1: The location and layout of Khayelitsha

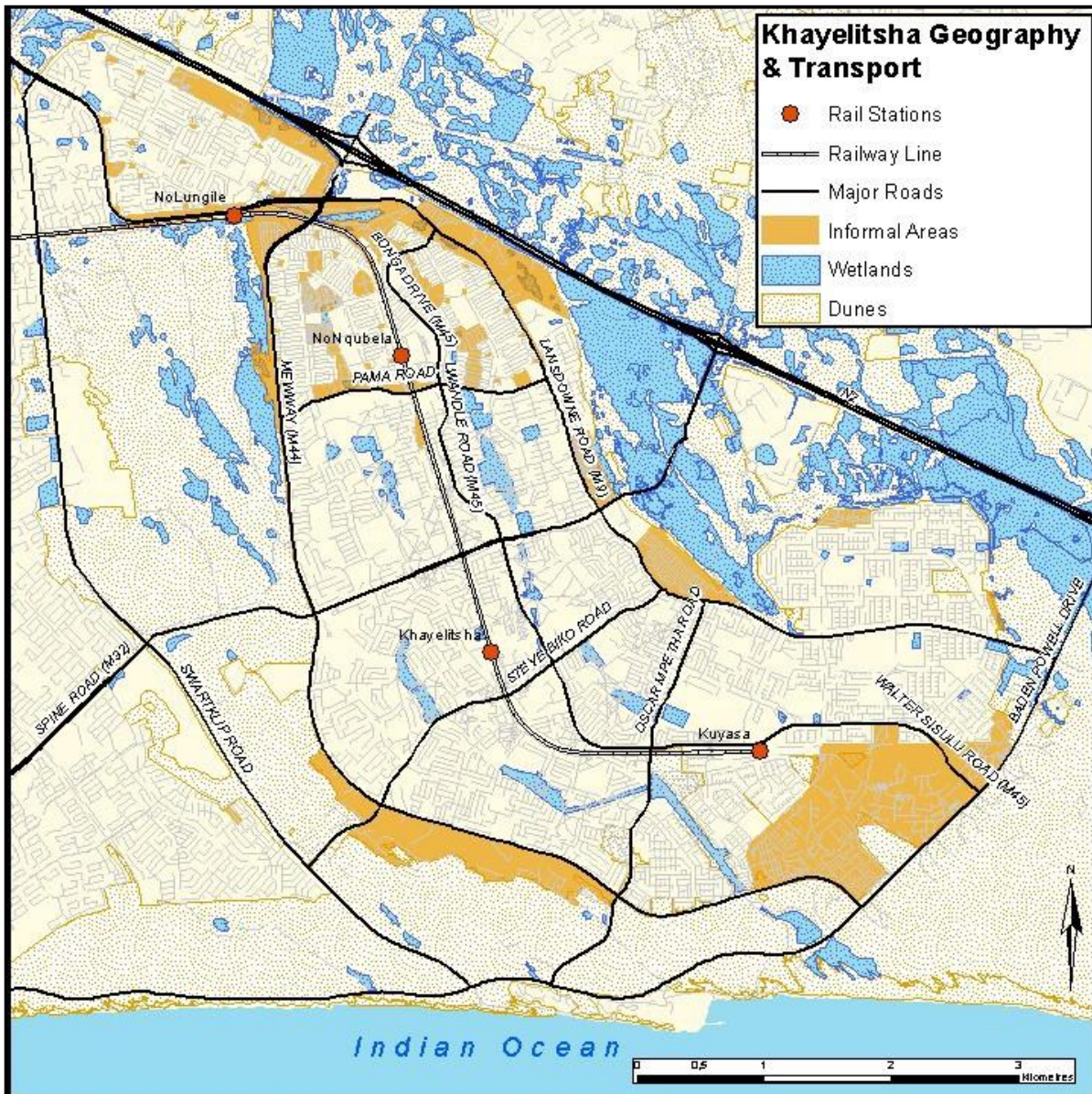


Figure 3.2: The physical geography and transport infrastructure of Khayelitsha

3.3 BUILT, SOCIAL AND ECONOMIC ENVIRONMENTS

Khayelitsha is home to around 400 000 inhabitants comprising roughly a tenth of the City of Cape Town's total population of 3.7 million inhabitants (Statistics South Africa, 2011).¹ In 2001 the population was estimated at 329 000 which implies a population growth of approximately two per cent annually. There have been several claims of much higher population figures for the township with estimates between 1 million and 1.6 million (Brunn & Wilson, 2013; O'Regan & Pikoli, 2014; Seekings, 2013). An accurate estimate of the population size is extremely difficult due to the high mobility of residents who periodically migrate back to other provinces in the country as well as because of the great number of residents living in informal housing without formal infrastructure or street addresses. The total population based on the census is however consistent with the numbers provided by several other organisations, namely registered voter data from the Independent Electoral Commission and data regarding the number of social grants paid in Khayelitsha in 2013 by the South African Social Security Agency (SASSA).

3.3.1 Built Environment

3.3.1.1 Housing

Khayelitsha is one of the most densely populated areas in South Africa with an average population density² of roughly 15 000 people per km² and a weighted population density per SAL of closer to 26 000 people per km². Rapid urbanisation and the inability of the government to cope with the growing housing needs of residents have contributed to the development of rapidly expanding informal settlements. Urbanisation is characterised by the gradual expansion of the surface area of the township, with most houses comprising single-storey stand-alone dwellings. Table 3.1 provides information about housing across the 583 SALs in Khayelitsha. Of the approximately 118 000 houses in Khayelitsha some 45% are formal dwellings and roughly 55% are informal dwellings (Statistics South Africa, 2011).

¹The 2011 census data is the most recent available in South Africa.

²The average population density for the inhabited 583 SAL's = $(391749/26\text{km}^2) = 15\ 067\text{km}^2$

Table 3.1: Descriptive statistics for housing and population density (Statistics South Africa, 2011; n = 583 SAL's)

	Mean	Std Dev	Min	Max
Density: Population (km ²)	26 440	16 397	43	114 285
Household size	3.2	0.6	1.9	4.5
Formal housing (Total %)	45.5	40	0	100
House on separate stand	43.7	39.4	0	100
Flat/room/semi-detached house	1.8	3.6	0	94.2
Informal housing (Total %)	54.5	40.0	0	100
Backyard shack (%)	8.2	11.4	0	78.3
Shack in informal settlement (%)	46.3	42	0	100

In South Africa slum housing or informal dwellings are referred to as shacks. (in squatter settlements or in backyards). Shacks are shelters generally made from corrugated metal sheets, used scrap metal and plastic. The formal housing is mostly situated in the older formal suburbs of the township built in the early to mid-1980s. These formal areas now also contain informal housing and informal backyard shacks (housing roughly eight per cent of residents) built in almost every formal plot. The renting out of backyard shacks provides additional income for residents of formal houses, most of whom live in severe poverty. The large informal settlements occur mostly around the fringes of greater Khayelitsha. Close to one third of all informal houses in greater Cape Town are located in Khayelitsha. The average household size of all dwellings in Khayelitsha is 3.2 people per house with household sizes in informal houses being generally smaller (2.7 persons per household) than in formal housing (roughly four people per household).

3.3.1.2 Access to Services

Service delivery in Khayelitsha is an ongoing challenge with many households without access to basic services. Table 3.2 shows the percentage of residents with access to various services. Only 62% of households have access to piped potable water in their dwelling or at least in the yard, while 38% of residents have to walk far distances to community stands to fetch potable household water or have no access to piped water at all.

Table 3.2: Descriptive statistics of access to services in Khayelitsha (Statistics South Africa, 2011; n = 583 SAL's)

Service	Mean	Std Dev	Min	Max
Access to piped water				
Piped water inside dwelling (%)	35.1	37.8	0	100
Piped water inside yard (%)	26.5	31.9	0	100
Piped water on community stand (%)	37.4	45	0	100
Other/ No access (%)	1	4.6	0	88.8
Access to toilet facility				
Flush toilet (%)	75.8	37.9	0	100
Chemical toilet (%)	3.4	14.5	0	100
Pit toilet (%)	1.2	7.3	0	100
Bucket toilet (%)	6.6	22.3	0	100
Other/ None (%)	13	30	0	100
Access to refuse disposal				
Removed at least once a week (%)	80.9	35.4	0	100
Removed less often (%)	1.4	9.3	0	98
Communal refuse dump (%)	11.2	28.9	0	100
Own or no rubbish disposal (%)	6.5	20.3	0	98
Source of energy for lighting				
Electricity (%)	80.9	31.5	0	100
Gas (%)	0.3	0.9	0	12.4
Other, including paraffin, candles (%)	18.6	31.3	0	100
None (%)	0.2	0.7	0	7.6
Source of energy for cooking				
Electricity (%)	75.2	31.4	0	100
Gas (%)	12	16.6	0	80
Paraffin, wood, animal dung (%)	12.5	22.9	0	100
None (%)	0.3	0.8	0	8
Source of energy for heating				
Electricity (%)	20.6	28.2	0	100
Gas (%)	3.4	7.6	0	74
Paraffin, wood, animal dung (%)	56.6	32.4	0	100
None (%)	19.4	17.9	0	95

With regards to sanitation only 76% of residents have access to a flush toilet, another eight per cent make use of bucket toilets or pit toilets and 13% (roughly 15 000 households) have no toilet at all. While the City of Cape Town has made thousands of shared communal toilets available in the township, they are neither cleaned nor maintained, leaving many in an unusable condition (O'Regan & Pikoli, 2014). Access to private, safe sanitary services is a basic human right, and while the lack of it is a source of much frustration, it also makes the community, specifically women, more vulnerable to crime (Jacobs, 2017; Winter & Barchi, 2016; Wrigley-Asante et al., 2016). This is illustrated in a study by Gonsalves et al. (2015) that found that forcing women to walk to toilets, drastically increases their risk of being a victim of sexual assault in the township. Roughly 20% of households in Khayelitsha do not have weekly refuse collection.

Almost 20% of residents have no access to electricity for lighting, 25% have no access to electricity for cooking and 80% do not have access to electricity for heating. These households make use of alternative energy sources such as gas, paraffin, wood or animal dung. Street lighting also remains problematic, with several high-mast lights installed but often not working (O'Regan & Pikoli, 2014). The lack of adequate lighting at night very likely contributes to the occurrence of criminal activity. In terms of household goods (not listed in the table), more than 35% of households in Khayelitsha do not own a refrigerator, 25% do not own a television and only nine per cent own a computer (Statistics South Africa, 2011).

3.3.2 Economic Environment

3.3.2.1 Income

The majority of residents in Khayelitsha live in extreme poverty, with the average income for a resident in Khayelitsha being approximately half of the mean household income for the rest of the City of Cape Town (O'Regan & Pikoli, 2014). Due to the sensitive nature of income information, census data in South Africa does not contain exact figures, only broad income categories. The lowest five categories are “no income”, R1 to R4 800, R4 801 to R9 600, R9 601 to R19,200, and R19 201 to R38 400. The last category translates to an average income of between R1 600 and R3 200 (US\$100-200) per month (Statistics South Africa, 2011). South Africa has three national poverty lines, ranging from an extreme food poverty line, a lower-bound to an upper-bound poverty line (R779 (US\$50) per month per person in 2011), and the latter

is the most widely used. The income levels for Khayelitsha are shown in Table 3.3. The average household in Khayelitsha is 3.2 people. An average monthly income of R779 multiplied by 3.2 people would amount to a poverty line of roughly R2500 (US\$150) per household per month. Accordingly, the majority of households in Khayelitsha, roughly 74%, live below the poverty line. Of the 74% of households who live in poverty, roughly 30% earn less than R600 (US\$40) per month, which is below the extreme poverty line¹ and another roughly 20% of residents earn no income.

Table 3.3: Descriptive statistics of income levels for Khayelitsha (Statistics South Africa, 2011; n = 583 SAL's)

Monthly income	Mean	Std Dev	Min	Max
No income (%)	18.8	9.41	0	63.7
R1 - R3 200 (%)	54.9	13.1	3.4	96
R 3 201 - R 6 400 (%)	15.1	6.1	0	42.9
R6 401 - R12 800 (%)	7.2	6.5	0	37.7
R12 801 or more (%)	4	6.7	0	47

3.3.2.2 Employment

Unemployment in Khayelitsha is rife. Only 65% of the working age population (between the ages of 15 and 64 years) are active in the labour force.² Table 3.4 provides information about employment status and shows that roughly 36% of the population of the township are unemployed. Of those who are employed, 70% are employed in the formal sector, which includes government, parastatals, registered non-governmental organisations (NGOs) and private businesses that are registered for income tax. Roughly 13% of the workforce are employed in the informal sector.³

¹The 'extreme' poverty line (R547 per person per month in April 2018), refers to the amount of money that an individual will need to afford the minimum required daily energy intake.

²According to the South African Reserve bank and Statistics South Africa a person is strictly defined to be unemployed only if they seek employment but cannot find a job. In practice, the strict definition of unemployment excludes discouraged work seekers and residents who are not economically active, regardless of whether they desire to work.

³The remaining 17% are unspecified.

Table 3.4: Descriptive statistics related of employment in Khayelitsha (Statistics South Africa, 2011; n = 583 SAL's)

Employment status (of labour force aged 15-64)	Mean	Std Dev	Min	Max
Unemployed (%)	36	15.2	0	90
Discouraged work seeker (%)	4.2	6.2	0	52.3
Other not economically active (%)	30.2	14.1	2.1	93.1
Employment sector				
Formal employment (%)	69.8	20.5	9	100
Informal employment (%)	13.1	12.5	0	81

The informal sector consists of businesses that are not registered for income tax, generally smaller in nature and seldom run from formal or rented business premises, but rather from homes or street pavements. They mostly involve retail and compete with many other informal vendors offering similar services and products (Freeman & Mc-Donald, 2015; Ugur, 2014). To establish and operate informal businesses are however extremely difficult in an environment such as Khayelitsha, with crime perceived to be one of the biggest hindrances (Bhorat & Naidoo, 2017; Cichello et al., 2011; O'Regan & Pikoli, 2014).

Youth unemployment is also extremely high with more than 50% of young men up to the age of 23 unemployed. Employment status differs by gender with a greater proportion of females (41%) unemployed compared to males (35%) (Statistics South Africa, 2011).

3.3.2.3 Education

The level of education among adults (aged 20 years and older) in Khayelitsha is low, with the average resident in Khayelitsha having attended school for only 8.5 years out of a possible 12 years (Statistics South Africa, 2011). Roughly 13% of the residents aged 20 to 24 years still attend school despite the final year of schooling ending when students are aged 18. Table 3.5 indicates the levels of educational attainment in the township. Only 30% of adults have attained a Grade 12 qualification (which is the final year of school in South Africa) and less than five per cent have a tertiary qualification. With these low levels of schooling Khayelitsha residents face poor prospects of finding employment in a labour market with few formal opportunities.

Table 3.5: Descriptive statistics related to education in Khayelitsha (Statistics South Africa, 2011; n = 583 SAL's)

Education	Mean	Std Dev	Min	Max
Secondary - Grade 12 (%)	29	8.8	0	74
Tertiary (%)	2	2.9	0	23

There are 33 public primary schools, 19 public secondary schools and three private independent schools in Khayelitsha. The occurrence of crime affects school attendance with previous research finding that schools may, in fact, be crime generators in the township (Breetzke & Edelstein, 2020). Children are forced to walk to and from school, and live in constant fear of being attacked while walking through the partially informal and underserviced areas, along informal footpaths and among densely packed buildings (Breetzke et al., 2019; Simons et al., 2018). Being robbed or attacked while en route to school is a common occurrence in the township and many children do not feel safe at school because of youth gangs (Freeman & McDonald, 2015; Gillespie, 2013; Mguzulwa & Gxubane, 2019).

3.3.3 Social Environment

3.3.3.1 Head of Household

Table 3.6 provides information related to family life in Khayelitsha. Shockingly, over 42% of households are headed by females, while four per cent of teenagers are pregnant. Less than one per cent (and exactly 339) of households are headed by minors (Statistics South Africa, 2011). Although the mean percentage of households headed by minors throughout Khayelitsha is low (0.3%), this figure rises to almost 10% of households in some neighbourhoods (Statistics South Africa, 2011).

Table 3.6: Descriptive statistics related to disrupted families in Khayelitsha (Statistics South Africa, 2011; n = 583 SAL's)

Disrupted families	Mean	Std Dev	Min	Max
Female-headed households (%)	42.1	8.5	18.9	72.4
Child-headed households, aged 0-17 years (%)	0.3	0.7	0	8.9
Teenage pregnancy (%)	3.6	1.3	0	9.8

The policies of apartheid not only led to the segregation of White and non-White communities, but also enabled the segregation and subsequent destruction of non-White families' social structure. The migrant labour system created a disenfranchised group of society, deprived of the rights of citizenship and excluded from having rights in terms of land ownership and employment. This forced caretakers and breadwinners to work far away from their families sometimes for prolonged periods of time, forcing families to live hundreds of kilometres apart and separating husbands and wives, parents and children (Emmett, 2003). Moreover, the apartheid government specifically targeted and restricted the settlement of Black African women in cities, arguing that it would encourage the permanent settlement of the Black African population in general (Cole, 2013). These ruthless policies destroyed the social fabric of family life and created highly dysfunctional and discontented communities throughout most of the country's townships, a trend that has continued more than 25 years into democracy.

3.3.3.2 Mobility

Khayelitsha, located in the Western Cape, has a highly mobile population with more than half of its residents being born in the adjacent Eastern Cape province (see Table 3.7). For a large number of its residents Khayelitsha serves as a gateway to the City of Cape Town. This has resulted in rapid and largely unmanaged urbanisation and has contributed to the township becoming partially informal with associated lack of basic services and overcrowding (Barolsky, 2016).

Apartheid laws restricting citizenship and travel have long since been abolished, but the patterns of labour migration persist. The migration patterns of Khayelitsha are consistent with the broader cyclical migration taking place in South Africa where residents frequently travel to and from township locations in search of employment (Turok, 2014). Although migration numbers are notoriously difficult to measure (Seekings, 2013), proxy measures of mobility exist, for example, tenure status. Accordingly, more than half of households in Khayelitsha live in a house which they own and is fully paid for while roughly 12% of households rent their dwelling, and 28% of residents occupy their home rent-free. According to the Department of Human Settlements (2015), the large proportion of households owning property is the a result of inheritance or state housing provision. Rent-free occupation often comprises a significant portion of the lower-income property markets, which include inadequate

housing types like ‘informal’ or ‘traditional’ dwellings. Moreover, information regarding tenure status of dwellings like informal houses and backyard shacks is often unreliable, with the occupants being uncertain whether they own the dwelling or the land on which it is built. The occupants might have paid for the building materials, but no formal rental agreement exists (Department of Human Settlements, 2015).

Table 3.7: Descriptive statistics of mobility (Statistics South Africa, 2011; n = 583 SAL’s)

Mobility indicator	Mean	Std Dev	Min	Max
Place of birth				
Western Cape (%)	42.3	12.9	4.7	87
Eastern Cape (%)	51.6	13.5	10	93
Other Provinces (%)	3.3	1.7	0	18.4
Outside South Africa (%)	1.5	1.6	0	12
Unspecified (%)	1.3	2.4	0	25
Dwelling tenure status				
Owned (%)	57	34	0	100
Rented (%)	11.5	13	0	100
Occupied rent-free (%)	27.5	34	0	100
Other (%)	4	12.8	0	98

3.3.3.3 Race and Language

Table 3.8 lists information about the language spoken and the population groups living in Khayelitsha. Regarding racial composition, the township is extremely homogeneous with almost 99% of the township population being Black African (Statistics South Africa, 2011). The township was originally designated for the Black African population and this racial group has remained dominant and unchanged since the end of apartheid. Khayelitsha is also linguistically homogeneous with isiXhosa being the most common home language (90%), followed by English (three per cent). A small proportion of the population speak other African languages, largely due to the migration of other Black foreign nationals into the area, but the largest proportion have migrated from the Eastern Cape where the predominant language is isiXhosa.

Table 3.8: Descriptive statistics of race and language (Statistics South Africa, 2011; n = 583 SAL's)

Language profile	Mean	Std Dev	Min	Max
isiXhosa (%)	90.5	8	9	99.6
English (%)	3.2	5.9	0	90
Other African Language (%)	3	2.1	0	19.2
Sign Language (%)	1.3	1.5	0	16.2
Afrikaans (%)	1.1	3	0	54
Other (%)	0.9	2.2	0	28.7
Population group				
Black African (%)	98.6	3.6	40	100
Coloured (%)	0.6	3.2	0	57
Indian or Asian (%)	0.1	0.2	0	1.5
White (%)	0.1	0.3	0	4.8
Other (%)	0.7	1.1	0	11

The next section provides an overview of crime in the township and examines the possible causes of crime in this environment.

3.4 CRIME IN KHAYELITSHA

According to the United Nations Office on Drugs and Crime (2018) the global murder rate is approximately six murders per 100 000 population. This varies between regions and countries with Western Europe, New Zealand, Australia and Canada, for example having murder rates of under two per 100 000 population, while the US, reputed to be one of the most violent countries in the developed world, had a murder rate in 2018 of five per 100 000. In the same year South Africa had a murder rate of approximately 36 incidents per 100 000, which is six times more than the global murder rate and 18 times that of Western Europe. Moreover, the type of crime committed in South Africa is exceptionally violent with the country having some of the highest rates of interpersonal and gender-based violence in the world (Altbeker, 2008; Holtzhausen, 2016; Seedat et al., 2009). According to the South African Police Service (SAPS) violent contact crimes against another person accounted for approximately one third of all serious crime reported in the country for the 2018/2019 reporting year.

Khayelitsha is plagued by exceptionally high rates of violent crime. In 2018/2019 Khayelitsha had a murder rate of over 80 per 100 000 people (Crime-Hub, 2018) which is more than double the national average and sixteen times higher than the global average. Figure 3.3 aids a comparison of the national, provincial and local (Khayelitsha) murder rates for 2009 to 2018. Over the ten-year period Khayelitsha's rates were consistently higher than that of the province and the country in general. There are three police precincts within the Greater Khayelitsha policing precinct, namely Khayelitsha Site B, Harare and Lingeletu-West. Together these precincts are among the most violent in South Africa. In 2018/2019 among the ten precincts with the highest murder rates in South Africa, Khayelitsha ranked third and Harare eighth respectively, and both were among the top ten most violent precincts in South Africa over the previous five years (SAPS, 2019).

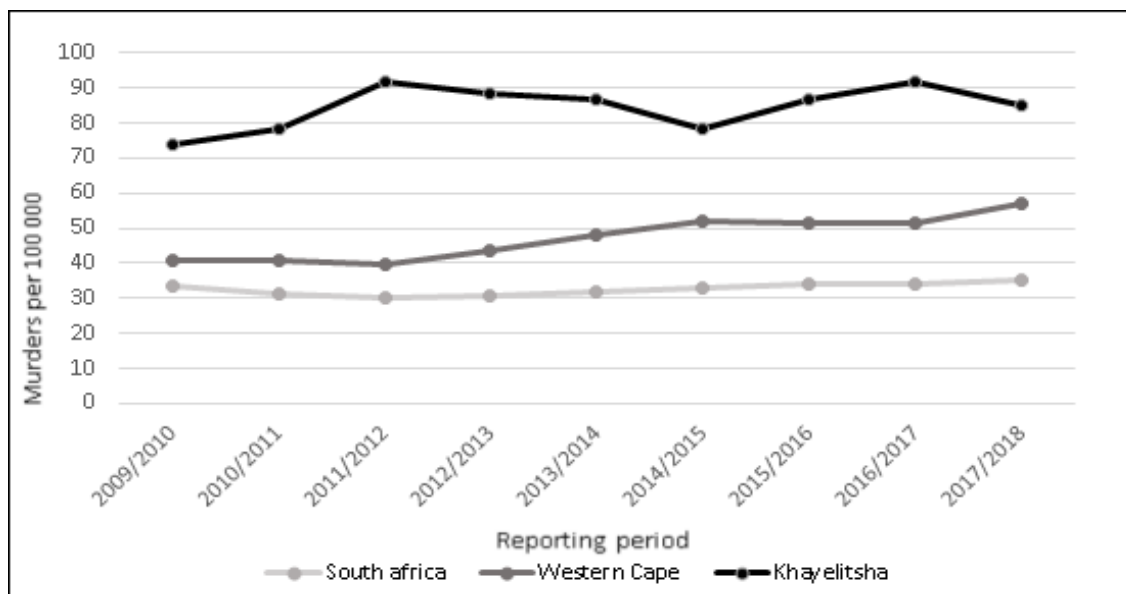


Figure 3.3: Murder rates per 100 000 population (2009 to 2018) (SAPS, 2019)

Crime in Khayelitsha reflects the remarkably violent nature of the country's crime scene. There are seven crime categories in the description of violent or contact crimes against a person¹ namely murder, attempted murder, common and serious assault, common and aggravated robbery and sexual offences. Assault entails the unlawful and intentional application of force to another person, while aggravated assault is committed with the intention to cause serious bodily injury. The aggravated robbery

¹There are 17 serious crime categories as reported by the SAPS.

category includes house, business and with a firearm or other instrument; sexual offences involve a range of offences against mainly women and girls, comprising any offence of an indecent nature, attempted sexual offences, sexual assault, rape and any unlawful sexual encounter with a child (SAPS, 2019).

Figure 3.4 shows violent crime as a percentage of all crime from 2009 to 2019 in South Africa, Western Cape and Khayelitsha. From 2009 to 2019 on average of 55% of all crime committed in Khayelitsha was violent (SAPS, 2019). This exceeds the national average of 35% and is well above the Western Cape provincial average of 30%.

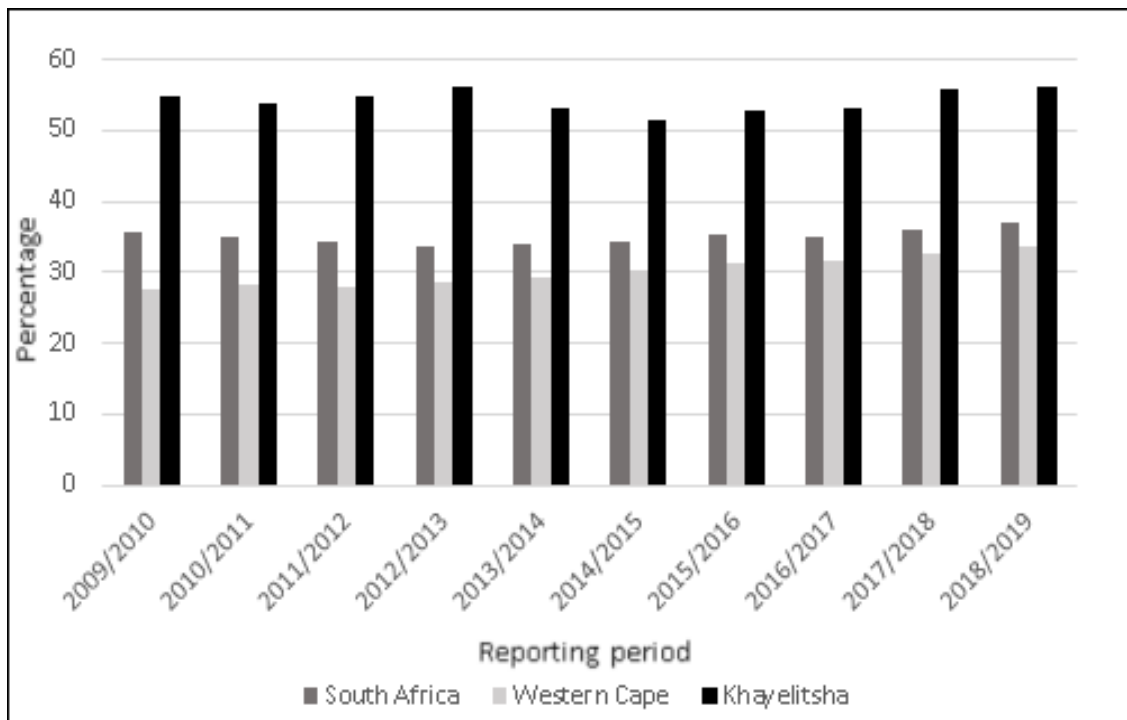


Figure 3.4: Percentage of violent crime: 2009-2019 (SAPS, 2019)

3.4.1 Formal Policing in Khayelitsha

In addition to the exceedingly high crime rates, it is disturbing that a large number of crimes in Khayelitsha remain unreported (Freeman & McDonald, 2015; Super, 2016; Ugur, 2014). Unfortunately, this is relatively common occurrence in developing countries where trust in the police is low and police efficiency and corruption are prevalent (Arias & Montt, 2017; Bergman, 2006; Blackmore, 2003; Frimpong et al., 2018). The relationship and interaction between the community and the police is reciprocal in which the police rely on the community to report crime and disorder while

the community relies on the police to maintain order and safety. The under-reporting of crime is one of the adverse effects of police inefficiency and it is estimated that roughly 40% of all crime in Khayelitsha remains unreported (Stone & Howell, 2019). This is largely due to the high levels of domestic violence, a fear of repeat victimisation, and a distrust in the police and their ability or willingness to solve crimes (O'Regan & Pikoli, 2014).

The lack of trust in the police in Khayelitsha has historical undertones. When the township was first established during the mid 1980s, it was a time of much political violence in South Africa. Individuals were forcibly moved to the township and as a result there were constant violent uprisings and conflict between residents and the security forces of the apartheid government (Jürgens et al., 2013; O'Regan & Pikoli, 2014). During the early years the South African Police of the apartheid government acted more like sentries keeping order and enforcing regulations in the township, and not focusing on the protection of residents (Super, 2016). After 1994 the new democratically elected government had ambitious intentions of transforming the police force into one focusing on crime prevention and community policing, and most notably initiated the National Crime Prevention Strategy (1996). The strategy proposed a holistic and integrated approach aimed at crime prevention and addressing broader socio-economic challenges as opposed to purely security issues (Department for Safety and Security, 1996). The strategy largely failed (Altbeker, 2007; Pelsler, 2007) and under mounting pressure from a population plagued by crime, subsequent policies shifted to reactive policing (Newham, 2005). The current residents of Khayelitsha continue to view the SAPS as corrupt and incompetent, and regard them not as protectors, but as aggressors. Indeed, the relationship with the police had deteriorated to such a point in Khayelitsha that a commission of inquiry was launched in 2012 to investigate allegations of police incompetence, corruption and brutality in the township (O'Regan & Pikoli, 2014). The commission concentrated on policing and issues surrounding police efficiency, but it also shed light on the extreme challenges of policing in the largely informal township. The findings revealed police performance to be unacceptably low with high levels of inefficiency, brutality, poor record keeping, and the underutilisation of available technology like GIS and CCTV surveillance cameras (Freeman & McDonald, 2015; O'Regan & Pikoli, 2014; Super, 2016).

One of the recommendations made by the Commission in their final report was to improve collaboration between the community and the SAPS through the use of community policing forums set up to allow more engagement with the community in

local policing matters. A recent survey conducted among Khayelitsha residents however found that more than 50% of participants were not aware of any active community policing forums and, those who were aware of and have attended community policing forum meetings, found them to unproductive and politically motivated (Freeman & McDonald, 2015). Furthermore, recommended neighbourhood watch programmes most often failed because police officers would be unavailable to accompany the residents, resulting in a continued mistrust in the police and a belief that the police are inefficient and corrupt (Manaliyo, 2016). Other recommendations from the commission included the construction of a new police station in Makhaza (which has to date not yet materialised) (Stone & Howell, 2019), the installation of additional street lighting and CCTV cameras, and the development of guidelines for policing informal settlements (O'Regan & Pikoli, 2014).

Poor implementation of recommendations made by the Commission in 2015 is largely due to political differences and interference in the process. For example, while the appointment of the commission of inquiry in Khayelitsha was supported by the premier of the Western Cape province, the then national Minister of Police (representing an opposing political party) objected to the appointment of the commission. After a lengthy court battle, the High Court of the Western Cape ruled that the inquiry should proceed. Once the inquiry was completed, in August 2015, the National Police Commissioner publicly dismissed the findings of the commission, while the Western Cape premier hailed the commission's findings and urged task teams to implement the recommendations. The opposing and inconsistent politically motivated messages from senior management and politicians provide some insight into the difficulty of policing and implementing the recommendations and taking any initiatives (Freeman & McDonald, 2015; Super, 2016). They also speak to the deep-seated systemic and political issues related to policing in townships in South Africa in general. Recent research shows that crime in South Africa predominantly concentrates in the townships (Breetzke, 2018), yet the unequal distribution of policing resources and limited police allocation in townships highlight the weaknesses of central and local government commitment to improved democratic governance (Stone & Howell, 2019).

3.4.2 Informal Policing and Gangsterism in Khayelitsha

The weak position of the police is further complicated by several forms of informal policing structures present in the township, namely street committees and taxi associations (Freeman & McDonald, 2015; O'Regan & Pikoli, 2014). Street committees are institutions that have been in existence in Khayelitsha since the apartheid era, when safety and security were not provided by the police but through structures aligned with the liberation movement. Anti-apartheid activists placed much emphasis on the collective strength of the suppressed community and viewed informal community-based policing as a good form of 'crime control' (O'Regan & Pikoli, 2014; Super, 2016). Today, these committees are still highly politicised and mostly aligned with the African National Congress (ANC) national government (Freeman & McDonald, 2015; Wilke, 2020). These committees consist of informally elected members and deal with residential problems, including crime. Rather worryingly, they usually serve as an informal or 'mob' justice system, with groups of ordinary community members physically punishing criminal suspects, often resulting in incidents of mob vigilantism (Gillespie, 2013; Super, 2016; Wilke, 2020). These informal community mechanisms were historically regarded as having substantial measures of success in terms of crime control and, while they are still generally viewed by residents as important structures in maintaining law and order, they have become weakened and often corrupt (O'Regan & Pikoli, 2014; Super, 2016). Furthermore, the tendency of residents to take the law into their own hands has had detrimental consequences, with crowds often violently overreacting to relatively small offences, while residents also take advantage of these mechanisms for personal gain (Kynoch, 2008; Stone & Howell, 2019; Super, 2016). In addition to street committees, taxi associations also provide a formidable alternative justice system in township settings. Taxi operators are largely viewed as being more effective than the police and are often approached by residents to help solve crime. They are, however, also widely feared, often involved in infighting among different taxi associations and a law upon themselves (Freeman & McDonald, 2015; O'Regan & Pikoli, 2014).

Youth gang violence is also a major policing challenge in Khayelitsha and a growing concern in the impoverished community where children join gangs to get access to material goods, but also to gain acceptance by peers and for protection (O'Regan & Pikoli, 2014). Although membership of a gang does provide some form of protection, it also makes the children targets for opposing gang members (Mguzulwa & Gxubane,

2019). Of greater concern is the fact that schools are often a feeding ground for crime and subsequent gang formation. A recent study by Breetzke and Edelstein (2020) found significant spatial clustering of violent crime around the schools in Khayelitsha. Mguzulwa and Gxubane (2019) investigated the impact of youth gang violence on the educational attainment of male high school learners in Khayelitsha and determined that the school learners joined gangs while aged between 14 and 16. The learners subsequently started performing poorly, failing grades or dropping out of school. Most of the participants felt that as gang members they had wasted their time and opportunities to attain a good education and, furthermore, they lost many friends due to violence while also being stigmatised within their communities. A study in townships by Christodoulou *et al.* (2019) compared youth arrests to the youths' level of education and found that young men who were less educated were more likely to have been arrested.

3.4.3 The Context of Crime in Khayelitsha

The broader socio-economic conditions in townships were, however, largely neglected by the commission of enquiry established in 2012. The unpacking of the numerous socio-economic issues in the township and their possible linkage to the high rates of crime has subsequently attracted the interest of increasing numbers of scholars, arguably because of the increased media attention. For example, Holtzhausen (2016) examined the social process of youth exposure to violence and living in a violent community such as Khayelitsha. Seventy-eight youths aged between 13 and 27 were questioned regarding their exposure to violent behaviour, including being threatened by and observing the use of physical force. The study revealed that a shocking 82% of young respondents had been exposed to some sort of violent behaviour which, in turn, put them at a higher risk of violent behaviour in early adulthood. Manaliyo (2016) examined barriers to community participation in crime prevention in Khayelitsha by conducting interviews with a wide range of participants including community leaders, ordinary citizens, and representatives of anti-crime organisations including SAPS, the street committees and neighbourhood watches. They found weak social control, a lack of unity and no sense of responsibility among the Khayelitsha community. Participants often blamed the parents of deviant children, while parents shifted the blame to the police and the police blamed the informal environment, insufficient resources and other forms of informal policing structures, among other reasons for the high rates

of crime. Similarly, when Barolsky (2016) examined the relevance of informal social control and collective efficacy and their roles in violence prevention in Khayelitsha, he found informal social control to be under severe strain.

Breetzke and Edelstein (2019) examined the spatial concentration and stability of crime hotspots in Khayelitsha and found, similar to international findings, that crime in Khayelitsha concentrates spatially and hotspots remained notably stable over an eight-year period. At the same time Edelstein and Arnott (2019) used point-level data to analyse the spatial patterns of murders and robberies in Khayelitsha and the findings provided evidence of several crime hotspots distributed throughout the township. In another study, Breetzke et al. (2019) examined the proximity of sexual violence to schools in Khayelitsha and detected marked spatial clustering of sexual crime around primary and secondary schools in Khayelitsha. Breetzke and Edelstein (2020) found further evidence of schools as prominent crime generators in the township when they compared the intensity of crime around potential crime generators, namely recreational hubs, transport interchanges and alcohol outlets. In the township environment where crime is rife and is extremely challenging to police, the identification of crime hotspots and crime generators can help to focus policing strategies and crime prevention.

An earlier study by Manaliyo (2014) investigated the underlying reasons or 'root causes' of crime in Khayelitsha by conducting interviews with residents and found poverty and unemployment to be perceived as the major reasons for high crime rates. Cichello et al. (2011) examined the responses to a survey conducted in Khayelitsha to explore labour market behaviour and also found concerns about crime to be the chief barrier to self-employment in the township. Such hindrances to self-employment exacerbate the already high unemployment rate, which has previously been shown to be associated with crime in South Africa (Blackmore, 2003; Breetzke, 2010b; Swart et al., 2016).

A number of attempts have been made to address the crime problems in Khayelitsha. One recent initiative is the Violence Prevention through Urban Upgrading (VPUU) programme (Trupe, 2016; Ugur, 2014). The programme is a collaboration between the City of Cape Town, the Western Cape Provincial Government, National Treasury, several other international agencies and NGOs. VPUU concentrates on creating and developing specific so-called 'safe-nodes' in areas identified as being characterised by higher crime rates, unemployment rates and levels of poverty compared to neighbouring areas. They have been involved in a variety of urban improvement and social intervention initiatives in Khayelitsha, specifically targeting unemployment and service delivery. For example,

the programme implemented the rezoning of land used by informal traders to legalise and formalise their trading space. The programme also involves the implementation of a GIS system that links the operation and maintenance of existing community water taps and toilets to the relevant municipal parties responsible for their ongoing maintenance (www.vpuu.org.za). Trupe (2016) has examined violent injury data obtained from health facilities and found that residents living in VPUU safe-node areas experience fewer and less severe personal injuries after its implementation, leading to some optimism regarding addressing the crime plaguing this community. Ugur (2014) evaluated the possibility of replicating programmes such as the VPUU initiatives in Khayelitsha in other vulnerable localities. She explored the complex and dynamic relationship between policy and practice in the fragile community and found whereas the policies were quite sound, the ground-level implementation of policies posed one of the biggest obstacles to the realisation of violence prevention in Khayelitsha.

3.5 CHAPTER SUMMARY

Khayelitsha is home to one of the most deprived and marginalised communities, not only in South Africa, but in the world. The vast majority of residents live on land unsuitable for housing (Goodness & Anderson, 2013) and/or in substandard informally constructed shacks, while many do not have access to basic services like water, sanitation and electricity (Statistics South Africa, 2011). Recent research confirms weak social controls and low levels of trust in this highly mobile community with its shocking numbers of broken homes, absent fathers and even child-headed households (Barolsky, 2016; Manaliyo, 2016). The breakdown of family life makes fragile youths more susceptible to concomitant youth gang violence (Mguzulwa & Gxubane, 2019). The dangerous environment elevates exposure to violent behaviour putting youths at greater risk of becoming the next generation of offenders, in a vicious cycle of life circumstances (Holtzhausen, 2016). Furthermore, the extreme poverty, high unemployment rates and low levels of education leave the residents with seemingly few opportunities and prospects of escaping their current circumstances. In this location, residents live in constant fear of becoming a victim of crime (O'Regan & Pikoli, 2014). This is a fear well justified and supported by annual crime statistics. The largely ineffective police force, suffering under unreliable and uncertain political support,

in combination with unchecked and informal policing structures, often with ulterior motives, has contributed to vigilantism, mob violence, gangsterism and, ultimately, to unmanageable crime (Freeman & McDonald, 2015; Gillespie, 2013; Stone & Howell, 2019; Super, 2016; Wilke, 2020).

The residents of Khayelitsha were purposefully neglected by the apartheid government (Cole, 2013; Du Plessis, 2014) but this neglect has continued under the democratically elected national government. The situation is dire and this long-neglected community is in desperate need of aid and assistance. An understanding of the causes of the extraordinarily high levels of violent crime in Khayelitsha has been formidably challenging with the seemingly obvious reasons like ineffective policing and deprivation rapidly becoming convoluted with deeper seated social and political issues linked to the complicated history in South Africa. Despite recent vital research into the causes and spatial patterning of crime, a more thorough theoretical understanding of crime and its underlying causes is imperative to inform the management of crime reduction. Social disorganisation theory, which involves the socio-spatial dimension of crime has been extensively tested in the developed world. The resultant production of a body of literature available now provide a sound theoretical framework within which crime can be studied in the developing context. But results yielded in the testing of complex social processes in different spatial locations are, however, often conflicting, especially so in the developing world. For this reason it is necessary to first examine crime in this unique context within the framework of social disorganisation. This exercise highlight the difficulties of using the theory as a framework as a result of the innumerable variables that can be selected to operationalise the theory.

CHAPTER 4: MEASURING SOCIAL DISORGANISATION AND CRIME IN KHAYELITSHA

* A version of this chapter has been accepted (pending minor revisions) for publication in *Methodological Innovations*. As a result, some sections may be repetition from previous chapters.

Groeneveld, G., & Breetzke, G. D.. The vagaries of variables: Towards a standardised approach for variable selection in spatial crime research. *Methodological Innovations*

4.1 INTRODUCTION

This chapter examines the socio-spatial dimension of violent crime in Khayelitsha by applying and testing the social disorganisation theory. The theory has its roots in the early to mid 1900s in the US and posits that levels of social disorganisation in a neighbourhood are linked to increased crime rates. Social disorganisation is determined by a combination of socio-economic characteristics of a place in recognition of the substantial role that place or location play in the occurrence of crime.

The notion that higher levels of social disorganisation within an area will increase the risk of crime has been tested by numerous researchers and shown to be contestably valid in a variety of international contexts, including the US (Kingston et al.,

2009; Polczynski Olson et al., 2009; Porter & Purser, 2010; Roh & Choo, 2008; Triplett et al., 2005); Canada (Andresen, 2006; Charron, 2009; Law & Quick, 2013); England (Sutherland et al., 2013); Netherlands (Bruinsma et al., 2013; Weijters et al., 2009); China (Zhang et al., 2007); Brazil (da Silva, 2014); Colombia (Escobar, 2012); Africa (Yahaya et al., 2013); Ethiopia (Kassahun, 2005); and South Africa (Breetzke, 2010b; Swart et al., 2016), among many others. However, the testing of the theory continues to yield conflicting results regarding the significance and type of associations found among the plethora of variables used to operationalise the theory. Given the variety of locations and contexts in which the research is conducted, some inconsistent results are indeed expected, but of greater concern is the considerable variation that exist with regards to the definition and application of the measures commonly used to represent the central tenets of social disorganisation theory.

While aiming to find relevant measures of social disorganisation in the context of Khayelitsha, this chapter examines:

- i) the way in which structural neighbourhood characteristics are defined and operationalised in the developing world context; and
- ii) the degree of subjectivity of model performance based on variable selection.

As a point of departure the same spatial regression models are employed, using separate sets of a variety of different variables, to demonstrate how the results of analyses can change depending on the variables selected. In some instances these results are dramatically different.

4.2 THE MEASUREMENT OF SOCIAL DISORGANISATION

Since its early genesis the conceptualisation and measurement of social disorganisation has proved to be a challenge (Bursik Jr, 1988; Kubrin, 2009) that has garnered the attention of researchers in their attempts to improve or adapt the theory (Bursik & Grasmick, 1993; Sampson & Groves, 1989; Sampson et al., 1997). Despite these efforts, social disorganisation theory has continued to be a prominent spatial theory of crime that has been tested extensively over the years and in numerous diverse contexts. This, no doubt, contribute to the highly differentiated manner in which

the central tenets of social disorganisation are selected, measured and defined.

The testing of social disorganisation theory involves the measurement of multifaceted structural neighbourhood characteristics, that often manifest in fragile and highly deprived social contexts. These characteristics represent complex social processes that are at the foundation of understanding social disorganisation and crime. There is little doubt that the process of creating simplified measures of social phenomena is a complicated one, which is evident in the variety of different ways in which variables have been operationalised to measure levels of social disorganisation within a community. These differences essentially reflect the subjective choices of researchers in identifying variables to measure a social disorganisation characteristic such as family disruption for example. Moreover, the epistemological assumptions of such research choices are that the variables have the capacity of producing accurate findings regarding social disorganisation and crime causation.

The following section highlights on the various variables used in previous research when operationalising the tenets of social disorganisation in both the developed and developing worlds respectively.

4.2.1 Operationalisation of Structural Neighbourhood Characteristics

Significant differences exist in the operationalisation of variables commonly applied as proxies for the central tenets of social disorganisation. Table 4.1 shows a selection of studies in developed world contexts in which social disorganisation theory has been the guiding framework. The list covers a variety of concepts used to characterise the tenets of the theory and shows the different ways of operationalising the five main characteristics.

Table 4.1: Variables for operationalising social disorganisation in developed contexts

Concept	Operationalisation	Source
<i>Socio-economic deprivation</i>		
Poverty	% Living below the poverty line	Martinez <i>et al.</i> , 2010; Polczynski-Olson, 2009; Roh & Choo, 2008; Strom & MacDonald, 2007;
	% Low family income	Law & Quick, 2013 Nieuwbeerta <i>et al.</i> , 2008;
	Median household income	Porter & Purser, 2010
	% Households with mid and high income	Sun <i>et al.</i> , 2004
	% Households with incomes in the top two income brackets	Lowenkamp <i>et al.</i> , 2003
Education	% Population with a Bachelor's degree	Porter & Purser, 2010
	% College graduates	Sun <i>et al.</i> , 2004
	% Secondary school education	Jones-Webb & Wall, 2008; Polczynski-Olson, 2009
Employment	% Professional or managerial positions	Lowenkamp <i>et al.</i> , 2003; Martinez <i>et al.</i> , 2010
	% Unemployed adult male population	McCall & Nieuwbeerta, 2007; Strom & MacDonald, 2007
	% Employed population	Sun <i>et al.</i> , 2004
<i>Residential mobility</i>		
Residential stability	% Resided in the same house for five years	Roh & Choo, 2008; Sun <i>et al.</i> , 2004; Martinez <i>et al.</i> , 2010
	% Residents (of 5-years and older) who lived in the same state but a different county a year before analysis was undertaken	Lanier & Huff-Corzine, 2006
	% Residents that were brought up in an area and within a 15-minute walk from home.	Sampson & Groves, 1989
	Number of years at current address	Mazerolle <i>et al.</i> , 2010
Tenure status	% Home ownership	Martinez <i>et al.</i> , 2010; Mazerolle <i>et al.</i> , 2010
	% Rental dwellings	Law & Quick, 2013

Table 4.1: Variables for operationalising social disorganisation in developed contexts

Concept	Operationalisation	Source
<i>Family disruption</i>		
Household head	% Female headed households with no spouse present and with children younger than 18	Lanier & Huff-Corzine, 2006; Roh & Choo, 2008
	% Female headed households with no spouse present and can include households headed by grandmothers or other female caregivers	Strom & MacDonald, 2007
Marital status	% People that were separated, divorced, or single and had children in their household	Lowenkamp et al., 2003; Porter & Purser, 2010
	% Lone-parent families	Law & Quick, 2013
<i>Racial or Ethnic heterogeneity</i>		
Race	Proportion of Whites, Blacks, and American Indians within the county	Lanier & Huff-Corzine, 2006
	% Black	Porter & Purser, 2010
	Proportion of the population in a given racial group	Roh & Choo, 2008
	% Black and % non-Black	Strom & MacDonald, 2007
Immigrants	% Immigrants and % Aboriginal residents	Law & Quick, 2013
Language	Language diversity	Graif & Sampson, 2009; Zahnow et al., 2013
	Language spoken at home (English =1 and other = 0)	Wickes et al., 2013
	% Linguistic isolation (where no household member 14 or older spoke English)	Varano et al., 2009
<i>Urbanisation</i>		
Location	Location in relation to the city centre	Lowenkamp et al., 2003; Markowitz et al., 2001
Density	Population size and density (per square kilometre or square mile)	Graif & Sampson, 2009;; McCall et al., 2010; McCall & Nieuwebeerta, 2007
	Structural density	Bruinsma et al., 2013

Regarding socio-economic deprivation, some studies have used poverty as a proxy measure to describe economic deprivation (Roh & Choo, 2008), while others use the concept of socio-economic status which includes additional economic factors such as education and employment status (Bruinsma *et al.*, 2013; Charron, 2009; Sampson & Groves, 1989). Other studies have use broader concepts such as social-, economic or concentrated-disadvantage, often including measures of family disruption (Lockwood, 2007; McCall & Nieuwbeerta, 2007; Thompson & Gartner, 2014; Triplett *et al.*, 2005). Inconsistencies also emerge in the different concepts and/or combinations of concepts used to represent the structural characteristics of neighbourhoods. When testing social disorganisation theory, these inconsistencies contribute to the crucial differences in translating the proxies into quantitative terms for measuring the various structural neighbourhood characteristics.

Table 4.2 shows a selection from studies in developing world contexts in which social disorganisation theory has been the guiding framework. Although similar variables are often also used to operationalise the central tenets of social disorganisation theory in the developing context, a number of variables that are unique to the developing world are shown here. In this context there are underlying spatial urban anomalies where the spatial location of poorer neighbourhoods is typically different to the location of poorer neighbourhoods in the developed world. For example, unlike the US where immigrants settled in the industrial heart of large cities, the rural migrants of Latin America and Africa tend to settle on the outskirts of urban areas, leaving them socially and spatially isolated and marginalised (Lancaster & Kamman, 2016). In the developing context, large-scale informal housing is typically characterised by the complete absence of resources, limited facilities, poor services and overcrowding, or absolute deprivation (United Nations, 2015a), whereas in the developed context, there is usually some form of service delivery provision.

Table 4.2: Variables for operationalising social disorganisation in developing contexts

Concept	Operationalisation	Source
<i>Socio-economic deprivation</i>		
Poverty	% Poverty across regional communities	Cofie, 2016
	% Head of household with no income	Ceccato et al., 2007
	% Households with income less than half minimum wage	de Melo et al., 2017
	% Population who experienced hunger for one or more days due to lack of money	Escobar, 2012
	% Households below 20% of wealth index	Yahaya et al., 2013
	Poverty index calculated on asset indicators and classified as 'poor', 'moderate' and 'better off' (included ownership of household items like iron, clock, sofa, radio, TV, sewing machine, refrigerator, bicycle, car, telephone, and characteristics of the dwelling including toilet facilities, drinking water, rooms in the dwelling, dwelling materials used and energy sources)	Kassahun, 2005
Services/ Goods	Source of water, toilet facilities, refuse or rubbish removal and energy or fuel for lighting, heating or cooking combined to create a deprivation index (ranging from 0-1)	Breetzke, 2010
	% Households with electricity, a bathroom, public illumination, paved roads, open sewers and accumulated garbage	de Melo et al., 2017
	% Households with phone, electricity and sewerage service	Escobar, 2012
Education	% Population 15 years or older who is illiterate	Escobar, 2012
	Literate household heads (1) or not literate (0)	Kassahun, 2005
	% Low educational attainment (persons with less than Grade 12 aged 25 years and older)	Swart et al., 2016
Employment	Unemployment rate	Breetzke, 2010; Cofie, 2016; Swart et al., 2016
<i>Residential mobility</i>		
	% Residents who have changed residences in the past five years	Breetzke, 2010; Yahaya et al., 2013; Swart et al., 2016
	% Population who moved from a different town or a different country in the past five years	Escobar, 2012
Tenure status	% Homeownership	Kassahun, 2005
	% Renter-occupied dwellings	de Melo et al., 2017; Breetzke, 2010; Swart et al., 2016

Table 4.2: Variables for operationalising social disorganisation in developing contexts

Concept	Operationalisation	Source
<i>Family disruption</i>		
Household head	% Households with under-age children headed by a single, separated or divorced women	Escobar, 2012
	% Female-headed and child-headed households	Swart et al., 2016; Yahaya et al., 2013
Marital status	% Estranged or deceased fathers	Breetzke, 2010
	% Divorced persons aged 15 and older	Swart et al., 2016
	% Primary caretakers with a spouse or partner	de Melo et al., 2017
<i>Racial or Ethnic heterogeneity</i>		
Race	% Residents that are Black	Breetzke, 2010; Swart et al., 2016
	% Population who self-identified as belonging to an ethnic minority	Escobar, 2012
	% Ethnic diversity within communities	Cofie, 2016
	Ethnic heterogeneity index	de Melo et al., 2017; Yahaya et al., 2013
Immigrants	% Non-South African citizens	Swart et al., 2016
Language	Linguistic diversity index	Awaworyi Churchill & Laryea, 2019
<i>Urbanisation</i>		
Density	Population size and density (square kilometre)	Yirmibesoglu & Ergun, 2007
Dwelling type	Informal dwellings	Swart et al., 2016; Lancaster & Kamman, 2016; Yirmibesoglu & Ergun, 2007

- *Socio-economic deprivation*

Poverty has been generally defined as “the lack of sufficient means to enjoy a standard of living considered normal and acceptable in a given society” (Castree et al., 2013, 392). In studies of social disorganisation, poverty has been defined as either high or low household income (Law & Quick, 2013; Lowenkamp et al., 2003; Nieuwbeerta et al., 2008; Porter & Purser, 2010; Sun et al., 2004), and/or as living below a certain poverty line (Lanier & Huff-Corzine, 2006; Martinez et al., 2010; Roh & Choo, 2008). A poverty line refers to monetary thresholds below which one does not have the means required for food and basic needs (Statistics South Africa, 2018). It is noteworthy that the measurements of poverty applied in different contexts are dissimilar and poverty lines vary internationally with countries applying a unique threshold of poverty in their particular context and linked to their currency.

The operationalisation of poverty in the developing context has often reflected higher levels of economic deprivation and has included measures of low household income (Swart et al., 2016), households earning less than half of the minimum wage (de Melo et al., 2017), households earning below 20% of the wealth index (Yahaya et al., 2013) and population experiencing hunger due to lack of money (Escobar, 2012). In Kenya Kassahun (2005) created a poverty index with twenty-three asset indicators, including the ownership of household items like furniture and kitchen appliances, means of transport and characteristics of the dwelling, while in Colombia Escobar (2012) included measures of a lack of phone service to measure social isolation. Another popular way of denoting socio-economic deprivation in the developing context is the inclusion of measures of access to basic services, albeit with varying definitions like access to potable water, sanitation provision and refuse removal (Breetzke, 2010b; Escobar, 2012). Other variables pertain to access to bathrooms or households with open sewers and/or uncollected and accumulated garbage (de Melo et al., 2017). Additional operationalisations include the access to and the type of energy sources used (Breetzke, 2010b; de Melo et al., 2017).

Access to, and levels of education have also been used to represent socio-economic deprivation. In the developed world, measures have included the highest level of secondary (Jones-Webb & Wall, 2008) or tertiary education obtained (Porter & Purser, 2010; Sun et al., 2004). While operationalisations of educational attainment in developed-world studies often include the highest level of educational attainment, the developing context operationalisations range from percentage illiteracy (Escobar,

2012) to the percentage having obtained secondary school enrolment or less (Swart et al., 2016).

- *Residential mobility*

Sampson and Groves (1989) defined residential mobility as the percentage of people brought up in an area and living less than a 15-minute walk from home. Other ways in which this characteristic has been measured in the developed world include the number of years at a current address (Mazerolle et al., 2010) and the time of residence in the same house for a period of time (Law & Quick, 2013; Martinez et al., 2010; Roh & Choo, 2008; Sun et al., 2004). Other popular definitions involve tenure status (Law & Quick, 2013) or homeownership (Martinez et al., 2010; Mazerolle et al., 2010). The developing world definitions of residential mobility are similar to those applied in the developed context, and most often include measures of residential stability and tenure status.

- *Family disruption*

In both the developed and the developing world contexts family disruption has most often been defined in terms of the percentage female-headed households (Lanier & Huff-Corzine, 2006; Roh & Choo, 2008; Strom & MacDonald, 2007; Swart et al., 2016; Yahaya et al., 2013) and the percentage divorced or separated (Beaulieu & Messner, 2010; Escobar, 2012; Lowenkamp et al., 2003; Porter & Purser, 2010). A common variation is the percentage lone-parent households (Law & Quick, 2013; Wong, 2011).

- *Racial/Ethnic heterogeneity*

Racial or ethnic heterogeneity has most often been operationalised in both the developed and developing contexts as the percentage of a particular ethnic group, such as Black, White or American Indian population groups (Lanier & Huff-Corzine, 2006; Roh & Choo, 2008), while in other cases distinctions were only made between Black and non-Black residents (Porter & Purser, 2010; Strom & MacDonald, 2007). Alternatively, heterogeneity has been operationalised as the percentage of immigrants or minority race groups in a given area (Law & Quick, 2013; Martinez et al., 2010), or as language diversity measured in relation to the English language (Varano et al., 2009; Wickes et al., 2013).

- *Urbanisation*

Levels of urbanisation have been operationalised using widely varying definitions in the developed world, including the location of a neighbourhood in relation to the inner

city (Lowenkamp et al., 2003; Markowitz et al., 2001), the population size and/or the population density (Graif & Sampson, 2009; McCall & Nieuwbeerta, 2007; McCall et al., 2010), as well as structural density (Bruinsma et al., 2013). With rapid urbanisation and increasing informality in urban settings, the type or condition of the dwelling, have also been included in the developing context (Breetzke, 2010b; Ceccato et al., 2007; Lancaster & Kamman, 2016; Swart et al., 2016).

In summary, the operationalisation of the structural neighbourhood characteristics of social disorganisation theory are varied. It is understandable that the variables deemed more appropriate in the developing context can differ quite significantly from those applied in the developed context. While alternative and additional definitions may be more suitable in the developing environment, it is important to be aware that such definitions can alter the meaning of certain concepts, ultimately affecting the results of studies of social disorganisation, as is demonstrated below.

4.3 DATA

4.3.1 Unit of Analysis

A question commonly raised regarding the unit of analysis employed in spatial studies of crime concerns the appropriate definition of a neighbourhood. A neighbourhood has been defined as “an urban residential area, generally small enough to be covered easily on foot. It is sometimes assumed that neighbourhoods are also communities defined by social interaction or defined by geographical boundaries such as major roads, parks or rivers, but this need not be the case” (Castree et al., 2013, 338). The area defined as a neighbourhood has no operational boundary per se but in practice administrative census boundaries, school districts or even police precinct boundaries are often used in studies examining neighbourhood effects. Although these administrative boundaries are very appropriate and necessary for spatial analysis, they are often meaningless to the community residing in the study area as they represent administrative lines on maps and not real boundaries delineating social communities (Brunton-Smith et al., 2013; Kubrin, 2009; Sampson et al., 2002; Schnell et al., 2017; Weisburd & Amram, 2014).

Another question relates to the use of the neighbourhood as a proxy for individual or

group behaviour. In much the same way that variables are used to represent complex social processes, the neighbourhood is often used to represent the behaviour of a large group of random, unrelated people with their most obvious commonality, their place of residence. Apart from this difficulty of defining a neighbourhood as an operational space, there has been a general trend (more specifically in the developed world) of moving to a finer scale of analysis such as street segments. Indeed it has been illustrated that using too coarse a scale might actually obscure valuable information in crime patterns occurring at a finer level (Andresen & Malleson, 2011; Braga et al., 2011; Brantingham et al., 2009; Weisburd, 2015). The occurrence of crime hotspots and the finding that a few micro places may contribute to a disproportionate amount of crime, has highlighted the growing need for smaller data units or micro places to be used in spatial crime research (Andresen et al., 2017; Braga & Clarke, 2014). Despite the need for micro-units of analysis, such as street segments, it is simply not feasible in several developing contexts because large sections of the developing world are informal with no formal road infrastructure. This is also the case in Khayelitsha in which large areas of the township (roughly 55%) have no defined road network and consequently no street addresses (Breetzke & Edelstein, 2019).

The spatial unit of analysis used in this study is therefore small area level (SAL) census units. The SAL is currently the smallest unit of analysis at which Statistics South Africa can legally disseminate spatial information. The SAL layer was created in the 2011 South African census by combining all enumerator areas (previously the smallest unit of analysis) with a population of less than 500 with adjacent enumerator areas. There are 583 SALs in Khayelitsha. Two exceptionally large areas in the eastern part of the township had low population densities (43 and 293 people per km²) and were discarded for analysis purposes. The remaining 581 small areas were included in the analyses.

4.3.2 The Dependent Variable

Crime data for this study was obtained from the South African Police Service (SAPS). Information was obtained pertaining to the location, the date and the time of occurrence of all crimes in Khayelitsha from 2010 to 2012. The dependent variable in studies examining social disorganisation theory usually represents levels of delinquency or crime at a particular level of spatial aggregation. For this study a composite violent

crime category was selected for use as the dependent variable. Seven types of serious violent crimes were extracted from the crime data set namely murder, attempted murder, common assault, assault with intent to cause grievous bodily harm, common robbery, aggravated robbery and sexual offences. The data was aggregated to create a single category called violent crime. A three-year average (2010-2012) was calculated to minimise the impact of temporal fluctuations and to coincide with the most recent 2011 South African census data. Point crime data was aggregated to the 581 small area level (SAL) units of analysis and a crime rate per 1000 population was calculated as the dependent variable.

Figure 4.1 shows the violent crime rate per 1000 population from 2010 to 2012 in Khayelitsha (mean = 14.04). High crime rates, depicted in dark red colours, are concentrated in relatively few neighbourhoods, while the majority of neighbourhoods exhibit low (depicted in light red colours) or no violent crime averaged over the three years. It is striking that the informal areas (on the townships outskirts) all have low crime rates.

The subsequent analysis will attempt to explain these patterns using various spatial analysis techniques. Spatial regression analysis models the association between a dependent variable (crime) and various selected independent variables representing structural neighbourhood characteristics in Khayelitsha. The independent variables are detailed in the following section.

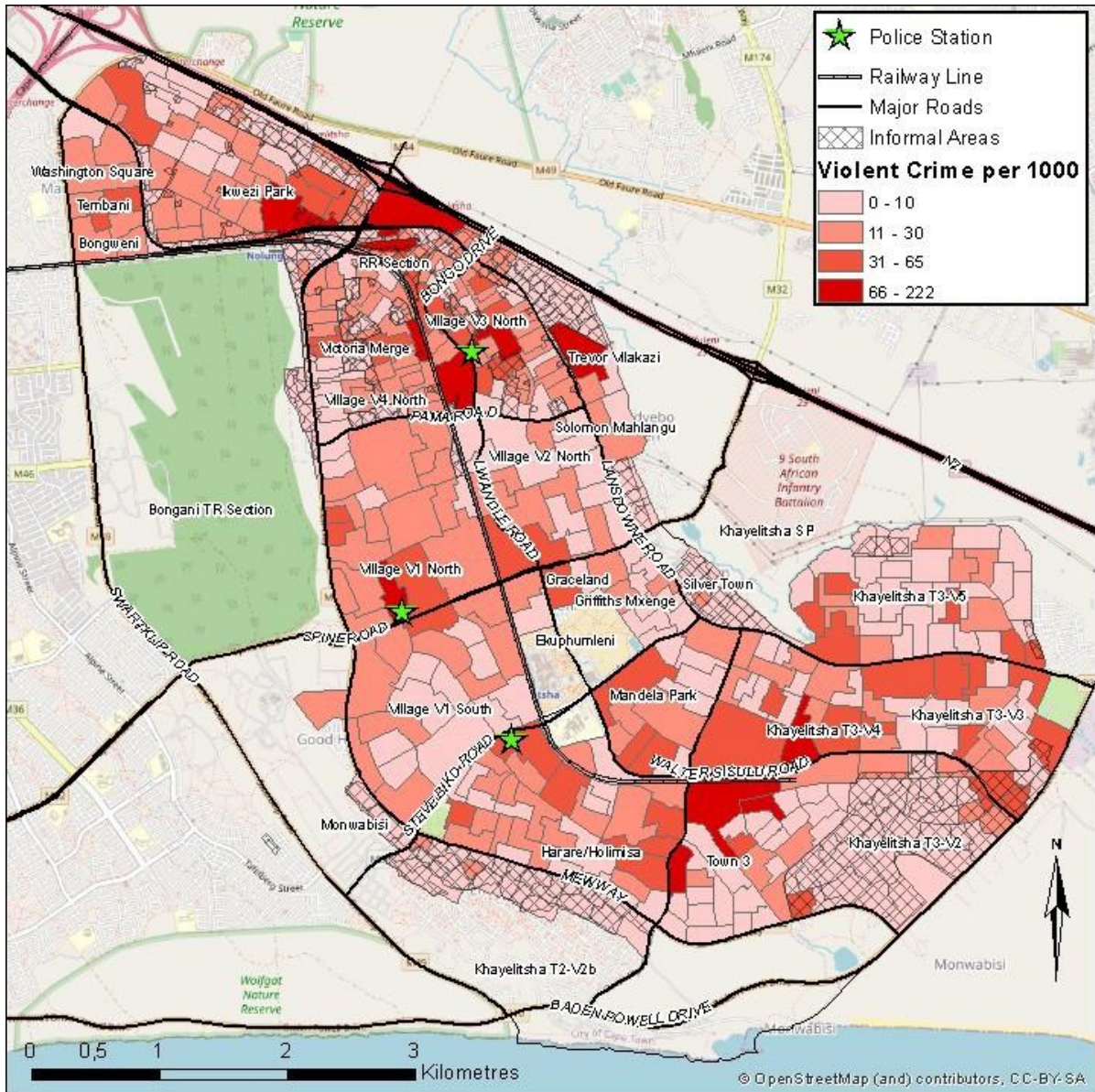


Figure 4.1: Spatial distribution of violent crime rate per 1000 population in Khayelitsha, 2010-2012 (n= 581 SAL's)

4.3.3 The Independent Variables

The wide variety of variables and proxies previously used in developed and developing contexts made it difficult to identify, define and operationalise variables in a new and different context. There is no set blue print for and no standardised way to operationalise these characteristics in practice. The disconnect between theory and practice allows scholars a great measure of subjectivity and leeway to customise the measurement of these characteristics and to tailor the selection of variables to suit a particular agenda. The inconsistencies in the selection and operationalisation of variables in previous studies using social disorganisation theory limit benchmarking and inhibit the cross-national comparisons of research that are vital to scientific reliability and validity. Without the option of comparative analyses, the establishment of a frame of reference, to gauge the contemporary explanatory value of a theory or by which to measure and plan performance or progress, is unattainable. Moreover, the advantages to be gained from the identification and adoption of the good practices followed elsewhere are lost.

Notwithstanding these issues, the selection of variables for this investigation of social disorganisation theory was based on 1) previous research (in developed- and developing-world contexts), 2) data availability, and 3) the unique context of Khayelitsha. The socio-demographic data was obtained from the national census statistics of Statistics South Africa (2011). The census data aligns closely with the available crime data and this is the most recent available data given that the national census is decennial.

The section below contains detailed descriptions of the independent variables (a total of 12) used to operationalise the social disorganisation theory. Discussions involve rationales for inclusion, detailed information pertaining to calculations and references to the spatial distribution of each variable in Khayelitsha as depicted on individual maps.

4.3.3.1 Socio-economic Deprivation

Socio-economic deprivation has been shown to be one of the strongest and most consistent predictors of criminal activity in the developed and developing context (Andresen, 2006; Breetzke, 2010b; He et al., 2017; Kingston et al., 2009; Livingston et al., 2014; McCall et al., 2010; Polczynski Olson et al., 2009; Swart et al., 2016; Thompson

& Gartner, 2014; Warner, 2014). It is a multi-faceted concept which can be operationalised in a variety of ways. In this study socio-economic deprivation was operationalised using five independent variables namely a deprivation index, the percentage of residents with no income, the percentage of residents employed in the informal sector, the percentage of residents with limited access to adequate sanitation and the percentage of residents with limited access to potable water.

Deprivation index

It is common practice in studies testing social disorganisation theory to combine several highly correlated socio-economic variables into a single index to simplify the input for statistical procedures such as regression analysis (Lockwood, 2007; Martinez et al., 2010; McCall et al., 2010; Nieuwbeerta et al., 2008; Peterson et al., 2000; Strom & MacDonald, 2007; Thompson & Gartner, 2014; Triplett et al., 2005; Weijters et al., 2009). Similarly, an index of deprivation was constructed and applied in this research and included as a possible predictor of crime in Khayelitsha. This deprivation index comprises a combination of three variables. First, the percentage of residents earning an income below R3200/month;¹ second, the percentage of unemployed residents;² and third the percentage of residents with less than a Grade 12 school education. The educational qualification of adults (aged 20 years and older) is relatively low with 68% of residents of Khayelitsha not having attained a secondary school qualification. These measures were combined to create the index by calculating a simple mean percentage of the three measures. The greater the percentage, the higher the level of deprivation. Based on this measure, roughly 60% of residents in Khayelitsha are highly deprived.

Figure 4.2 shows the spatial distribution of the deprivation index values in Khayelitsha and shows a highly deprived community throughout. There is slightly less deprivation in the older, more centrally located neighbourhoods and higher levels of deprivation around the township's edges in the predominantly informal areas.

¹See Section 3.3.2.1.

²Unemployed residents are individuals without work but actively seeking employment in a recent past period (four weeks), and currently available for employment.

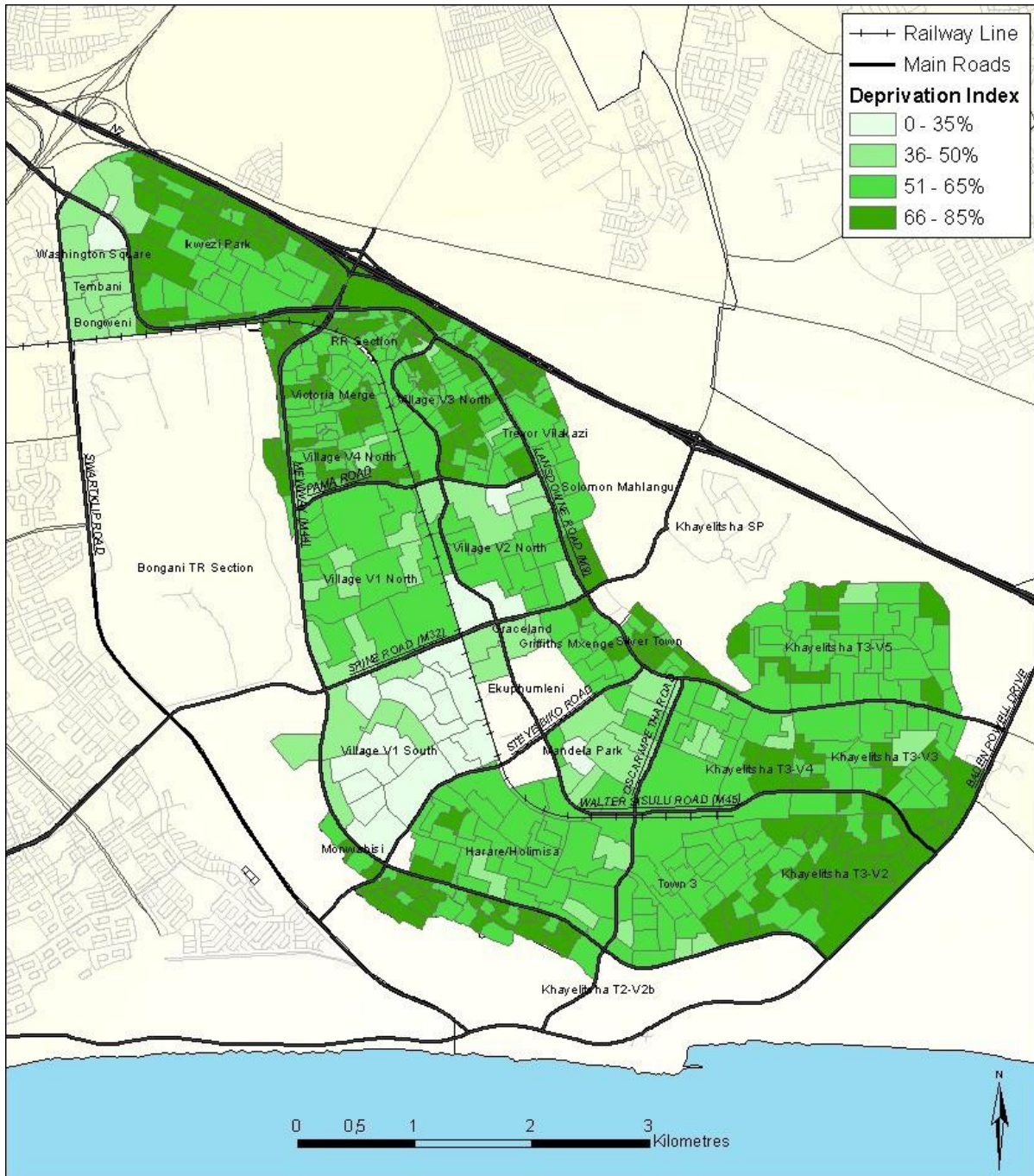


Figure 4.2: Spatial distribution of deprivation index values in Khayelitsha (n=581 SAL's)

Percentage of residents with no income

Measures pertaining to low income or living below the poverty line have frequently been applied as a proxy for deprivation, in both the developed (Law & Quick, 2013; Nieuwbeerta et al., 2008) and developing contexts (de Melo et al., 2017; Winter & Barchi, 2016). In 2011 the majority of residents in Khayelitsha lived below the poverty line and approximately 20% of the township's residents earned no income (Statistics South Africa, 2011). Although it is not frequently included in studies examining social disorganisation, Ceccato et al. (2007) included a measure of 'no income' in São Paulo, Brazil and found it to be a highly significant predictor of homicide. For this reason the percentage of residents earning no income was included in the analysis. In Figure 4.3 Khayelitsha's population earning no income show a higher prevalence in the newer, less established neighbourhoods in the south-eastern and north-eastern parts and on the fringes in the informal parts of the township.

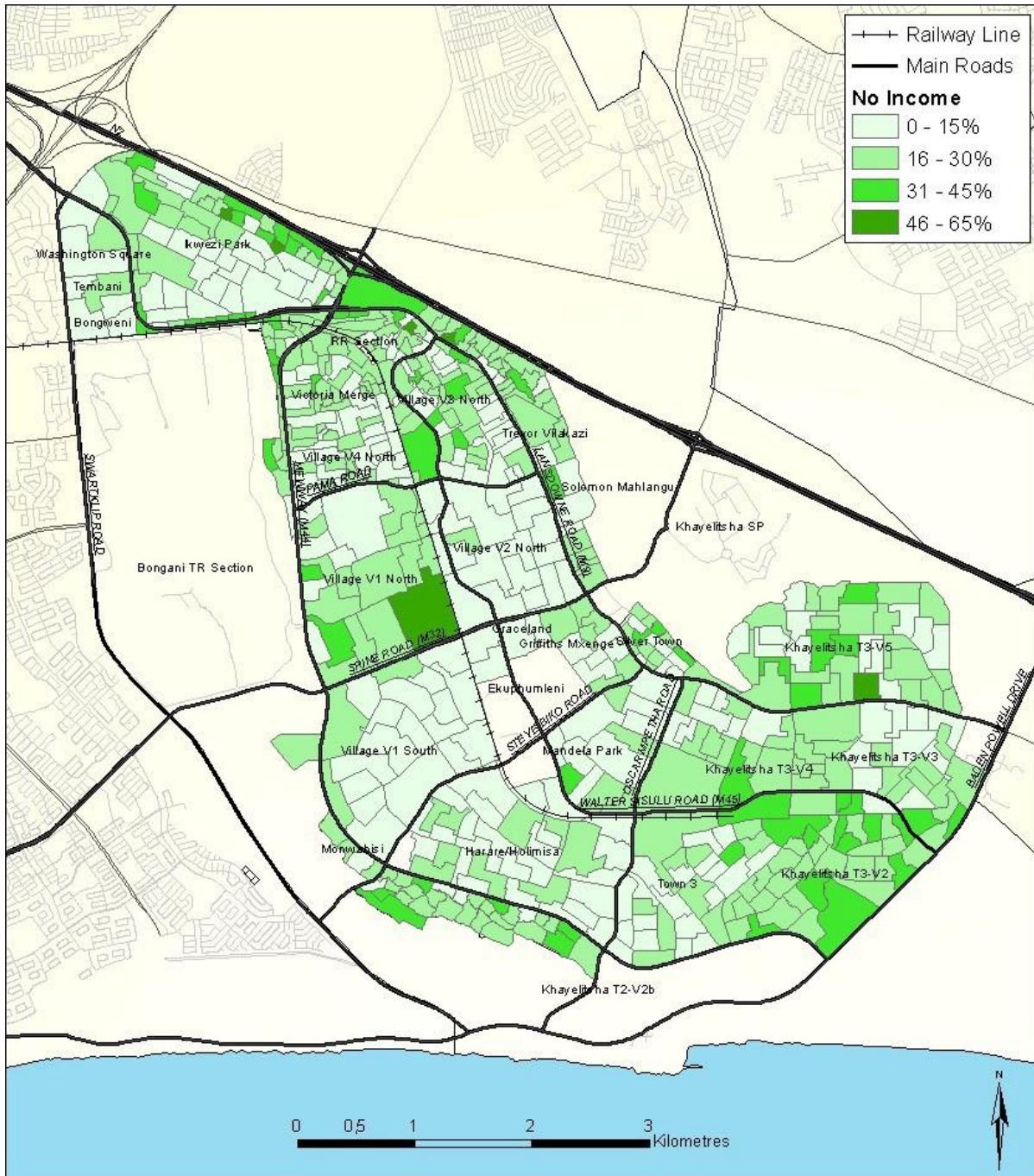


Figure 4.3: Spatial distribution of the percentage population earning no income in Khayelitsha (n=581 SAL's)

Percentage employed in the informal sector

The informal economy typically includes all economic activity not formally regulated (Castree et al., 2013). Employment in the informal sector has persistently grown in developing world countries (Williams & Lansky, 2013), providing much needed economic opportunities for the poor and those residents unable to secure formal employment (Husmanns, 2004), but is still nevertheless a proxy for deprivation.

Statistics South Africa distinguishes the type of employment sector in which the working population is employed. Accordingly, the informal sector consists of those businesses that are not registered for income tax or value added tax (VAT). In Khayelitsha where unemployment is rife, a large component (roughly 13%) of the workforce is employed in the informal sector (Statistics South Africa, 2011). Although employment in the informal sector is not a measure typically included in studies of social disorganisation, the percentage of people employed in this sector was included as a measure of socio-economic deprivation because of the well-known occurrence of informal businesses in the township.

The percentage of the Khayelitsha population who are employed in the informal sector is shown in Figure 4.4 and appears to be widespread throughout the township. There is, however, no discernible spatial pattern or clustering of these, mostly small retail, businesses that are run from homes or street pavements (Freeman & McDonald, 2015; Ugur, 2014).

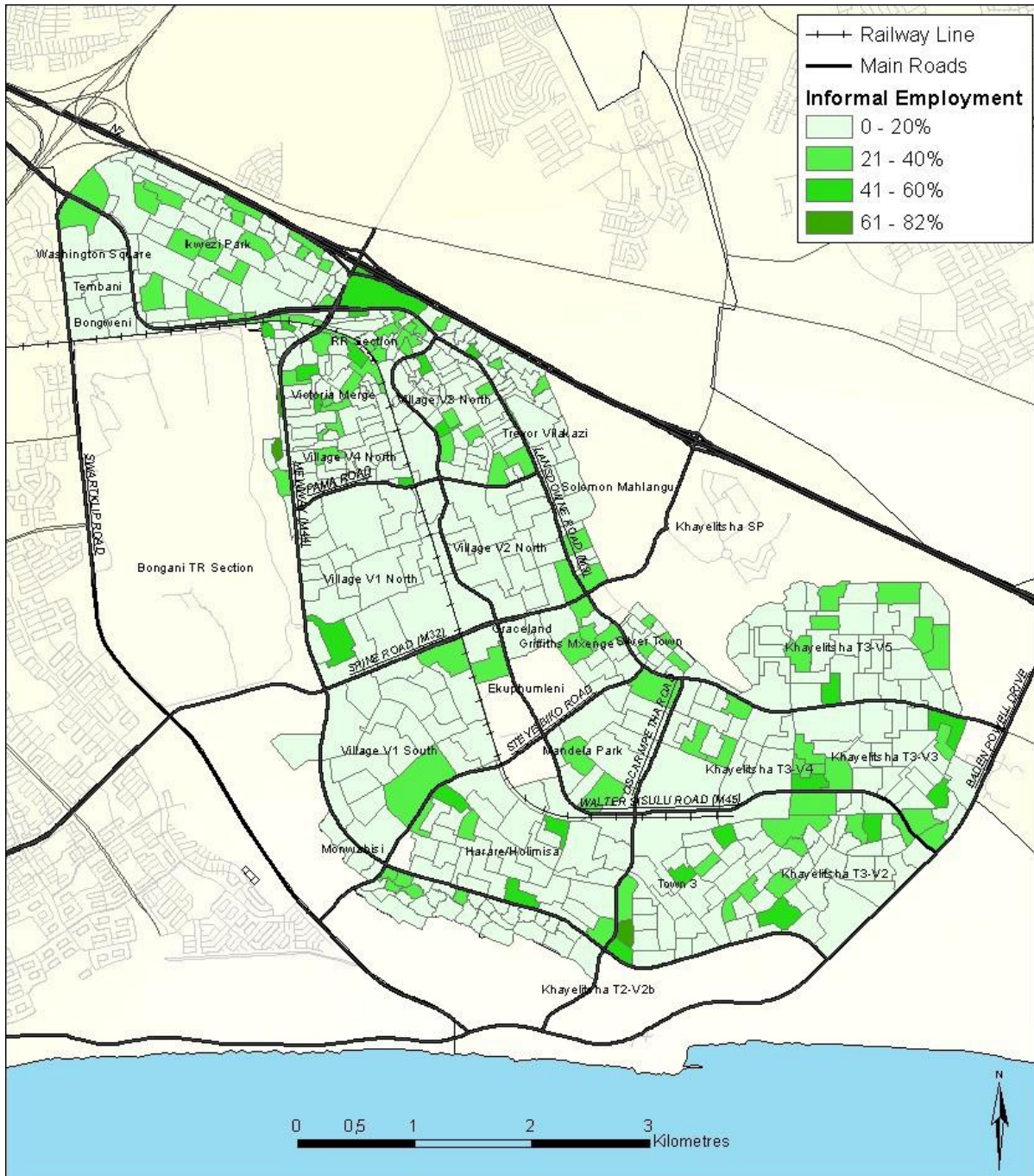


Figure 4.4: Spatial distribution of the percentage of population in informal employment in Khayelitsha (n=581 SAL's)

Percentage with no access to flush toilets

Several studies have shown the association between crime and the lack of basic services in the developing world (Breetzke, 2010b; de Melo et al., 2017; Escobar, 2012; Zakaria & Rahman, 2017). More specifically, a strong association between reduced access to private and safe sanitation and violence against women has been found in South Africa (Jacobs, 2017) and Kenya (Winter & Barchi, 2016), among others. Access to sanitation remains a persistent challenge in Khayelitsha, where only 76% of the residents have access to a flush toilet and these are often shared communal toilets that are neither cleaned nor maintained (O'Regan & Pikoli, 2014). The variable, percentage of residents with no access to flush toilets (connected to a sewerage system or with a septic tank), was therefore employed in this study as an indicator of deprivation in Khayelitsha. Residents of these households either make use of chemical, pit or bucket toilets.

Figure 4.5 shows the spatial pattern of the roughly 25 percent of the Khayelitsha population with no access to flush toilets. There is a clear spatial divide in the supply of sanitation services which is better in the formal parts in the centre of the township compared to the informal settlements situated on the fringes.

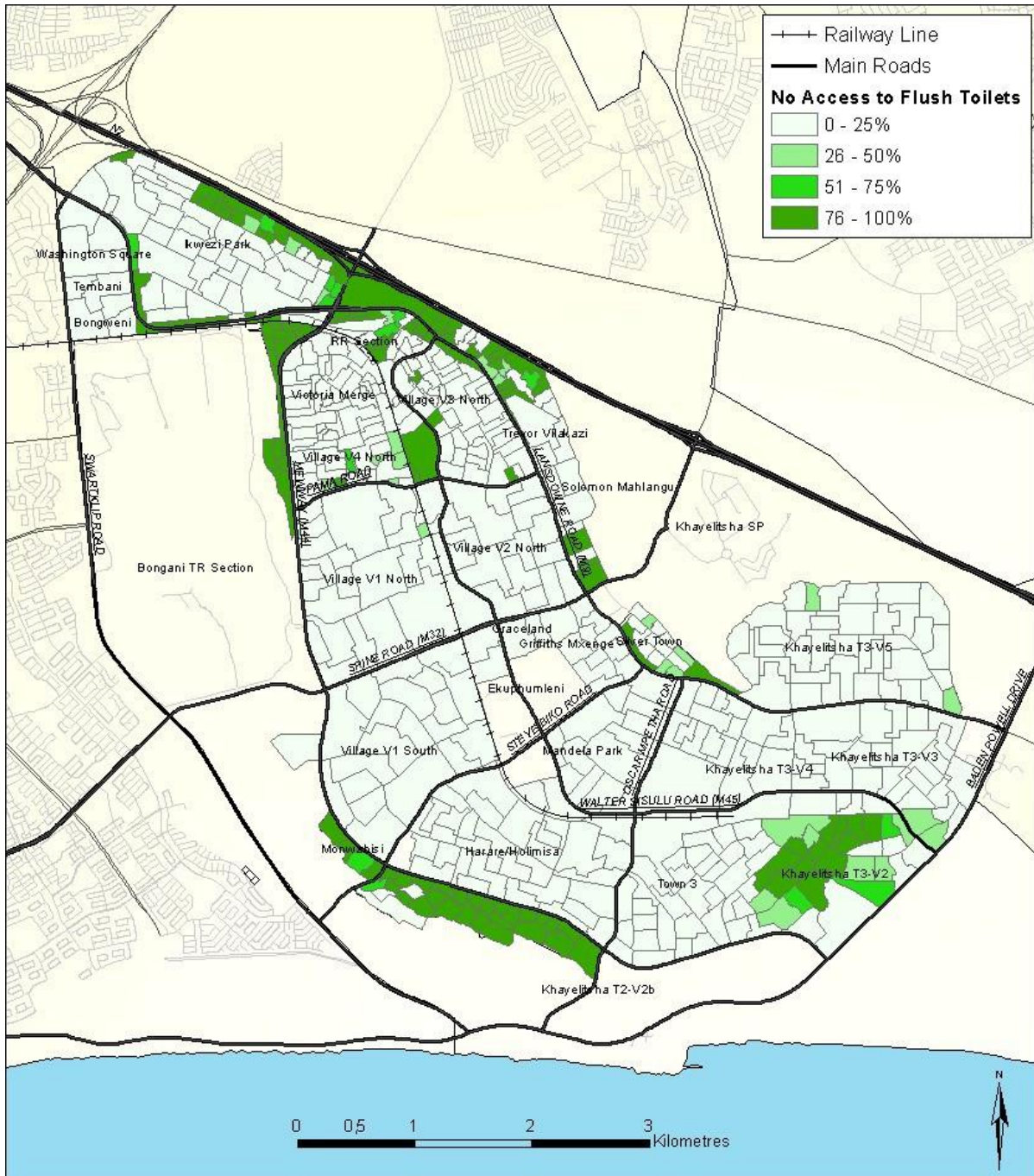


Figure 4.5: Spatial distribution of the percentage of households with no access to flush toilets in Khayelitsha (n=581 SAL's)

Percentage with no access to indoor potable water

Finally, the percentage of households with no access to water inside their dwelling or yard was included as an indicator of limited access to potable water. Roughly 39% of households only have access to piped water at community stands, located up to one kilometre from their dwelling or they have no access to piped water at all (Statistics South Africa, 2011).

Figure 4.6 shows the percentage of the Khayelitsha population with no access to potable water inside their home or yard. Similar to the supply of sanitation services, the map shows a clear lack of potable water supply around the fringes and in the informal parts of Khayelitsha.

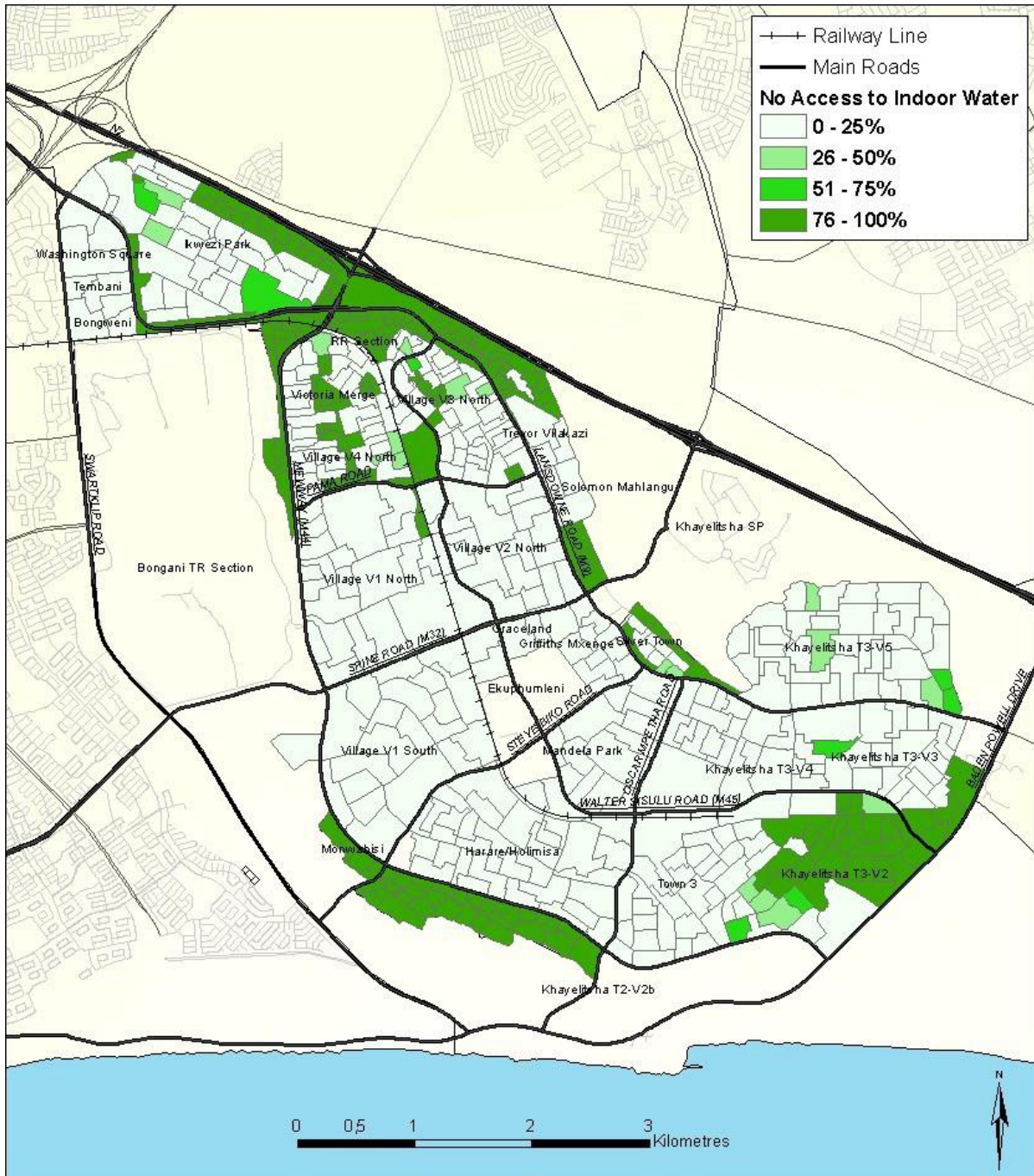


Figure 4.6: Spatial distribution of the percentage of households with no access to indoor water in Khayelitsha (n=581 SAL's)

4.3.3.2 Family Disruption

Disruption in or to a family is thought to decrease social control where parents are unable to provide sufficient guardianship and supervision to youths. One variable commonly used to operationalise family disruption, namely the percentage of female-headed households, was included in the analysis.

Percentage female-headed households

Family disruption is frequently measured using the percentage of female-headed households on the assumption that the absence of a father increases disruption in a family through reduced income, less social controls and a lack of male role models. Measures of family disruption, operationalised in this way, have been shown to have a direct relationship with increased social disorganisation and crime in the developed (Jones-Webb & Wall, 2008; Lanier & Huff-Corzine, 2006; Polczynski Olson et al., 2009) and developing world (Vilalta & Muggah, 2016; Yahaya et al., 2013). Almost half, 42% of households in Khayelitsha are headed by females (Statistics South Africa, 2011).

Figure 4.7 shows the percentage distribution of female-headed households in Khayelitsha. There is a high concentration in the southern and central neighbourhoods of Mandela Park and Khayelitsha T3-V4, where often more than 60% of households are headed by females. Female-headed households appear to be less common around the fringes in the informal areas.

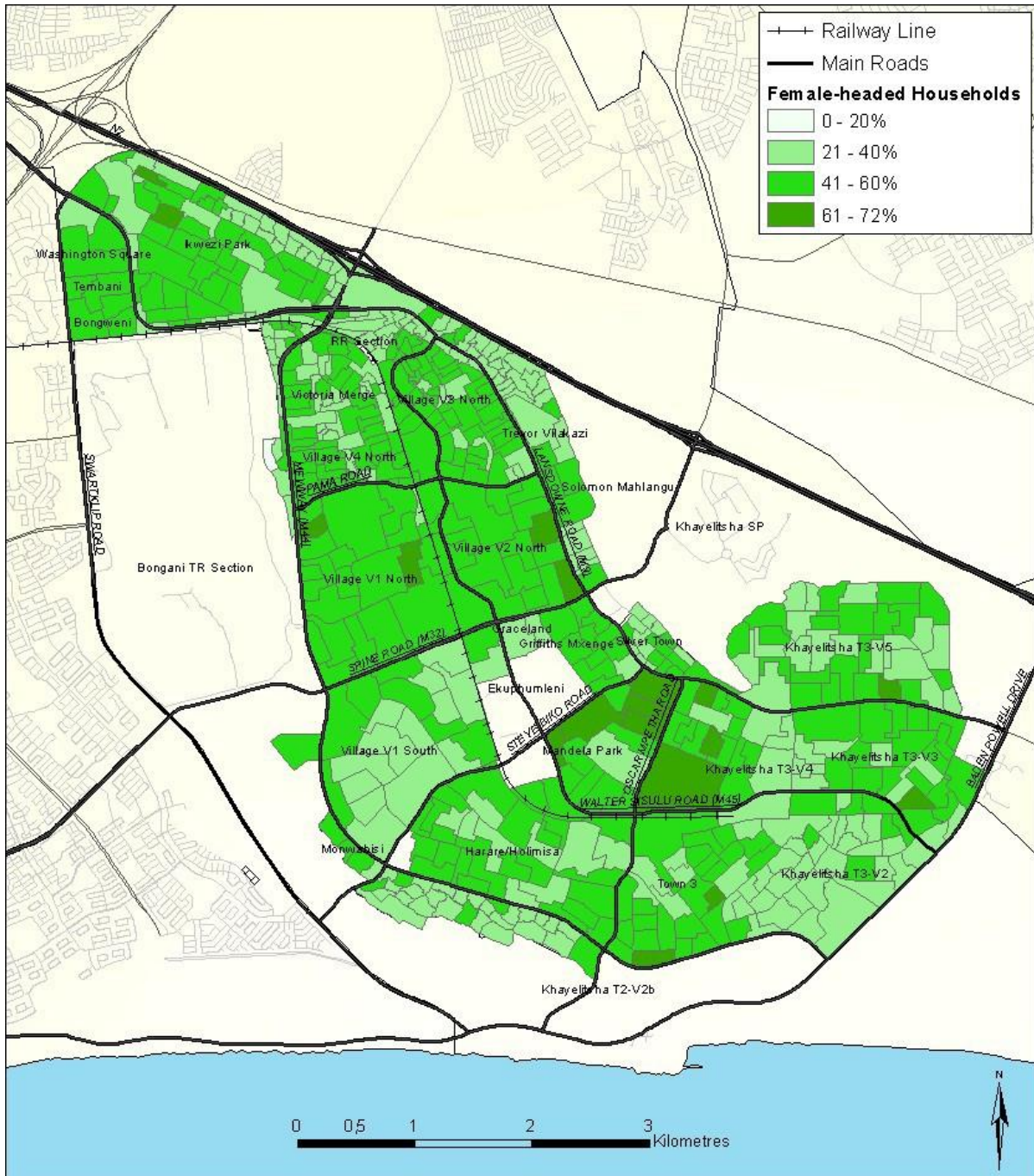


Figure 4.7: Spatial distribution of the percentage female-headed households in Khayelitsha (n=581 SAL's)

4.3.3.3 Residential Mobility

A high turnover of residents in a neighbourhood or frequent changes of residence can compromise social bonds and a shared sense of community, which in turn can lead to increased social disorganisation and crime. Residential mobility is operationalised using three variables in this study, namely the percentage of households renting, the percentage of households residing rent-free and the percentage of residents who are born outside the Western Cape province.

Percentage of households renting

High residential mobility – typically measured as the percentage of homeowners or the percentage of renters in an area – has been found to exhibit a direct relationship with high crime in the developed (He et al., 2017; Thompson & Gartner, 2014; Warner, 2014) as well as the developing world (de Melo et al., 2017; Lancaster & Kamman, 2016). In Khayelitsha 12% of households rent and of those households around 50% reside in informal backyard shacks (Statistics South Africa, 2011). In South Africa, informal backyard rental housing is most often located in the older and low-income neighbourhoods (or townships) which were developed under the apartheid government (Gardner & Rubin, 2017; Lategan et al., 2020). The spatial distribution of the percentage of households that are renting is shown in Figure 4.8. The proportions of rented households are low in the informal settlements and there appear to be large concentrations of rental households in the older neighbourhoods of Washington Square, Tembani and Bongweni in the north-western part of Khayelitsha and in neighbourhoods south of Spine Road in south-western Khayelitsha.

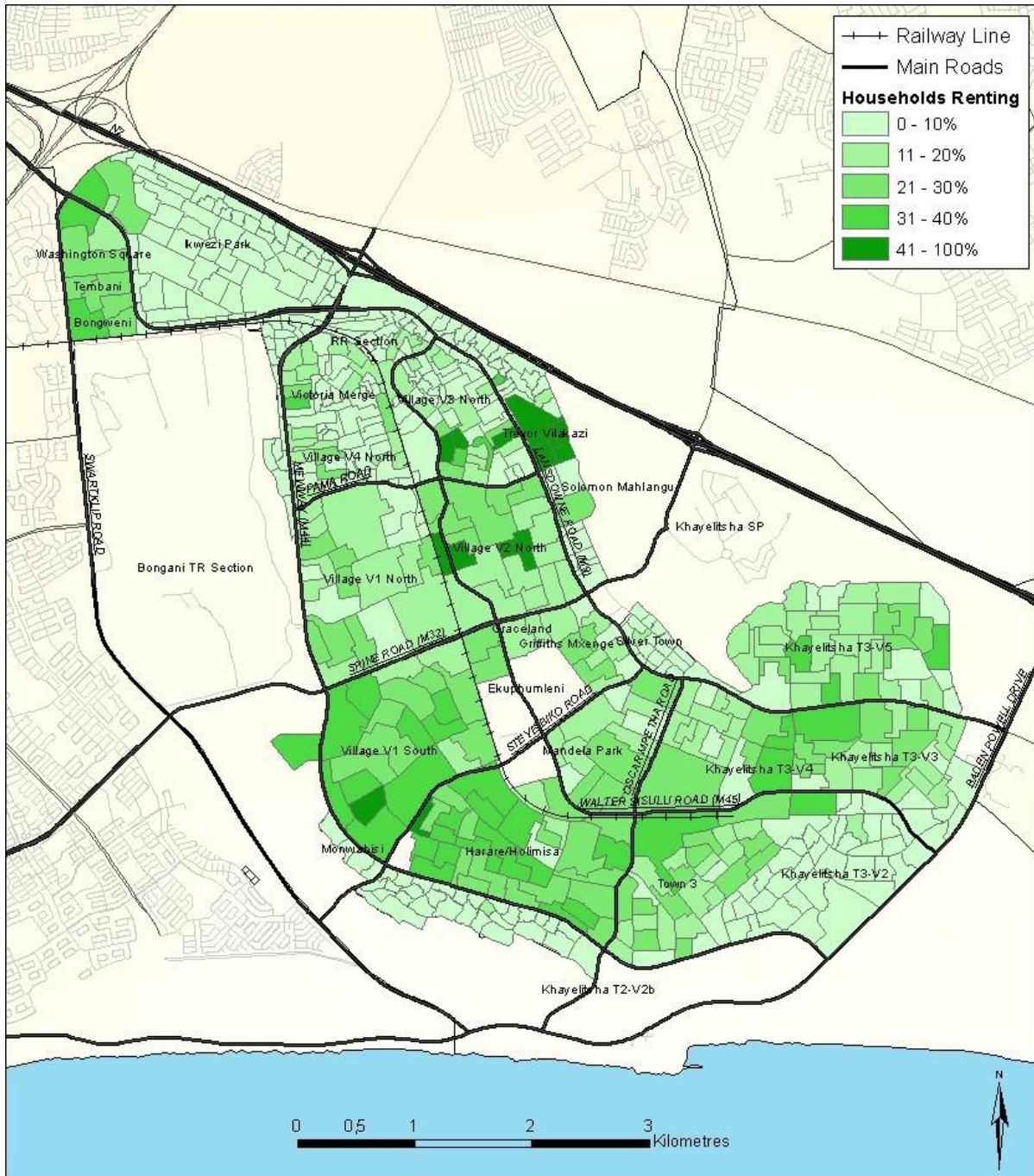


Figure 4.8: Spatial distribution of the percentage of households renting their dwelling in Khayelitsha (n=581 SAL's)

Percentage of households residing rent-free

According to the Department of Human Settlements of the Western Cape Government (2015), rent-free occupation is a common occurrence in South Africa particularly in areas characterised by informal dwellings where the occupants are often uncertain with regarding their tenure or ownership status. Some 28% of all households in Khayelitsha do not pay any rent, which also provides an indication of the degree to which housing is informal. Because of its common occurrence in the township, this unconventional measure of residential mobility was introduced in this study.

Figure 4.9 shows the distribution of households residing rent-free. With the exception of the older and more established neighbourhoods in the north-western part of Khayelitsha (Washington Square, Tembani and Bongweni) and in Village V1 North and Village V1 South in the central-western parts of Khayelitsha, rent-free occupation of a home appears to be relatively widespread throughout Khayelitsha. In several SALs in the northern and eastern parts of Khayelitsha rent-free occupation rises to between 80% and 100%.

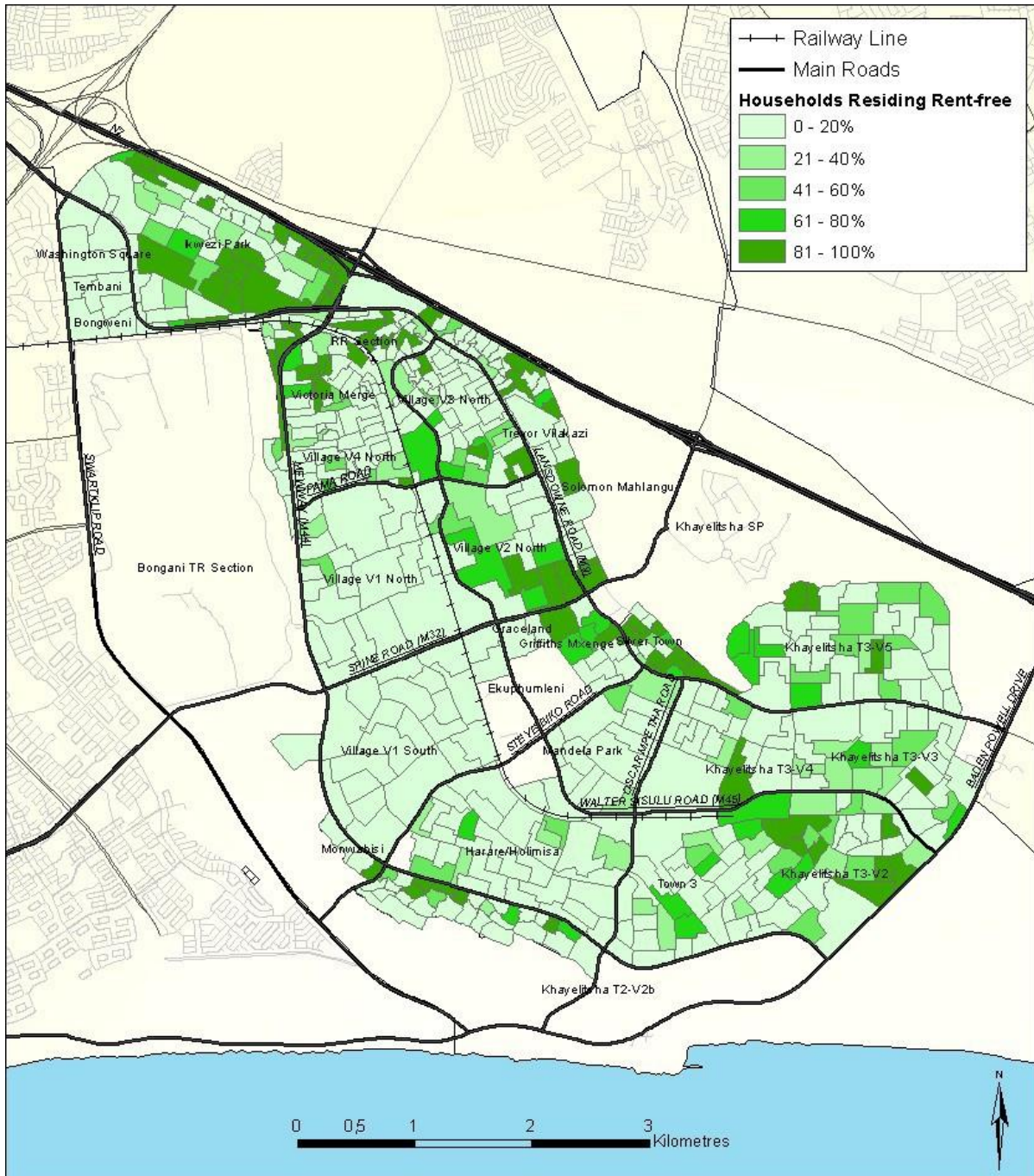


Figure 4.9: Spatial distribution of the percentage of households residing rent-free in Khayelitsha (n=581 SAL's)

Percentage of residents born outside the Western Cape

A measure of people not born in the same location as they currently reside is often included in studies of social disorganisation in the developed world (Allen & Cancino, 2012; Escobar, 2012; Martinez et al., 2010). The third measure relating to residential mobility included is the percentage of residents born outside the Western Cape province. In Khayelitsha almost 60% of the residents were not born in the Western Cape province. This is linked to the political history and the concomitant enforced racial residential segregation of the population.

Figure 4.10 shows the percentage of population not born in the Western Cape. The map reveals a clear spatial division between the older more established neighbourhoods in the central parts with low percentages (below 40%) compared to the rest of Khayelitsha and especially the informal areas around the fringes where the proportions exceed 60%, even 80%. It is here where many of the residents who were born in the Eastern Cape find access to the city, resulting in large scale unmanaged urbanisation.

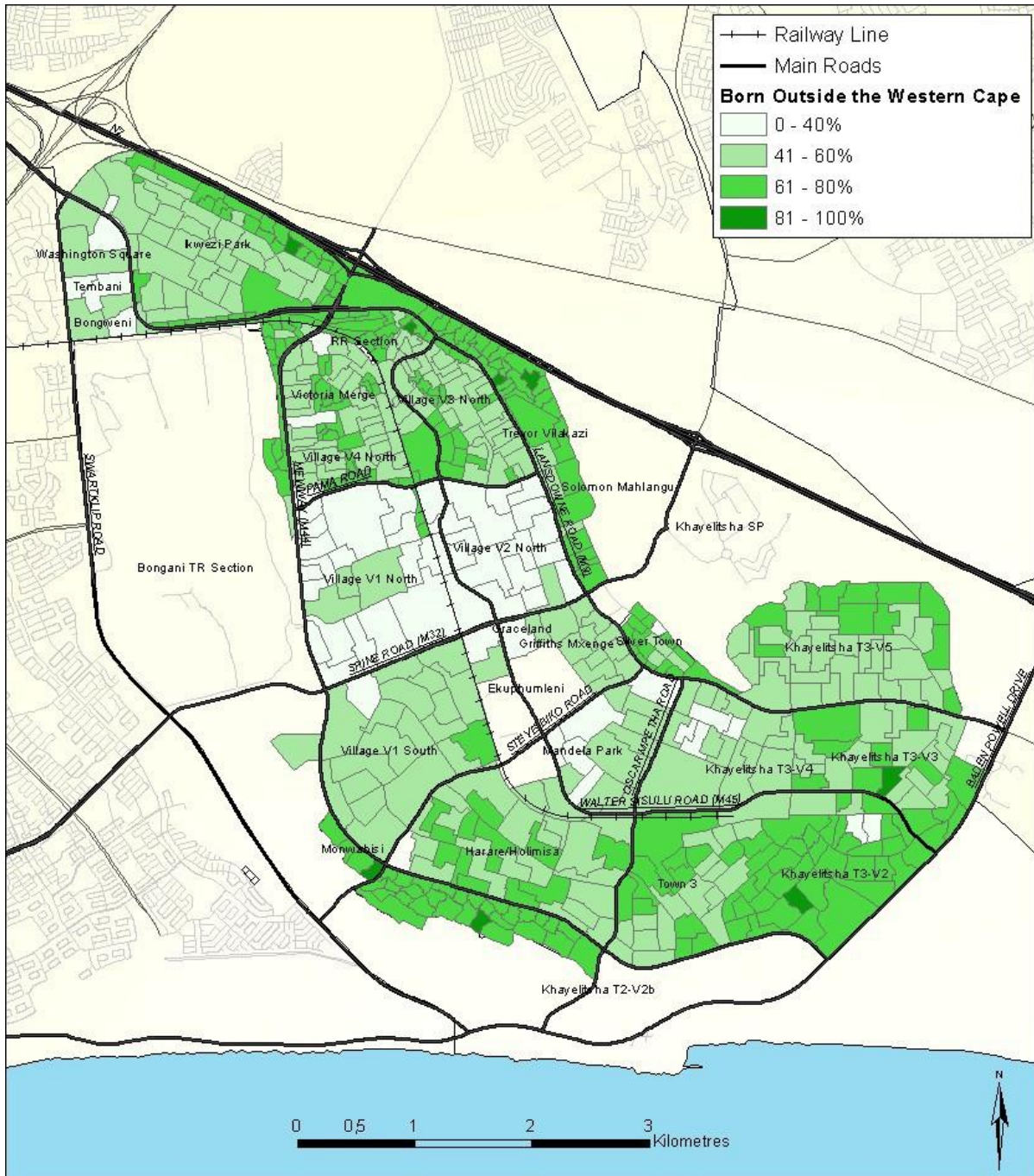


Figure 4.10: Spatial distribution of the percentage of the Khayelitsha population not born in the Western Cape (n=581 SAL's)

4.3.3.4 Racial/Ethnic Heterogeneity

Studies of social disorganisation have typically used the percentage of non-Whites in an area as a measure of heterogeneity (Breetzke, 2010b; Jones-Webb & Wall, 2008; Lanier & Huff-Corzine, 2006; Strom & MacDonald, 2007; Swart et al., 2016). Measures pertaining to immigration remain popular choices in the developed world (Allen & Cancino, 2012; He et al., 2015, 2017; Law & Quick, 2013; Martinez et al., 2010) and in the developing world (Breetzke, 2018; Zakaria & Rahman, 2017) as a proxy for racial or ethnic heterogeneity. Khayelitsha is remarkably racially homogeneous with only 1.5% foreign-born residents and 99% Black African residents (Statistics South Africa, 2011). This is relatively common in South Africa where racial segregation was enforced by law until 1994 and, despite desegregation, neighbourhoods remain largely homogeneous in terms of race. As a result, racial heterogeneity measured in terms of race or nativity, which often forms an integral part of the social disorganisation theory, could not be included for statistical analysis.

An alternative measure of ethnic diversity that has been frequently applied in both world contexts is linguistic variability (Awaworyi Churchill & Laryea, 2019; Danielsson, 2016; Graif & Sampson, 2009; Wickes et al., 2013; Zahnnow et al., 2013). In this study, linguistic variability is used as a proxy for diversity. Whilst Khayelitsha is still remarkably homogenous in terms of its language (almost 90% of residents speak isiXhosa) there is a greater variation of languages spoken than different racial groups and as a result this measure was therefore selected as an alternative indicator of diversity.

Language diversity index

Previous research on racial or ethnic heterogeneity have used measures of language diversity (Graif & Sampson, 2009; Zahnnow *et al.*, 2013), specifically a language diversity index. One of these, the Blau index (Blau, 1977), captures variations of a specific characteristic, like language, in an area. A perfectly homogeneous group scores zero on the Blau index and a completely heterogeneous group receives a score of 1. The Blau index is defined as:

$$1 - \sum p_i^2$$

where p is the proportion of members in a given category and i the number of different categories.

The Blau index was calculated for the 581 SALs in Khayelitsha and are shown in Figure 4.11. The map clearly indicates a largely homogeneous community in terms of language.

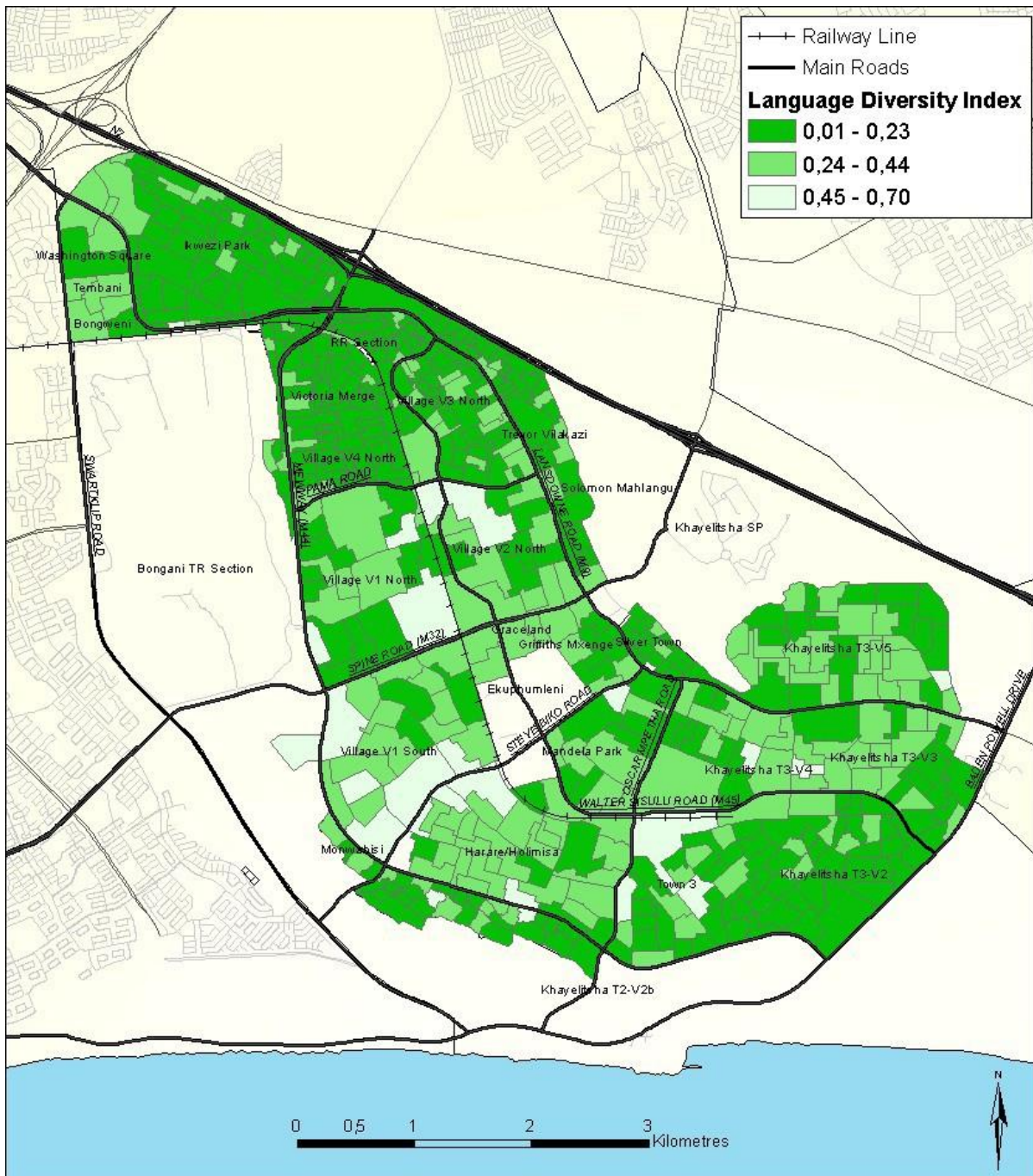


Figure 4.11: Spatial distribution of language diversity in Khayelitsha (n=581 SAL's)

4.3.3.5 Urbanisation

Sampson and Groves (1989) included urbanisation as a structural measure of social disorganisation and found that increased levels of urbanisation, measured in terms of distance from the city centre, resulted in increased social disorganisation and crime. Further studies in the developed world have established that urban communities residing closer to the city centre tend to have a decreased capacity for social control, which leads to an increased probability of crime (Lowenkamp et al., 2003; Markowitz et al., 2001). In this analysis two different measures appropriate to this context were included to capture the level of urbanisation, namely the proportion of households residing in informal housing and population density.

Percentage residing in informal housing

High levels of urbanisation in the developing world often result in substandard or even illegal housing commonly associated with the absence of basic services and severe overcrowding (Arias & Barnes, 2017; Arias & Montt, 2017; United Nations, 2015a). In the developing context, researchers have applied various measures of the incidence of informal housing structures (Ceccato et al., 2007; Lancaster & Kamman, 2016; Swart et al., 2016). These studies have confirmed the association of high levels of social disorganisation and crime with informal housing. In this study, a proxy variable used for urbanisation included the percentage of households living in informal housing, comprising a combination of shacks and backyard shacks. In Khayelitsha where 54% of residents reside in informal housing, 46% of these residents reside in shacks in informal settlements and another eight percent in backyard shacks. Figure 4.12 shows a distinctive spatial pattern with higher incidences of informal housing around the fringes of Khayelitsha.

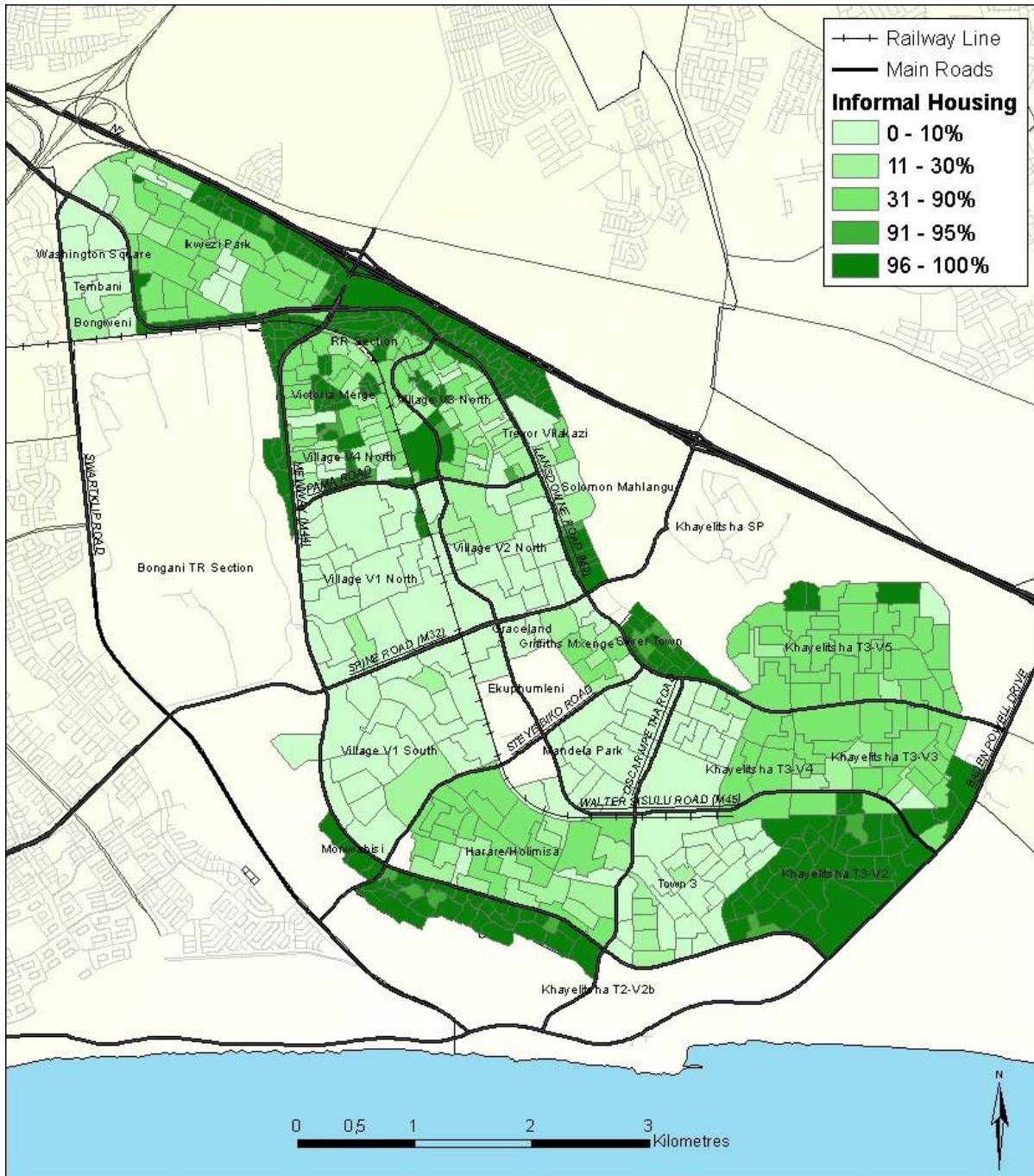


Figure 4.12: Spatial distribution of the households residing in informal housing in Khayelitsha (n=581 SAL's)

Population density

In studies using social disorganisation theory, measures of greater population size and high densities have consistently been found to be associated with higher crime rates in the developed world (Ceccato & Dolmen, 2011; Hardyns, 2012; McCall & Nieuwbeerta, 2007; McCall et al., 2010) and in the developing world (Ishak & Bani, 2017; Lancaster & Kamman, 2016; Yirmibesoglu & Ergun, 2007).

With a mean population density of close to 26 000km², Khayelitsha is one of the most densely populated areas, not only in South Africa, but in the world. Population density per square kilometre was therefore included as a measure of urbanisation. Figure 4.13 shows the high population densities in Khayelitsha. In scattered areas south of Steve Biko road exceptionally high population densities exceed 20 000 population per km² and in the northern parts in Ikwezi Park, Victoria Merge, Village V3 North and Village V4 North it even exceeds 40 000 population per km².

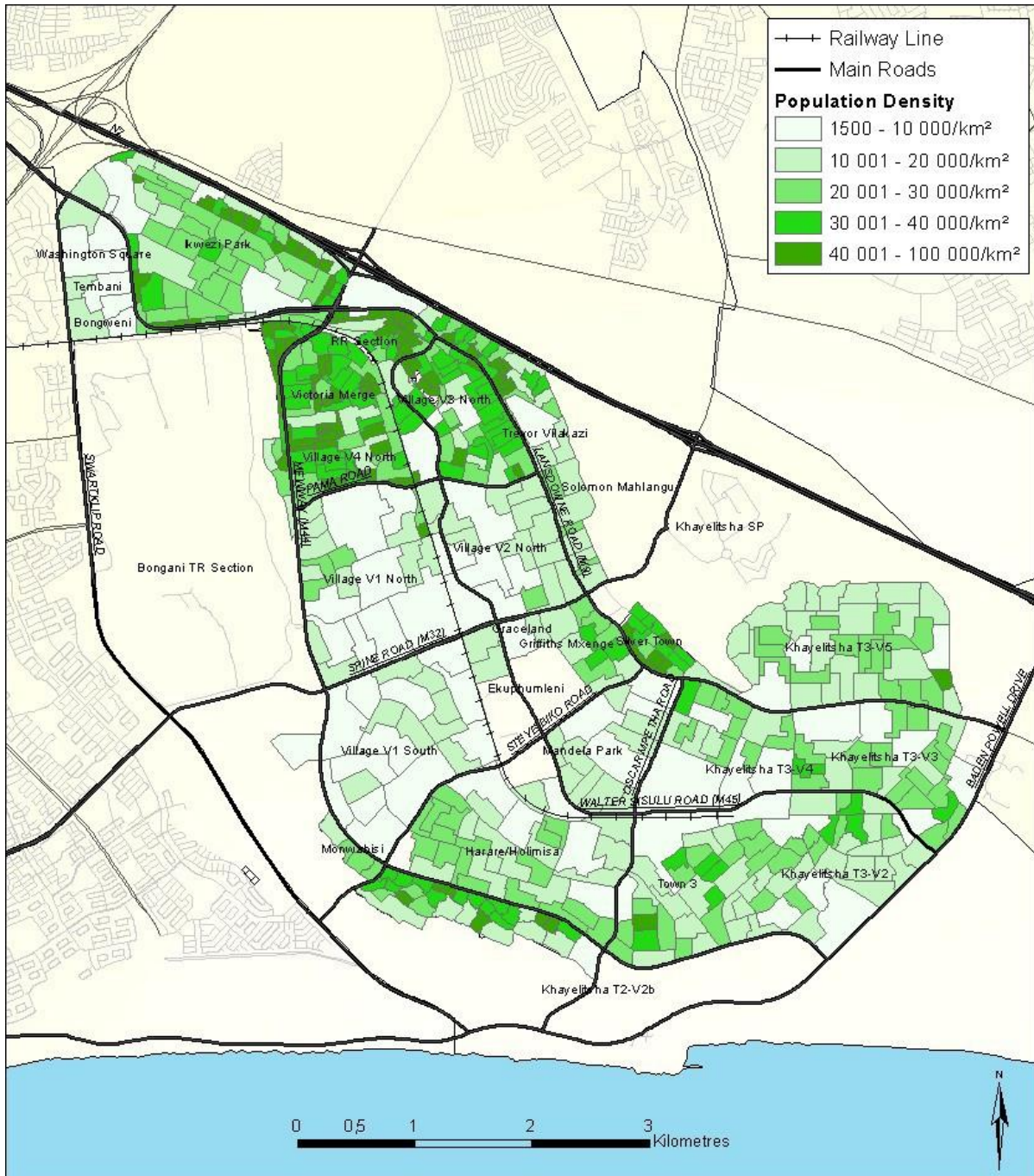


Figure 4.13: Spatial distribution of population densities in Khayelitsha (n=581 SAL's)

4.3.3.6 Descriptive Statistics for the Independent Variables

Table 4.3 summarises the descriptive statistics for the independent variables used in the study. The statistics are presented as raw variables prior to transformations.

Table 4.3: Social disorganisation: Descriptive statistics (n=581)

Data	Mean	Std Dev	Min	Max
Dependent variable				
Violent crime per 1000 population	14.04	19.85	0	222
Independent variables				
<i>Socio-economic deprivation</i>				
% Deprivation index	60.3	10.3	20.4	83.71
% No income	18.87	9.57	0	63.68
% Informal employment	13.08	12.53	0	80.95
% No access to flush toilets	24.59	38.28	0	100
% No access to indoor water	38.65	45.21	0	100
<i>Family Disruption</i>				
% Female-headed households	42.09	8.54	18.9	72.38
<i>Residential Mobility</i>				
% Households renting	11.62	13.11	0	100
% Households residing rent-free	27.49	34.14	0	100
% Residents born outside the Western Cape	57.53	13.01	12.9	95.31
<i>Racial/ethnic Heterogeneity</i>				
Language diversity index (0-1)	0.2	0.1	0.01	0.66
<i>Urbanisation</i>				
% Informal housing	53.89	40.07	0	100
Population density (km ²)	26530	16352	1694	114285

4.4 METHODS

The spatial statistical techniques used to examine spatial patterns of violent crime and the associations with social disorganisation in Khayelitsha are explained below. As mentioned before, the selection of these variables was guided by previous research as well as by the availability of data and the unique local context of Khayelitsha - in this way mimicking most previous studies in which the social disorganisation is used as a framework for guiding variable selection. In the analysis outlined below, three separate sets of variables (comprising different combinations of the twelve independent variables) are used to illustrate the subjectivity of model performance based on variable selection.

4.4.1 Modelling Framework

Initially, exploratory spatial data analysis (ESDA) techniques were used to explore the spatial distribution of violent crime in Khayelitsha.¹ ESDA is a combination of techniques to describe and visualise spatial distributions of a phenomenon. Moreover, the techniques guide and inform subsequent spatial analysis. The first step was to determine whether patterns of spatial dependence exist in the data. The global Moran's I statistic measures spatial autocorrelation, or the overall correlation of similar values in similar locations and summarises the result in a single statistic. Positive spatial auto-correlation refers to the spatial clustering of like values. The value, or cross-product, is positive when neighbouring values are either both larger than the mean or both smaller than the mean. On the other hand, negative spatial autocorrelation refers to high values surrounded by low values at a location or vice versa. With this method the cross-product is negative when one value is smaller than the mean and the other one larger. The cross-product is bounded from -1.0 to +1.0 and is represented by Moran's index. The global Moran's I provides a general or global pattern of significant spatial autocorrelation over the whole study area, while the local indicator of spatial association (LISA) statistics measure the degree of localised spatial correlation or dependence between a particular location and the average of its neighbours.

¹GeoDa open-source software developed by Dr. Luc Anselin, <https://geodacenter.github.io/>, was used to conduct all the ESDA analyses.

The second step in the analysis procedure was to undertake a bivariate correlation analysis using Pearson product-moment correlation. This was done to determine the strength and nature of the relationships between the selected independent variables. Third, a series of spatial regression models were used to examine the association between crime and a selection of structural neighbourhood characteristics in Khayelitsha, using the three separate sets of variables for each model and the same spatial regression specifications. While ordinary least squares (OLS) is one of the simplest forms of a linear regression model, the use of OLS with spatial data is problematic. This is mainly due to spatial dependence among neighbouring observations which violates assumptions of independence of observations (Andresen, 2006; Law & Quick, 2013; Ratcliffe, 2010; Zakaria & Rahman, 2017). This can result in the presence of spatially autocorrelated residuals in these models which are indications of systematic under- or over-predictions in areas close to each other. Evidence of spatial autocorrelation should be taken into consideration and the spatial processes be accounted for, otherwise the model may produce a misleading measure of fit, biased parameters and false indications of significance (Anselin, 2005; Messner et al., 1999).

As a result of the limitations of OLS regression, there is an increasing tendency for researchers to use spatial regression which takes spatial variation into account (Breetzke, 2010b; Bruinsma et al., 2013; Ceccato & Dolmen, 2011; Ceccato et al., 2007; de Melo et al., 2017; Liu et al., 2016; Porter & Purser, 2010). Spatial regression techniques can adjust for bias and inefficiency caused by spatial autocorrelation. The type of spatial regression model to use is guided by results from the Lagrange multiplier (LM) statistical test, which measures the null hypothesis of no spatial dependence against spatial error (LM-Error) and spatial lag (LM-Lag) dependence respectively.

The spatial error regression model was applied in this analysis and the general form is:

$$y = X\beta + \varepsilon \text{ with } \varepsilon = \lambda W \varepsilon + u$$

Where y represents the number of violent crimes per 1 000 population; X is the set of independent variables; β is the coefficient describing the strength and sign (positive or negative) of the relationship to the dependent variable; ε is the error term; W is the spatial weights matrix; u a vector of errors; and λ is a parameter.

Although spatial regression takes spatial dependence into account, it is limited in that it provides global output which assumes that the average relationships between the dependent and independent variables are constant over the entire study area. It does not take into account any spatial variation in the associations between the dependent

and independent variables. Spatial regression model diagnostics include a test for heteroscedasticity, which tests the variance of the error, indicating whether relationships between some or all of the independent variables and the dependent variable are non-stationary. If non-stationarity exists then a geographically weighted regression (GWR) model is the preferred model of choice. In the final step in the analysis, a geographically weighted regression model was used to identify local spatial variation in the study area.

The equation for a typical GWR model is represented in the following form:

$$y = \beta_0 + \beta_1X_1 + \beta_2X_2 + \beta_nX_n + \varepsilon$$

Where y represents the dependent variable, the number of violent crimes per 1 000 population; X the explanatory variable associated with a regression coefficient β describing the strength and sign (positive or negative) of the relationship to the dependent variable; and ε the error term.

GWR produces local parameter estimates for each independent variable by fitting a regression equation to every feature in the data set. It produces a model estimate of the varying relationship across space to indicate where the relationship is strong and where it is weak, thereby signifying where locally weighted regression coefficients differ from global values. The model thus addresses spatial non-stationarity or the inherent characteristic of spatial data that changes over space.

4.4.2 Selection of Variables

The spatial regression analysis was conducted using three separate sets of variables each comprising different combinations of variables (see Table 4.4). The combinations were selected randomly but each set includes at least one or more variable representing each of the central tenets of social disorganisation theory. For example, the percentage of the population earning no income and the percentage employed in the informal sector were used to represent socio-economic deprivation in the first set of variables (Model 1), whereas the deprivation index and the percentage of the population with limited access to potable water and sanitation services were used to represent socio-economic deprivation in the third set of variables (Model 3).

The variables are all consistent with social disorganisation theory based on the literature, and the various variables included in the three sets have been found to be

significant in both or either the developed or developing world contexts (with the exception of informal employment and rent-free tenure). Moreover, the variables could all be used as proxies to represent the central tenets of social disorganisation theory.

Table 4.4: Three sets of variables to represent social disorganisation

Combinations of independent variables	Model 1	Model 2	Model 3
Socio-economic deprivation			
Deprivation index (%)		X	X
No income (%)	X	X	
Informal employment (%)	X		
No access to flush toilets (%)		X	X
No access to indoor water (%)		X	X
Family disruption			
Female-headed households (%)	X	X	X
Residential mobility			
Households renting (%)		X	
Households residing rent-free (%)	X		X
Residents born outside the Western Cape (%)	X	X	X
Ethnic Heterogeneity			
Language diversity index	X	X	X
Urbanisation			
Informal housing (%)	X	X	
Population density km ²			X

The inclusion of three separate sets of variables illustrates the vagaries and inconsistencies inherent in selecting variables to represent social disorganisation. The subsequent analysis highlights the opportunities that exist for the subjective operationalisation of social disorganisation theory. The analysis also demonstrates that a researcher can, to some extent, determine how 'successful' social disorganisation theory is in explaining crime in a specific context. The inconsistent manner in which the central tenets of the theory is being operationalised is shown and reflected in the results.

4.5 RESULTS

4.5.1 Exploratory Spatial Data Analysis

The global Moran's I statistic for violent crime in Khayelitsha was 0,189 ($p < 0.00$) which indicates a spatially clustered pattern of violent crime across the township. The LISA statistics are shown in Figure 4.14. High-high or hot spot crime clusters are concentrated in relatively few neighbourhoods and scattered throughout the study area in the north, towards the western border and in the central southern area. Low-low clusters or cold spots are scattered around the perimeter and concentrated in the south. There are several spatial outliers which are scattered around the railway line and predominantly located in the north at the intersections of Mew Way and Lansdowne Roads, Bonga and Pama Roads, and in the south around the intersection of Oscar Mpetha and Walter Sisulu Roads.

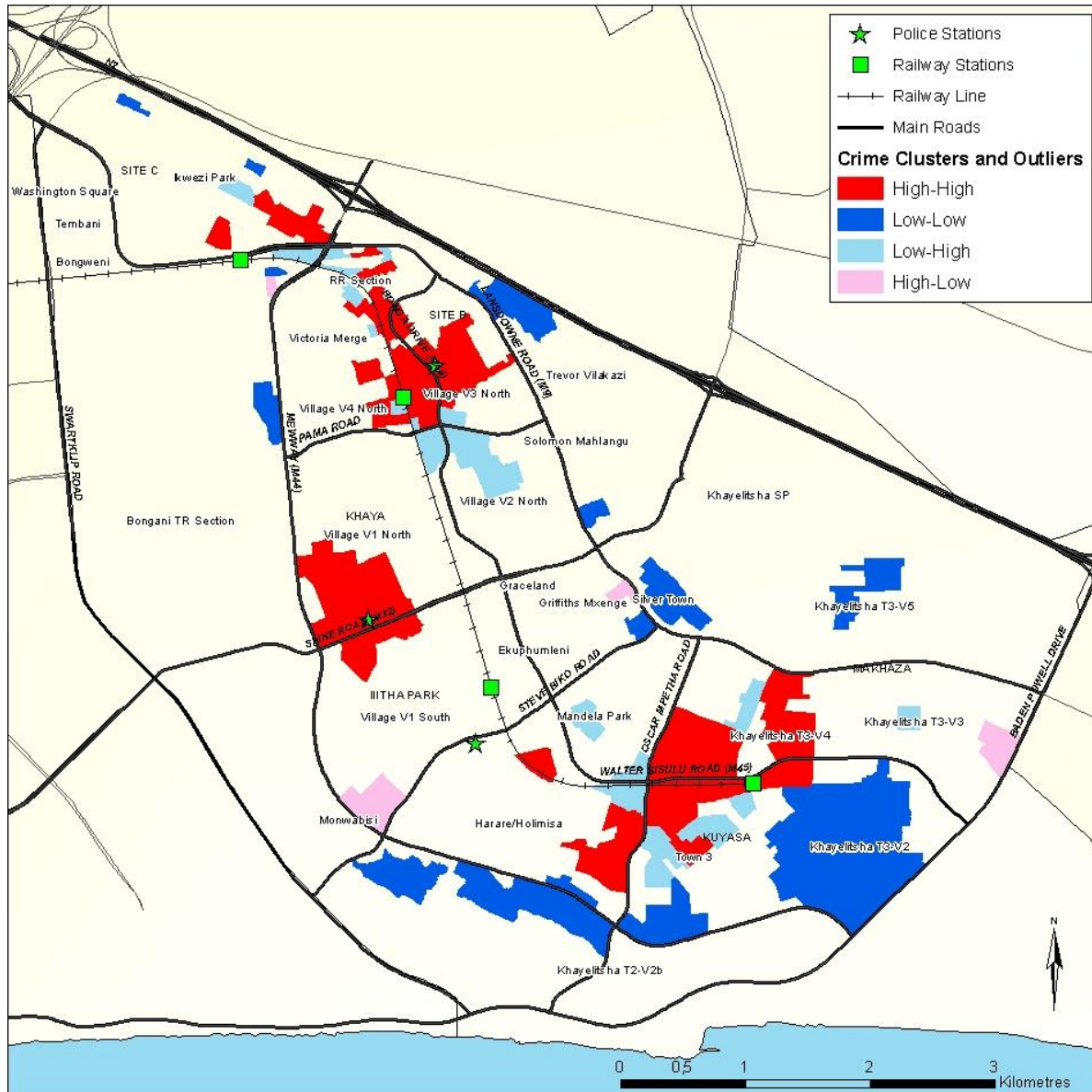


Figure 4.14: Local indicators of spatial association in Khayelitsha

4.5.2 Correlation Analysis

The correlation between the dependent variable, crime rate per 1000 population, and the 12 independent variables are shown in Table 4.5.

Table 4.5: Correlation coefficients for the dependent and independent variables analysed in Khayelitsha

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1 Crime per 1000population	1.00												
2 % Deprivation index	-0.12*	1.00											
3 % No income	-0.02	0.49**	1.00										
4 % Informal employment	-0.02	0.08	-0.03	1.00									
5 % No access to flush toilets	-0.19**	0.40**	0.38**	0.06	1.00								
6 % No access to indoor water	-0.20**	0.51**	0.46**	0.04	0.76**	1.00							
7 % Female headed households	0.13*	-0.26**	-0.27**	-0.07	-0.42**	-0.54**	1.00						
8 % Households renting	0.18**	-0.49**	-0.37**	-0.05	-0.47**	-0.62**	0.27**	1.00					
9 % Households residing rent free	-0.09	0.26**	0.08	0.05	0.17*	0.22**	-0.12*	-0.24**	1.00				
10 % Born outside the Western Cape	-0.14**	0.51**	0.35**	0.06	0.52**	0.63**	-0.54**	-0.39**	0.18**	1.00			
11 Language diversity index	0.09	-0.35**	-0.15**	-0.01	-0.17**	-0.29**	0.12*	0.36**	-0.11*	-0.17**	1.00		
12 % Informal housing	-0.20**	0.60**	0.47**	0.1	0.66**	0.80**	-0.56**	-0.58**	0.25**	0.73**	-0.30**	1.00	
13 Population density km ²	-0.29**	0.37**	0.12*	0.06	0.29**	0.47**	-0.18**	-0.39**	0.15**	0.34**	-0.27**	0.45**	1

** $p < 0.001$; * $p < 0.01$

In terms of the independent variables, correlations exhibiting expected relationships include the deprivation index, which is correlated positively with the percentage of residents with no access to indoor water, residents living in informal housing and the percentage of residents who were not born in the Western Cape. Both of the variables related to service delivery (percentage of residents with no access to flush toilets and indoor water) were also as expected significantly and positively correlated with living in informal housing and not being born in the Western Cape. The percentage of households headed by females was, however, negatively correlated with living in informal housing and not being born in the Western Cape. Similarly, the percentage of households renting their property was negatively correlated with having with no access to indoor water and living in informal housing. Whilst a number of these correlations are high and posed the risk of collinearity, none of the correlation coefficients are greater than 0.80, a common threshold for concern (Andresen, 2006) while all the variance inflation factors were below four.

4.5.3 Spatial Regression Analysis

The highly significant results from the global Moran's I statistic provide evidence of spatial autocorrelation and confirmed the use of a spatial regression model. OLS regression diagnostics (through the LM tests) further led to the specification of a spatial error model. First-order queens' case contiguous spatial weights were used. Five variables were transformed to better fit a normal distribution. They are the dependent variable, the percentage employed in the informal sector, the percentage of households renting, population density and the percentage of households residing in informal housing.

Spatial (error) regression was used to model each set of variables. The results of the spatial regression using the three separate sets (models) of social disorganisation are presented in Table 4.6. For ease of interpretation, all variables included in the three separate sets are indicated in the table, but only the significant variable coefficients are shown. In terms of overall model performance, there was an approximate 20% difference between the pseudo R^2 values of the three models, and a notable reduction in the AIC values. Variables representing socio-economic deprivation performed markedly different depending on the set of variables used. For example, the deprivation index was significant but negatively associated with violent crime in Model 2, but not significant in Model 3. In contrast, the percentage of households with no income was positively and significantly associated with violent crime in Model 2, but not in Model 1. There was, however, one consistency with the percentage of households with no access to indoor water significant and negatively associated with violent crime in both Models 2 and 3. On the other hand, the percentage of households with no access to flush toilets was not significantly associated with violent crime in either model in which it was included. The one variable used to operationalise family disruption (the percentage of female-headed households) was not significant in any of the models.

Similar to socio-economic deprivation, the three variables used to represent residential mobility also performed differently. For example, the percentage renting was found to be a significant predictor violent crime in Model 2, while the other two proxies for residential mobility produced conflicting results, with the percentage of households residing rent-free and the percentage born outside the Western Cape both exhibiting negative associations with violent crime in Khayelitsha in Model 1. These variables were both however not significant when using Model 3. The percentage born outside the Western Cape was also non-significant in Model 2. Finally, population density was negatively significant

in Model 3 while the percentage of households residing in informal housing was also found to negatively predict violent crime in Model 1 but exhibited no significance in Model 2.

Table 4.6: Results of the spatial regression analysis

Spatial Regression (Crime per 1000 population (log))	Model 1	Model 2	Model 3
Independent variables	Coefficient		
Socio-economic deprivation			
% Deprivation index	-	-0.006*	-
% No income	-	0.006**	-
% Informal employment (log)	-	-	-
% No access to flush toilets	-	-	-
% No access to indoor water	-	-0.004**	-0.002**
Family disruption			
% Female-headed households	-	-	-
Residential mobility			
% Households renting (log)	-	0.14**	-
% Households residing rent free	-0.001*	-	-
% Residents born outside the Western Cape	-0.007**	-	-
Ethnic heterogeneity			
Language diversity index	-	-	-
Urbanisation			
% Informal housing (log)	-0.11*	-	-
Population density km ² (log)	-	-	-0.85***
Spatially lagged variable	0.61***	0.61***	0.75***
Pseudo R²	39%	45%	58%
Moran's I	0.02	0.02	0.001
Likelihood Ratio Test	158.9***	160.2***	263.3***
Breusch-Pagan (Heteroskedasticity)	29.2***	33.5***	32.2***
AIC	723.5	672.9	542.4

*** $p < 0.001$; ** $p < 0.01$; * $p < 0.05$

- Variables included but not significant

4.5.4 Geographically Weighted Regression (GWR)

The results of the GWR are shown in Table 4.7. Again, each model refers to the different set of variables specified in Table 4.4

Table 4.7: Geographically-weighted regression results

	Model 1	Model 2	Model 3
R²	52%	52%	58%
Min R²	10%	10%	20%
Max R²	61%	59%	63%
Adjusted R²	39%	41%	48%
Moran's I	0.1	0.1	0.12
	z=5.6	z=5.5	z=7.07

Similar to the spatial regression models, the local R² estimates demonstrate the variability in results using different sets of variables. Local predictions for the 581 SALs for Model 1 range between 10% to 61%, for Model 2 between 10% to 59% and for Model 3 between 20% to 63%.

The average difference in R² predictions between the three GWR models are shown in Figure 4.15. The discrepancies in predictions show great variations across the study area. The distribution of the high and low R² predictions in the respective models are distinctly different with discrepancies of up to 25% in different local R² predictions between the three sets of variables used (Models 1-3). It appears that the highest discrepancies are clustered around the large transport intersections of Lansdowne road and Mew Way in the north, Palma road and Bonga drive in the central northern part and Walter Sesulu and Oscar Mpetha roads in the south. This further illustrates how the spatial variability of results differ based on the set of variables used.

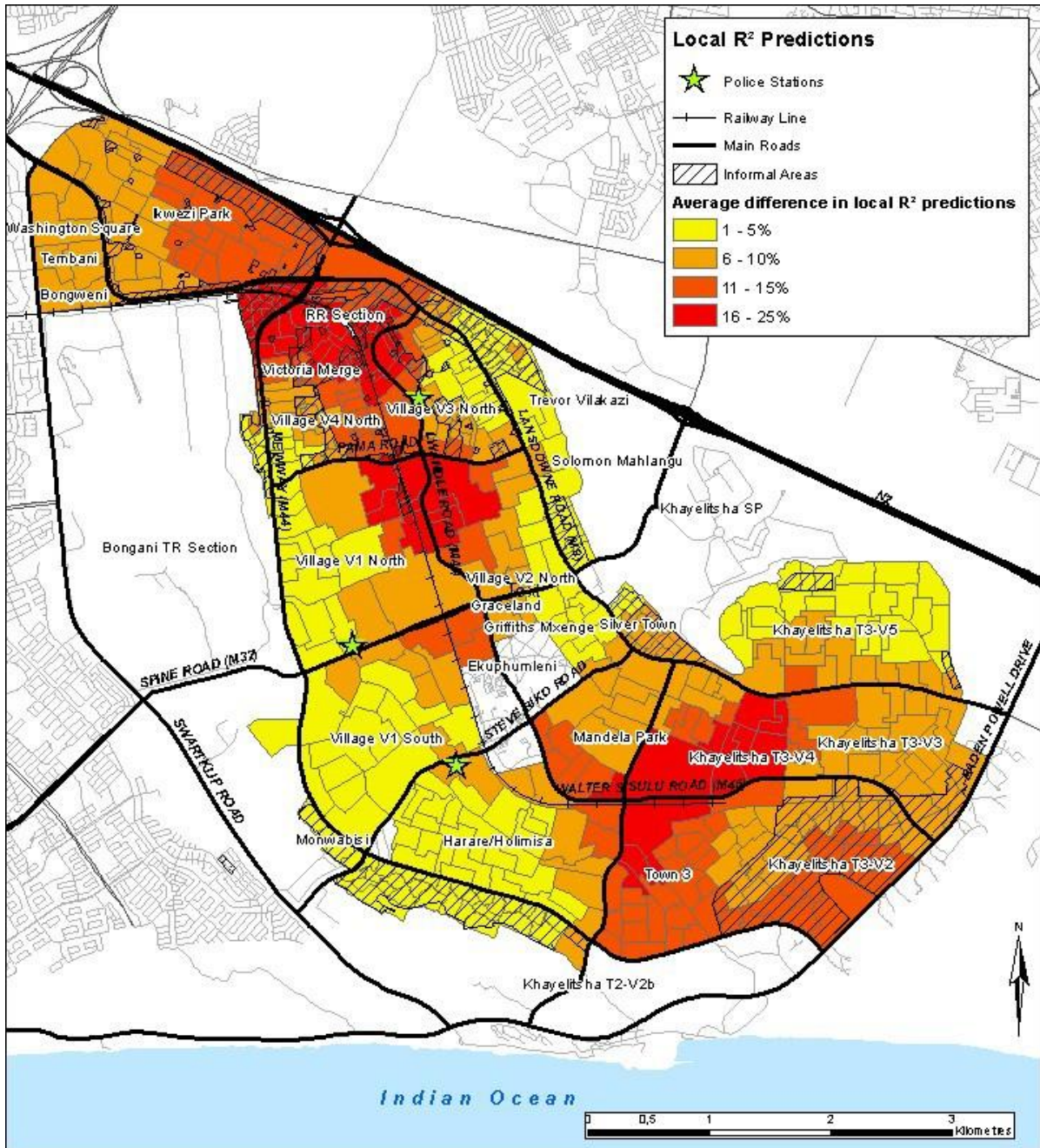


Figure 4.15: Average difference in R² predictions (n=581)

Figures 4.16 to 4.19 shows the associations between certain of the independent variables and their spatially varying relationship with violent crime using GWR across models; this is done by highlighting major differences between variables of the three models using their variable set. The figures all show vast differences in the predicted coefficients of the same independent variables used in the three models. Simply mapping parameter estimates without including t-values could produce misleading results, as these suggest that areas with high parameter estimates exhibit stronger relationships between dependent and independent variables, while these areas may not in fact be significant (Matthews & Yang, 2012; Mennis, 2006). Therefore the t-values are also provided which indicate significance. The spatial variations in local associations across the study area are characterised by differences both in the direction (positive or negative) and significance of the independent variables (coefficients). All negative associations are shown in shades of red and orange and positive associations are shown as shades of green.

The local associations of violent crime with the percentage of households with no access to indoor potable water, when measured using the second and third sets of variables (Models 2 and 3), are shown in Figure 4.16. The variable is negatively significant using both spatial regression models and, although both predictions in the GWR model are predominantly negative (77% and 90% respectively), the location of these local predictions vary significantly. The map showing coefficients for variable set three (Model 3) reveals a cluster of SALs with predicted positive associations in the north, compared to the entirely negative predictions in the same area when using variable set two (Model 2). There are considerably fewer positive predictions in the south for variable set three (Model 3) compared to the second variable set where most of the south-eastern portion of the study area show predicted positive associations for access to indoor potable water.

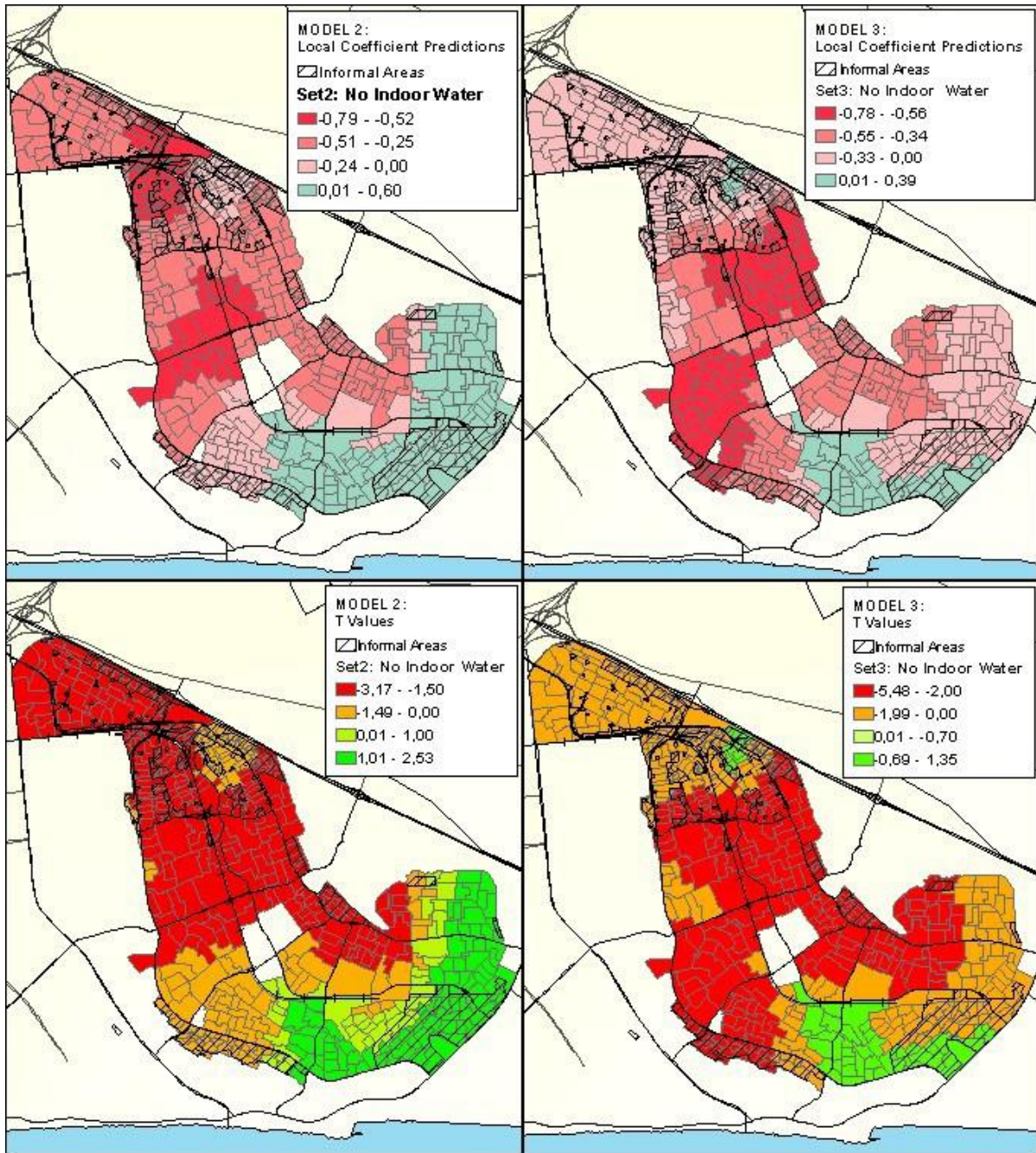


Figure 4.16: Local associations of violent crime with households with no access to indoor water (Models 2 and 3)

The local associations of violent crime with the percentage of households residing rent-free are shown in Figure 4.17. The associations are negatively significant using the first set of variables (Model 1) in the spatial regression model, but are non-significant when using the third variable set (Model 3). The average local relationships are also negative in both Models 1 and 3, but this is only marginally true with approximately 45% of SALs (in both models) of the study area predicted to have a positive association with violent crime. This is apparent in the large green areas in the northern and southern parts of the maps. The areas with negative and positive associations are quite different though, with the first variable set (Model 1) including a section of negative predicted associations in the north, compared to only positive predicted associations using the third set (Model 3) in this area. The third variable set (Model 3) includes a section of positive predicted associations in the southern central part, while the first variable set (Model 1) only includes negative predicted associations in the south.

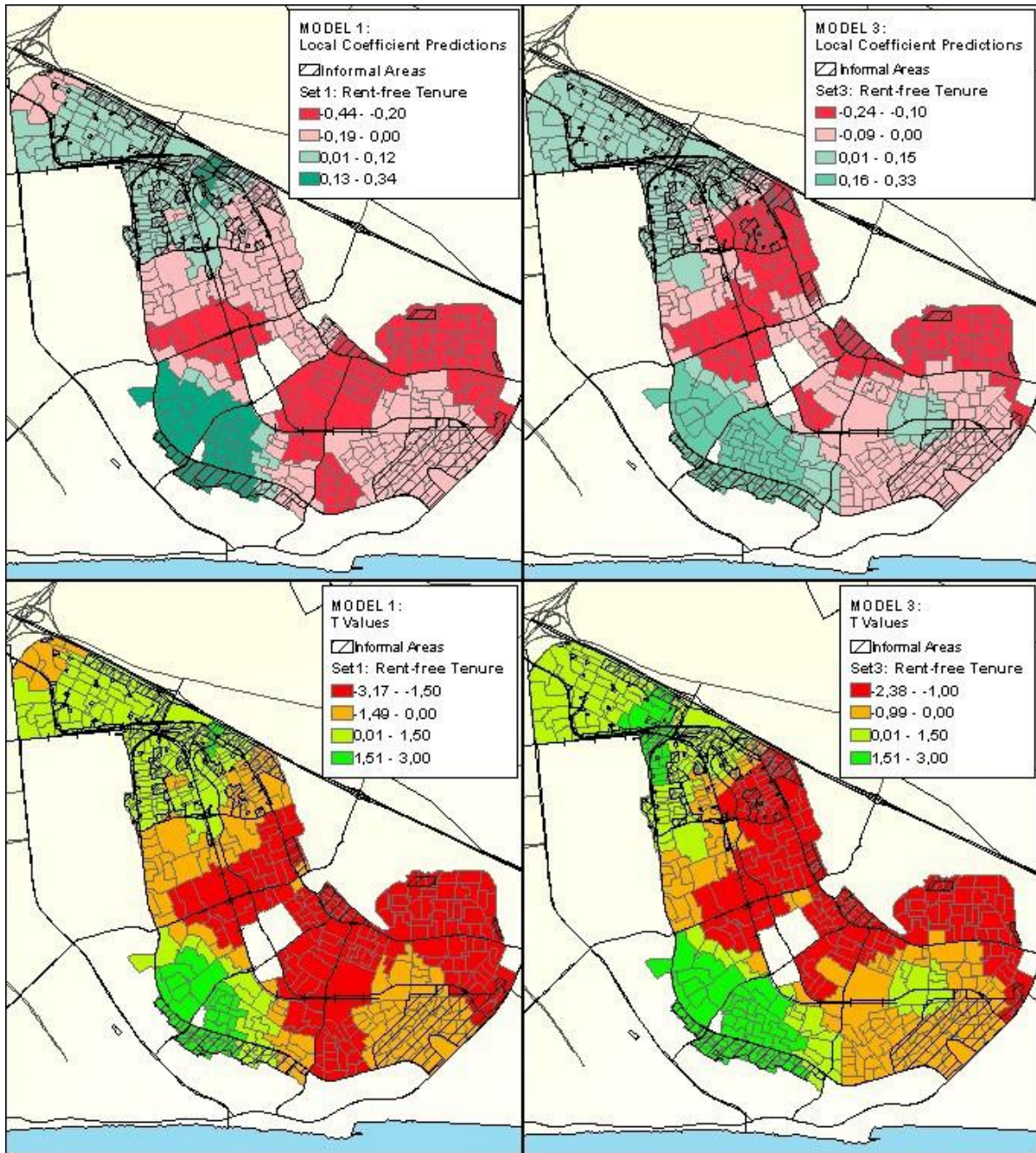


Figure 4.17: Local associations of violent crime with households residing rent-free (Models 1 and 3)

Figure 4.18 illustrate the local associations of violent crime with the percentage of residents born outside the Western Cape, using the first and the third sets of variables (Models 1 and 3). The variable is negatively significant using the first set of variables (Model 1) in the spatial regression model, and non-significant in the third variable set (Model 3). The local associations are, however, significantly different, the prediction when using the first variable set (Model 1) being predominantly negative (56% of SALs), while the associations using the third set (Model 3) being predominantly positive (54% of SALs). These differences are most visible in the northern parts of the study area.

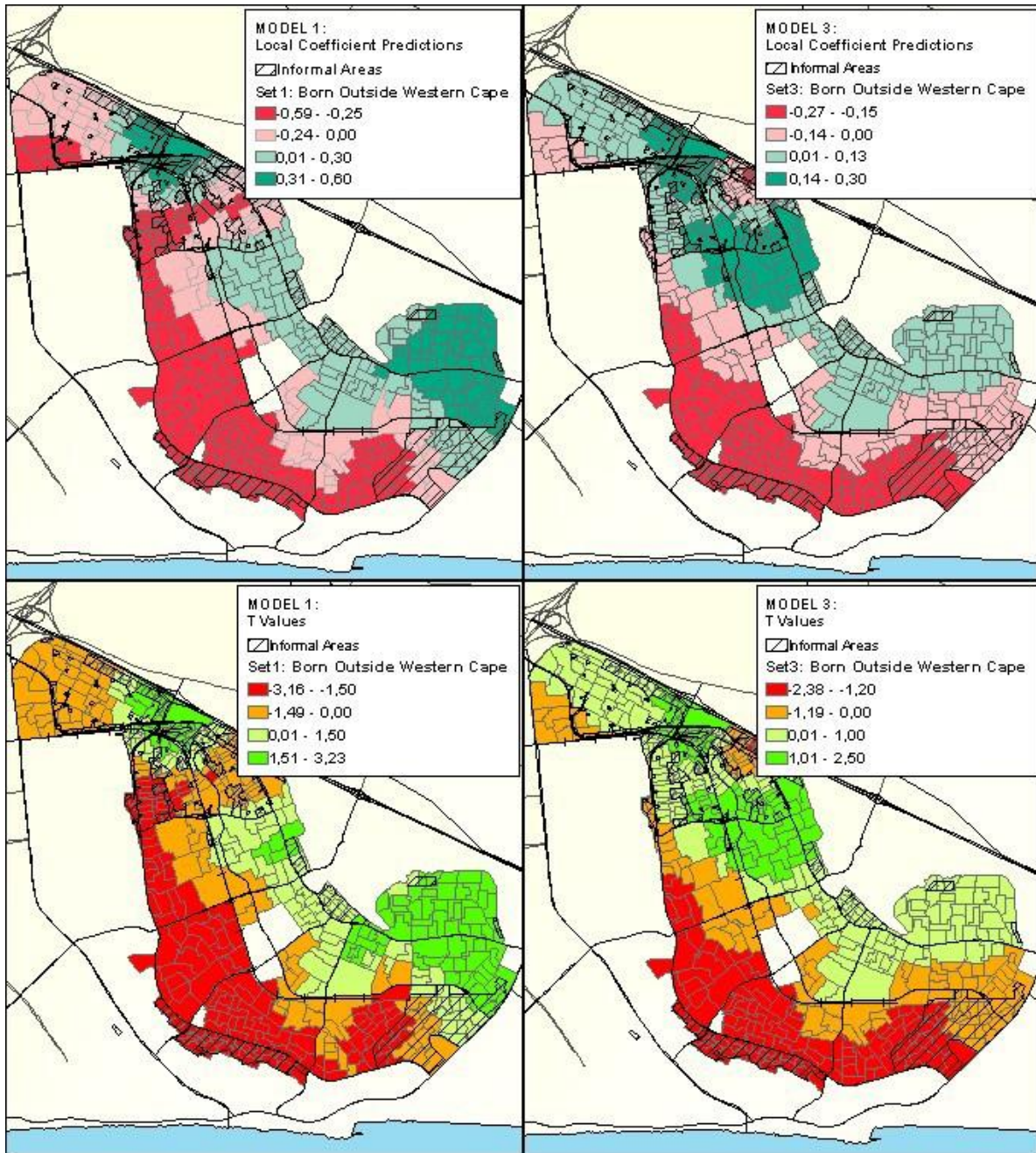


Figure 4.18: Local associations of violent crime with residents born outside of the Western Cape (Models 1 and 3)

Figure 4.19 shows the local associations of violent crime with the percentage of residents residing in informal housing which are remarkably different. The variable was applied as a proxy for urbanisation, using the first and the second sets of variables (Models 1 and 2) and was found to be negatively significant using the first set of variables (Model 1) in the spatial regression model and non-significant in the second variable set (Model 2). The local predictions when using the first variable set (Model 1) are predominantly negative (98.5%) and although the associations when using the second set (Model 2) are also to a larger extent negative, they are marginally so with only 54% of the SALs showing a negative association with violent crime. When using Model 2 large parts of central and southern Khayelitsha have predicted positive associations with violent crime.

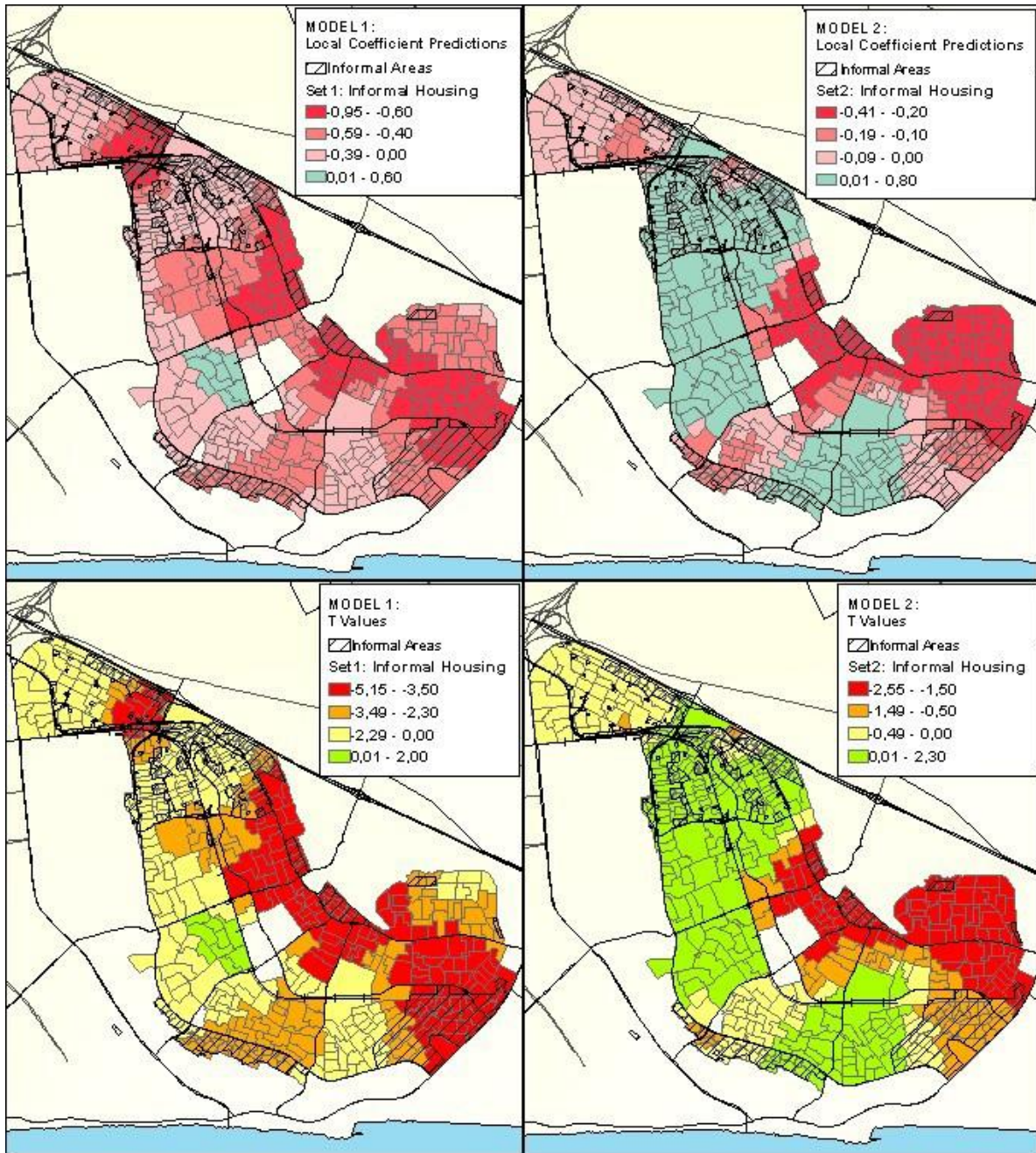


Figure 4.19: Local associations of violent crime with residents residing in informal housing (Models 1 and 2)

4.6 DISCUSSION

The purpose of this chapter was to demonstrate how the selection and combination of variables commonly used to represent social disorganisation can impact overall model performance, as well as the associations (both global (using spatial regression) and local (using GWR)) and significance of the variables themselves. This was done by identifying a list of twelve variables used as input into three separate but identical regression models. Importantly, with the exception of informal employment and rent-free tenure, all the variables selected for use in the analysis have previously been used in studies of social disorganisation. Rather unsurprisingly, the results of the spatial regression models differed by almost 20% in terms of overall model performance, while the significance and associations of the variables differed too depending on the model used. For example, neither variable representing socio-economic deprivation in Model 1 (percentage with no income and percentage informal employment) was found to be significant, yet three of the four variables representing socio-economic deprivation in Model 2 (the deprivation index, percentage with no income and percentage with no access to indoor water) were found to be either negatively or positively significant in Model 2. Thus, the interpretation of the results based on Model 1 is that socio-economic deprivation is not significantly associated with violent crime in Khayelitsha. However, the results based on Model 2, lead to a conclusion that socio-economic deprivation plays a more complex role in predicting violent crime in the township with one variable being positive as expected (percentage with no income), two variables being negative and significant (the deprivation index and percentage with no access to indoor water) and one variable (percentage with no access to flush toilets) exhibiting no significance. There were also large localised spatial discrepancies in the variable coefficients and the associated t-values using GWR.

Several questions come to mind. For instance, which model is correct? Or rather, are any of the models correct? Which variables representing the characteristics of social disorganisation are the most 'appropriate' given the unique context of Khayelitsha? Or, what would the outcome be if all four individual variables used as proxies for socio-economic deprivation are combined in a single measure or index, which is not uncommon in studies of social disorganisation (Lockwood, 2007; Martinez et al., 2010; McCall et al., 2010; Nieuwebeerta et al., 2008; Thompson & Gartner, 2014; Weijters et al., 2009). The answers to these questions are not straightforward.

Researchers have in the past attempted to 'standardise' methods and data when applying social disorganisation theory in cross-national comparisons (McCall & Nieuwbeerta, 2007; Van Wilsem, 2004), or in cross-city comparisons (Strom & MacDonald, 2007; Weijters et al., 2009). In those cases the researchers attempted to identify similarities or differences in the localities in order to identify possible causes of crime. Other researchers have gone to considerable effort to measure the causes of crime over time by applying exactly the same measures to be able to compare results (Beaulieu & Messner, 2010; Ceccato & Dolmen, 2011; Livingston et al., 2014; Martinez et al., 2010). For example, McCall and Nieuwbeerta (2007) compared the predictors of homicide rates over 40 years and included a large sample of cities (904) and states (50) across the US from 1960 to 2000. A similar study by Beaulieu and Messner (2010) compared the effect of divorce rates on homicide over a period of five decades in 131 large cities in the US. In these, and other studies, researchers have used a standardised methodological approach in order to find a comparable association between social disorganisation and crime. The problem, however, is that the robust and consistent predictors of crime identified in their studies are limited to the US. Without globally standardised measures, different interpretations of social disorganisation variables will continue to remain a hindrance in the identification of consistent predictors of crime across international contexts.

A possible solution to the inconsistencies is to use International Organization for Standardization (ISO) 37120 indicators to operationalise social disorganisation theory in spatial crime research. The ISO 37120 is a set of guidelines which forms part of a worldwide initiative to promote and implement sustainable development (ISO, 2014). The indicators contained within the ISO 37120 provide a standardised manner to measure performance and to monitor progress over time, while promoting information sharing, transparency and open data. The indicators include measures related to poverty, transport, immigration and service provision, among numerous others. The indicators were specifically developed to promote international comparisons by providing an international benchmark to measure and compare the quality of life and services in cities, thereby promoting the sharing of best practices.

There are a number of ISO 37120 indicators which can potentially be used to represent the central tenets of social disorganisation theory. Importantly, these internationally-agreed indicators include clearly defined specifications regarding their measurement and calculation. For example, the unemployment rate (measured as the number of

working-age city residents who were not in paid employment or self-employment, but available for work and seeking work (numerator) divided by the total labour force (denominator)) or the percentage of the population without electricity (measured as the percentage of the population without authorized electrical service) could be used to operationalise socio-economic deprivation. Other, more complex, indicators related to environmental economics and sustainability could also potentially be applied. The overarching aim is that the application of these standards will promote simplified and inexpensive reporting which can be applied in diverse localities, irrespective of size, location or level of development. Currently, there are no international standardised measures allowing for these types of crime comparisons to be made across contexts.

But why is it important or necessary to have standardised measures to represent social disorganisation theory? At face value, this chapter examined the causes of crime in Khayelitsha, South Africa. Violent crime was found to be positively and negatively associated with socio-economic deprivation in the township. It was also found to be non-significant. These perplexing and contradictory findings are the result of using a variety of different variables and combinations of variables to represent this particular tenet of social disorganisation theory. The non-standardised way in which the central tenets of social disorganisation theory are operationalised, limits the ability of researchers, particularly in the developing world, to compare and benchmark their results with other international studies. Comparative analysis requires standardised approaches and standardised variable definitions. The ISO provides one such universally-agreed upon framework to guide variable selection.

Townships such as Khayelitsha desperately require crime prevention and reduction interventions based on sound empirical evidence. This evidence can emanate from comparative knowledge sharing with other international studies which can arguably only be achieved through international benchmarking. The use of these indicators also offers the benefit of contributing towards the creation of a reliable foundation of globally standardised data which can assist cities in building core knowledge surrounding crime causation, and can be used for comparative knowledge sharing in spatial crime research. Other advantages are the potential for long-term performance assessments, informed decision making to guide policy and openly available and transparent data.

The theory of social disorganisation has been shown to be relevant in most international settings and it could provide a sound theoretical framework for studying and understanding crime in Khayelitsha and, more importantly, to inform strategies aimed

at preventing and reducing the occurrence of violent crime. However, the results of the foregoing analysis raise more questions than answers regarding the theory's applicability. If, however, there is confirmation of the applicability of the theory in a South African context using a standardised cross-national comparative methodology, this will allow the relevant role players that deal with crime prevention in the country to prescribe policies to reduce crime. It is important to note that a number of crime prevention strategies commonly employed worldwide are based on existing crime theory (Akers, 1973; Sampson & Wilson, 1995; Shaw & McKay, 1942) and South Africa could potentially follow suit. Of course, this is not an advocacy for the substitution of existing 'conventional' variables in spatial crime research or in studies which employ social disorganisation theory or other spatial crime theories, but rather to motivate that standardised measures can, in certain instances, provide an extra string in the bow for researchers, particularly in contexts outside the West, to compare and contrast their results with their Western peers. Any such advantage should be welcomed, particularly in a context such as Khayelitsha where crime is normalised and the criminal justice and state structures employed to address this scourge have no legitimacy.

The next two chapters present the second part of the study. These sections introduce the possible solution to the problem of variable inconsistency illustrated above. That is, using ISO 37120 indicators to operationalise social disorganisation characteristics in spatial crime research. Chapter 5 demonstrates the opportunity that exists to apply sustainable development standards in studies of social disorganisation and includes a table identifying ISO 37120 indicators that can be used to represent the central tenets of social disorganisation theory. Chapter 6 tests this taxonomy by undertaking a cross-national comparison of crime causation in Khayelitsha and Fort Lauderdale using these specifications.

CHAPTER 5: THE IDENTIFICATION OF ISO VARIABLES TO OPERATIONALISE THE SOCIAL DISORGANISATION THEORY

5.1 THEORETICAL BACKGROUND

In Chapter four the numerous ways in which social disorganisation theory can be operationalised were demonstrated. These inconsistencies shown in the previous chapter hinder attempts at comparative analyses, yet no studies have attempted to examine the utility of standardised indicators or variables in spatial crime analysis. This chapter provides theoretical background pertaining to widely recognised and accepted international policy on urban safety and sustainable development. The aim here is to motivate the relevance and applicability of using existing and available sustainable development standards (such as the ISO) in studies measuring social disorganisation.

5.1.1 Urban Safety

Social disorganisation is intrinsically linked to the concept of urban safety. According to the official report on *The State of Urban Safety in South Africa* (Urban Safety Reference Group, 2016, 12), urban safety is defined as “living free from the threat or fear of violence and crime, it is a basic human right, a public good, and both a necessary condition for the realisation of spatial transformation, integrated and sustainable human settlements, economic development, job creation and active citizenship”. Urban safety is a global concern, particularly in the developing world where poorly planned and

managed urban spaces contribute to rising inequalities in cities. According to the United Nations (2015b) informal urbanisation has increased dramatically in developing countries over the past decade and a large percentage of urban residents in developing countries have been victims of crime, at least once over the previous five years, with victimisation rates as high as 70% in parts of Latin America and Africa.

The South African government has repeatedly acknowledged that crime and urban safety are major problems in the country (Urban Safety Reference Group, 2016). The National Development Plan's (NDP) (National Planning Commission, 2013) section on building safer communities notes that the high crime levels in South Africa have dramatically slowed social and economic development. The Plan further highlights the fact that many South Africans live in constant fear of crime which makes it harder for individuals to pursue their personal goals and to take part in social and economic activity. A number of policies and strategies have been put in place in South Africa to promote urban safety, including the White Paper on Safety and Security (Civilian Secretariat for Police, 2016), the National Development Plan (National Planning Commission, 2013) and the Integrated Urban Development Framework (Department of Cooperative Governance, 2016). These policies all acknowledge that crime is not just a security issue, but an urban safety issue that has deep social and economic roots. The collective policies stress the need for a holistic approach to community safety that takes issues such as poverty, inequality and unemployment into account, and also emphasise the importance of integrating urban safety into existing crime fighting policies and programmes. In the fight against crime, however, much emphasis is put on role players in the justice and security clusters, and much less on crime prevention and addressing the issue of urban safety. Furthermore, the implementation of urban safety initiatives together with the measurement and management of urban safety, remains weak (Ugur, 2014).

5.1.2 Measuring Urban Safety

Urban safety is a cornerstone of sustainable development (United Nations, 2015b). The concept of sustainable development formed the foundation of the United Nations Conference on Environment and Development held in Rio de Janeiro in 1992. The concept gained status as a major global challenge at this seminal summit attended by over 100 heads of state and representatives from 178 national governments. Agenda 21

was adopted as an action plan and strategy to move towards sustainable patterns of development. Agenda 21 highlights three broad integral themes; the economy, the physical and the social environment, which must all be considered in order to achieve sustainable development. The majority of countries from across the globe have committed themselves to various sustainable development initiatives. While this is admirable, the effectiveness of these initiatives needs to be continually monitored and evaluated to determine their value.

In 2018 the World Bank published its urban sustainability framework (USF) which provides an integrated approach to help cities understand their sustainability status and formulate and implement action plans (World Bank, 2018). The USF is based on the 2030 Agenda for Sustainable Development and sets out an extensive action plan of how to implement 17 sustainable development goals which form the backbone of the agreement (World Bank, 2018). The first phase of the framework involves the construction of a database, including geo-spatial data and the infrastructure to analyse and create knowledge out of data. It involves the selection of indicators or some form of measuring unit or parameter. This is pivotal as these indicators form the groundwork for future developments with indicators serving as input to future development and planning. The indicators are descriptive (quantitative or qualitative) measures that enable the simplification of information on complex phenomena, such as poverty or crime, and also allow for clear and unambiguous communication (Huovila et al., 2019).

Once the indicators have been defined, it is possible to identify benchmarks against which to compare other similar cities to assess performance. This can help city officials to identify and adopt good practices used elsewhere to strengthen their own cities' sustainability. On a temporal scale, indicators can be compared to historical data from the same city to help in measuring growth or improvements. The indicators can reveal past patterns and the beneficial and detrimental impacts of previous practices (World Bank, 2018). Standardised indicators also allow users to identify trends, make predictions and monitor the impact of policies over time. The question in this study is whether it is feasible to apply measures of sustainable development and urban safety in studies of social disorganisation?

5.1.3 The ISO and Standardised Measures

Established in 1947, the International Organization for Standardization (ISO) is an independent and non-governmental organisation with a mission to develop international standards that can facilitate the exchange of goods and services among its 165 member countries. The ISO has published hundreds of standards over the past few decades on a diverse range of topics ranging from ISO 1 which specifies the standard reference temperature for geometrical product specification and verification to ISO 4921 which defines terms for basic knitting concepts. The ISO 37100 range of international standards in particular helps communities adopt strategies to become more sustainable and resilient. Among the series of standards within this sub-group is the ISO 37120, *Sustainable development of communities - Indicators for city services and quality of life*, published in 2014,¹ which outlines key measurements for evaluating a city's service delivery and quality of life. ISO 37120 provides a list of standardised indicators and outlines a uniform approach and methodology in order for the indicators to be directly comparable across cities and countries. The standards also provide guidance to cities on how to assess their performance towards contributing to the United Nations Sustainable Development Goals, the global roadmap for a more sustainable world. The ISO 37120 standards are structured around seventeen broad themes including the economy, education, energy, safety, shelter and services.² Within each broad theme there are several indicators for city performance which have been divided into core or required indicators and supporting or recommended indicators, as well as profile indicators providing basic statistics and background information. All of the indicators are clearly defined with specifications and guidelines given regarding their measurement and calculation. The indicators are not targets per se, but rather the aim is that the application of these standards will promote a simplified and inexpensive reporting which can be applied in cities, municipalities or local governments, irrespective of size, location or level of development. They also provide a standardised manner by which to measure performance and monitor progress over time, while promoting information sharing, transparency and open data. They offer the added benefit of contributing towards the

¹A revised version was released in July 2018 with an additional 28 new indicators, 24 old indicators removed and slight modification to 10 indicators.

²The 17 categories include: economy, education, energy, environment, finance, fire and emergency response, governance, health, recreation, safety, shelter, solid waste, telecommunication and innovation, transportation, urban planning, waste water, water and sanitation.

creation of a reliable foundation of globally standardised data which can assist cities in building core knowledge, and can be used for comparative knowledge sharing (ISO, 2014).

5.1.3.1 Indicators to Measure Performance

The use of indicators to measure performance is not new. There are a number of recent examples of studies conducted to promote the use of standardised indicators to contribute towards sustainable development and information sharing (González-García et al, 2019; Hong et al., 2019; Leonova et al., 2018). Several studies have specifically examined the relevance of applying ISO standards. Huovila et al. (2019), for example, compared the use of different sets of standardised indicators to identify indicators that correspond to different cities' needs. They recommended ISO 37120 for sustainability assessments while stressing the importance of data quality and the detrimental effect of basing decisions on erroneous input data. They furthermore outlined the advantages of using indicators, including setting targets, monitoring their performance over time and increasing data transparency to residents. De Campos Filho et al. (2019) used ISO 37120 indicators to compare the sustainability of four cities, two from developed and two from developing countries namely, Boston (US) and London (UK), Tbilisi (Georgia) and Guadalajara (Mexico). The researchers produced comparative sustainability scores on a range of measures, enabling city managers and other relevant stakeholders to benchmark and compare the position of their city globally in terms of its sustainability. In the Ukraine Bortnik (2019) found that ISO 37120 indicators improved existing non-standardised indicators used by local government, and assisted in measuring the effectiveness of urban services and quality of life over time. The indicators allow for knowledge sharing, benchmarking and provide support for policy development and future planning.

5.1.3.2 Indicators of Social Disorganisation

There is much overlap between the neighbourhood characteristics commonly used to represent social disorganisation theory and the 17 World Bank prescribed sustainable development goals for 2030 that are reflected in the ISO 37120 indicators. This study is the first attempt to empirically merge the theory and indicators of sustainable development.

Table 5.1 lists the components used to measure social disorganisation and the comparable ISO 37120 indicators and sustainable development goals. The similarities and overlaps among the indicators, variables and goals are evident. The neighbourhood characteristics related to socio-economic deprivation and urbanisation are relatively well represented among the ISO 37120 indicators. Ethnic heterogeneity and residential mobility can be measured using ISO 37120 guidelines regarding immigration, migration and the percentage of the population that is foreign born. Other neighbourhood characteristics, specifically related to family disruption are, however, poorly represented among the ISO indicators. It is nevertheless a good starting point for creating standardised variables to measure social disorganisation globally and developing additional standardised indicators to measure family disruption.

Table 5.1: Indicators of social disorganisation

Social Disorganisation Concept	ISO 37120 Indicator (2014)	2030 Sustainable development goal
Crime	Violent crime rate per 100 000 population	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable; Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.
Socio-economic deprivation		
Poverty	% Population living in poverty	Goal 1. End poverty in all its forms everywhere.
Unemployment	Unemployment rate	Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.
Education	% Population completing primary/secondary education	Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
Access to services: Solid waste	% Population with regular solid waste collection	Goal 3. Ensure healthy lives and promote well-being for all at all ages.
Access to services: Potable water	% Population with potable water supply	Goal 6. Ensure availability and sustainable management of water and sanitation.
Access to services: Sanitation	% Population with access to sanitation	
Access to Services: Internet access (to measure isolation)	% Population with Internet connections	Goal 9. Promote inclusive and sustainable industrialisation and foster innovation.
Access to energy	% Population with electricity service	Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all.
Access to transport, (to measure isolation)	% Population with personal auto-mobiles	Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable.

Table 5.1: Indicators of social disorganisation

Social Disorganisation Concept	ISO 37120 Indicator (2014)	2030 Sustainable development goal
<i>Residential Mobility</i>		
Immigrants	% New immigrants or foreign born	
<i>Urbanisation</i>		
Slum housing	% Population living in slum housing	Goal 9. Build resilient infrastructure
Population/dwelling density	Population/Dwelling density per km ²	

5.2 CHAPTER SUMMARY

The primary aim of this chapter was to motivate for the use of various ISO 37120 indicators as proxy variables in defining social disorganisation characteristics and to outline certain applicable indicators. Using these variables in spatial crime research would allow for a standardised approach to follow when undertaking research in vastly differing contexts. While crime and social disorganisation can be particularly challenging to measure and test in developing contexts, the ISO indicators can potentially be used to create a consistent and comprehensive database, thereby establishing a foundation for comparative analysis. Such a reliable platform of globally standardised data will enable researchers to contextualise levels of social disorganisation in communities, track progress and measure long-term performance, while encouraging knowledge sharing and, ultimately, promote informed management and decision making regarding planning and policies aimed at mitigating the risk of crime.

The following chapter examines the feasibility of employing a standardised approach by using variables informed by ISO 37120 guidelines to examine the causes of crime in two diverse contexts: Khayelitsha (in South Africa) and Fort Lauderdale (in the US). In this way Khayelitsha can be compared (for the first time ever) to a developed-world city regarding crime causation, to serve as an international benchmark against which to measure and compare levels of urban safety.

CHAPTER 6: THE USE OF ISO VARIABLES IN A CROSS-NATIONAL COMPARATIVE STUDY

* A version of this chapter has been submitted for publication to International Criminal Justice Review. As a result, some sections may be repetition from previous chapters.

Groeneveld, G., & Breetzke, G. D. (submitted). A cross-national spatial study of crime using variables informed by the International Organization for Standardization (ISO). International Criminal Justice Review

6.1 INTRODUCTION

The non-standardised way in which the central tenets of social disorganisation theory have been operationalised is problematic as it limits the ability of spatial crime researchers to compare and benchmark their results with other international studies. This is particularly relevant to scholars undertaking spatial crime research in a developing context who would like to test the applicability of a 'Western' theory of crime such as social disorganisation theory in their particular context and, in doing so, gain a more thorough theoretical understanding of crime and its underlying causes. The practical and policy implications of being able to suitably compare results across countries is also significant as many crime prevention strategies are informed by theory (Akers, 1973; Wilson & Kelling, 1982). One mechanism that allows for the standardisation of variables used to operationalise spatial crime theories such as social disorganisation theory is the standards produced by the International Organization for Standardization (ISO). The ISO is a worldwide federation of national standards bodies that develop standards on a range of topics that are internationally agreed upon by experts in their field. In particular, the ISO 37120 indicators were developed to assist in

the monitoring and evaluation of sustainable development initiatives pertaining to the environment and contain a number of standards that could potentially be used as proxies for the central tenets of social disorganisation theory. Currently there are no existing international standardised measures allowing for crime comparisons across differing contexts.

This study serves as an attempt to fill this gap by examining the causes of crime in two vastly different contexts: Khayelitsha, in South Africa, and Fort Lauderdale, in the United States, using variables informed by indicators developed by the ISO. In undertaking this analysis, a city in the Global South (Khayelitsha) can be compared (for the first time ever) to a city in the Global North (Fort Lauderdale) in terms of its crime causation, serving as an international benchmark against which to measure and compare broader levels of urban safety. This is the first study of its kind to directly compare spatial crime patterns in cities in South Africa and the United States using a standardised approach. This chapter highlight the potential as well as challenges involved when undertaking cross-national spatial crime research.

6.2 STUDY AREAS

The township of Khayelitsha is located approximately 30km south-east of Cape Town in South Africa. Similar to other so-called segregated ‘townships’, Khayelitsha is located on the urban periphery and is grossly under-serviced and under-resourced with very few recreational and green spaces, limited commercial and transport services, and sub-standard housing (Brunn & Wilson, 2013). It has an average population density of 15 000 people per km² and official figures state the population size of the township at just under 400 000 (Statistics South Africa, 2011). Khayelitsha is one of the most deprived and marginalised communities not only in South Africa but in the world with just under three-quarters of the population living in severe poverty (Statistics South Africa 2011). Crime is rampant with the township among the most violent in the country and a homicide rate consistently over 80 per 100 000 residents, almost double the national average (Crime-Hub, 2018).

The city of Fort Lauderdale is situated on the south-east coast of Florida in the central part of Broward County, approximately 40km north of Miami (see Figure 6.1). The study area (145km²) comprises one of ten sub-counties within Broward county and has an average population density of roughly 2 100 people per km² and a population of roughly

300 000. This is about one sixth of the total population of Broward county which has an overall population of just under two million inhabitants. Similar to Khayelitsha, the city of Fort Lauderdale has higher levels of deprivation, and crime when compared to the national average (United States Census Bureau, 2018) although the city is nevertheless located in a highly developed state and country.

There are a number of notable similarities and differences between the two study sites in terms of their population and spatial structure. Both areas have roughly the same population size and number of households. However, Khayelitsha is on average seven times more densely populated than Fort Lauderdale, and the latter's average block group area (analysis unit) is close to twenty times larger than an average SAL. Table 6.1 contains the descriptive statistics relating to the population for the two study areas. The census data that was used in this study was the data that most closely aligned to the crime data that was available. Ideally, the same year would be used for each study area but that was simply not possible in this instance.

Table 6.1: Descriptive statistics for population of Khayelitsha in 2011 per SAL and Fort Lauderdale in 2018 per block group
(Statistics South Africa, 2011; United States Census, 2018)

Descriptive statistics	Mean	Std Dev	Min	Max
Khayelitsha (n = 581)				
Population (391 749)	671.9	237.51	20	1792
Population density - weighted (km ²)	26 530	16 353	1695	114 285
Analysis unit size (km ²)	0,04	0,04	0,001	0,33
Households (118 000)	203	68	6	595
Fort Lauderdale (n= 197)				
Population (306 704)	1557	788	242	4381
Population density - weighted (km ²)	2594	1459	227	10 757
Analysis unit size (km ²)	0,76	0,59	0,09	5,65
Households (121 353)	616	302	107	1871

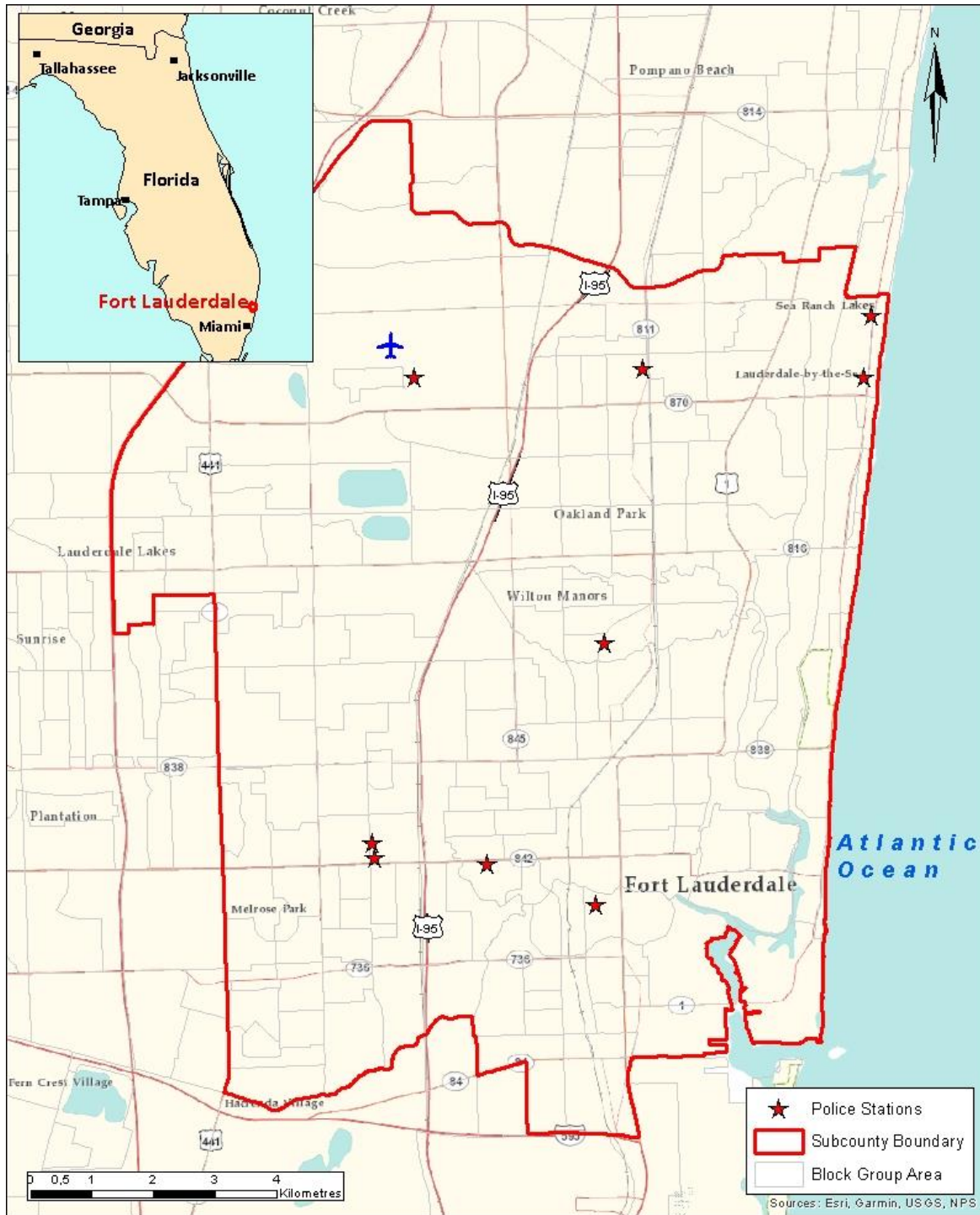


Figure 6.1: The location and layout of Fort Lauderdale

6.3 DATA AND METHODS

This section provides detailed descriptions of the dependent and independent variables used for Khayelitsha and Fort Lauderdale respectively. Two similar sets of standardised variables were calculated for the two study areas. The dependent variable and six of the eight independent variables were informed by ISO guidelines. Various defined census data had in some cases to be altered to adhere to ISO specifications, once again confirming the need for prescribed standards. In the two instances where there were insufficient ISO-defined variables available to operationalise a particular concept, other census variables were included in the analysis on condition that the variable under consideration had an identical definition in each respective country's census data. The section concludes with ISO informed variables, considered for the analysis, but excluded largely due to socio-demographic differences between the study areas or incompatible census data. Some of the difficulties are highlighted regarding attempts to align ISO defined variables and the reality of extracting these indicators from data sets in two vastly different contexts.

6.3.1 Unit of Analysis

The socio-economic data used for Khayelitsha was obtained from Statistics South Africa's census of 2011 (<http://www.statssa.gov.za/>). The spatial unit of analysis is the small area level (SAL). Of the 583 SALs in Khayelitsha, two exceptionally large areas towards the east of the township had very low population densities (43 and 293 people per km² respectively), and were discarded. The remaining 581 small areas have an average surface area of approximately 0.04km² and an average population size of 672 people (Statistics South Africa, 2011).

The socio-economic data used for Fort Lauderdale was obtained from the United States Census (2018). The data used was extracted from the American Community Survey (ACS), which forms part of the US decennial census programme. The ACS provides additional yearly estimates that are based on data collected from randomly sampled addresses. Although it is preferable to have compared spatial crime causation in Fort Lauderdale with that of Khayelitsha for the same time period, certain data constraints prevented it, notably the non-alignment of available crime data.

The spatial unit of analysis used for Fort Lauderdale is the block group level, which is the

smallest geographical level at which the ACS data required for this study was available (United States Census, 2018). There are 197 block group areas in Fort Lauderdale sub-county. These have an average surface area of approximately 0.8km², and an average population of 1557 people.

6.3.2 The Dependent Variable

There is no standard way in which to represent delinquency or crime in studies of social disorganisation. Neighbourhood or community crime levels have been represented using either offender or offence data, and while studies most often focus on measures of victimisation (Lowenkamp et al., 2003; Marzbali et al., 2014), a smaller number of studies have included measures of offender data (Bruinsma et al., 2013; Law & Quick, 2013; Oberwittler, 2004; Polczynski Olson et al., 2009). Similarly, criminal offences have been represented using a variety of categories namely property crime (Allen & Cancino, 2012; Zhang et al., 2007) or sexual crime (Breetzke et al., 2019; Polczynski Olson et al., 2009; Yahaya et al., 2013). Arguably the most popular way to represent community crime in studies of social disorganisation is homicide (Ceccato et al., 2007; Escobar, 2012; Graif & Sampson, 2009; Lancaster & Kamman, 2016; Nieuwbeerta et al., 2008; Thompson & Gartner, 2014) or violent crime (Cahill & Mulligan, 2007; Ceccato & Oberwittler, 2008; Kubrin et al., 2018; Sampson & Raudenbush, 2004; Sun et al., 2004; Triplett et al., 2005; Wickes et al., 2013).¹

Violent crime rate: ISO 37120 indicator

According to the ISO 37120 violent crimes are offences that involve force or the threat of force to a person. Four offences are classified as violent crime, namely murder and non-negligent manslaughter, rape, robbery, and aggravated assault. The total incidence of reported violent crime is the total sum of the four categories. The violent crime rate per 100 000 population is calculated as the total number of all violent crimes reported per 100 000 population (ISO, 2014). According to the ISO (2014) guidelines the number of violent crimes is an indicator of the amount of serious criminal offences in a city and a lead indicator of feelings of personal safety. The number of violent crimes in a city is considered as a benchmark measure of the overall level of safety in that city.

¹The number of homicides per 100 000 population was not used to represent the dependent variable because of the large amount of study units with zero homicides: Approximately 44% of SALs in Khayelitsha, and 97% of block groups in Fort Lauderdale.

The point-level crime data for the greater Khayelitsha policing precinct was obtained from the South African Police Service (SAPS). The SAPS include seven crimes in the category serious contact crimes, namely murder, attempted murder, common robbery, aggravated robbery, rape, assault with the purpose to inflict grievous bodily harm (including other sexual assault) and common assault. Although common assault is a category which is often included as a component of violent crime in other studies of social disorganisation (Breetzke, 2010b; Jobes et al., 2004; Lockwood, 2007; Sun et al., 2004; Triplett et al., 2005), it was excluded from this analysis as per the ISO 37120 guidelines.

The relevant ISO violent crime offences were extracted from the SAPS crime dataset and a three-year average (2010-2012) was calculated to compensate for possible temporal fluctuations, and to coincide with the most recent 2011 South African census data. Over the three-year period an average of 2682 violent crimes per year were recorded based on the ISO (2014) guidelines, or 680 crimes per 100 000 population. This included 333 murders per year or roughly 80 per 100 000 population. Table 6.2 (at the end of this section) gives the descriptive statistics of violent crime in greater Khayelitsha (and Fort Lauderdale).

Figure 6.2 shows spatial distribution of the mean violent crime rate per 100 000 population in Khayelitsha per SAL. Extremely high crime rates exceeding 3000 per 100 000 population are concentrated in a few neighbourhoods located predominantly in the north around the intersections of Mew Way and Lansdowne Roads in Ikwezi Park and Bonga and Pama Roads in Village V3 North, and in the south around the intersection of Oscar Mpetha and Walter Sisulu Roads. Crime rates exceeding 1000 per 100 000 population are relatively common and scattered throughout the study area with roughly 40% of neighbourhoods exhibiting crime rates between 250 and 1000 per 100 000 population. A small number, 80 SALs or 14% are without any recorded violent criminal incidences over the three-year study period.

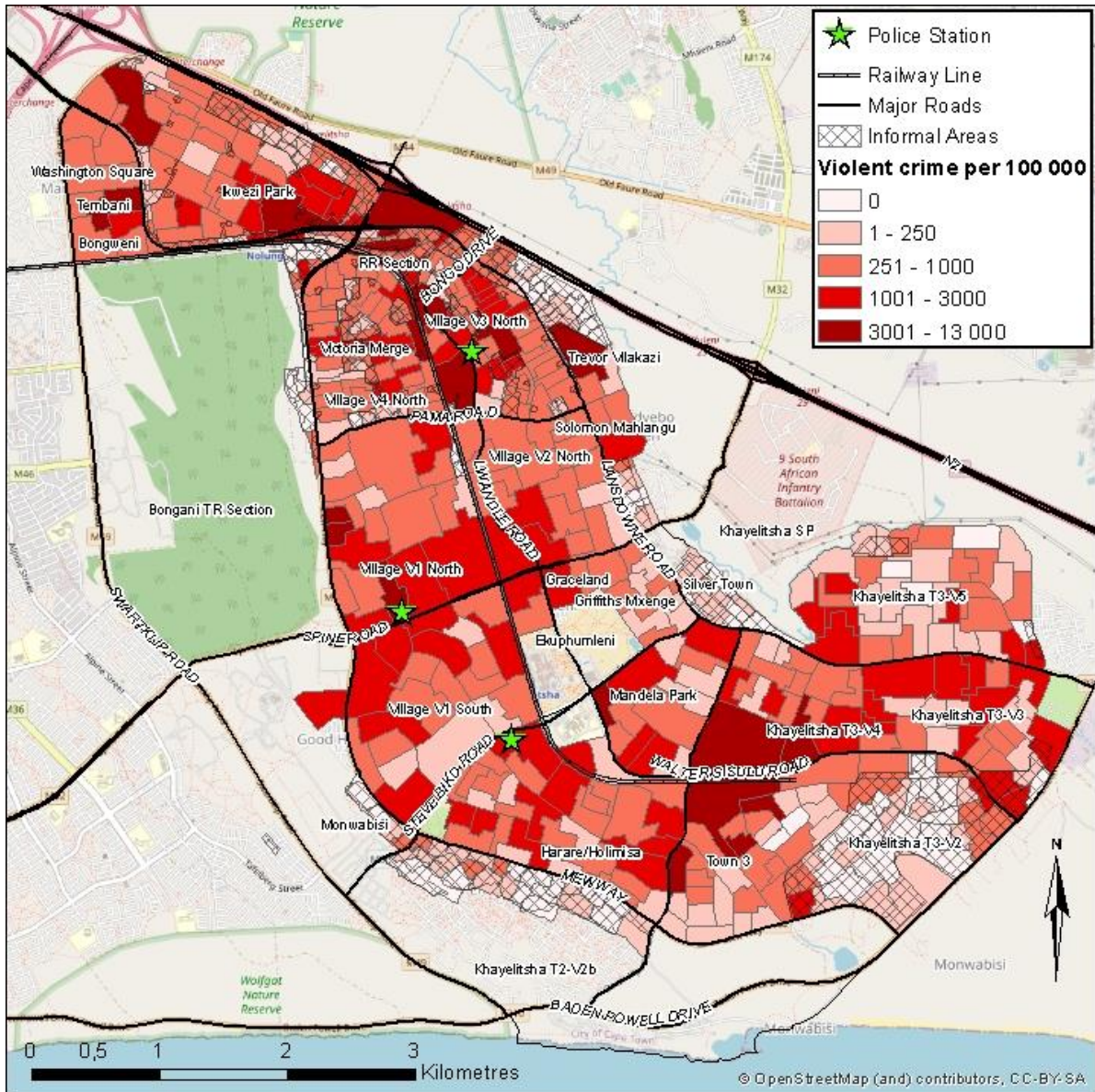


Figure 6.2: Spatial distribution of violent crime rate per 100 000 population in Khayelitsha, 2010-2012 (n= 581 SAL's)

Point-level crime incident data for Fort Lauderdale was obtained from the Fort Lauderdale Police Department. The data set included criminal incidents which occurred between January 2014 to December 2018. The relevant ISO categories (including all other sexual assault incidents) were extracted and a four-year average (2015-2018)¹ was calculated to coincide with the American Community Survey (ACS) census data from 2014-2018 (United States Census Bureau, 2018). One of the additional benefits of using ISO categories is that the user is restricted to delineating crime categories based on the ISO specifications. Robbery may be defined differently in different countries but by relying on the ISO guidelines, this incongruity is overcome. Crime data from the same time period for both study areas would have been ideal, but due to the non-alignment of available data, this was not possible. This does limit the ability of direct comparison of crime causation over the exact same time period, but allows for a general comparison to be undertaken.

Figure 6.3 shows the spatial distribution of the mean violent crime rate per 100 000 population in Fort Lauderdale per block group. Crime rates are spatially concentrated in a relatively few number of neighbourhoods, specifically in the north around the airport and in central-southern parts of the city along the I-95 highway and along the coast. Compared to Khayelitsha, roughly 31% of neighbourhoods in Fort Lauderdale do not have any serious criminal incidences over the 4-year period and another 26% recorded only one and two incidents.

¹The 2014 data is incomplete, and therefore excluded.

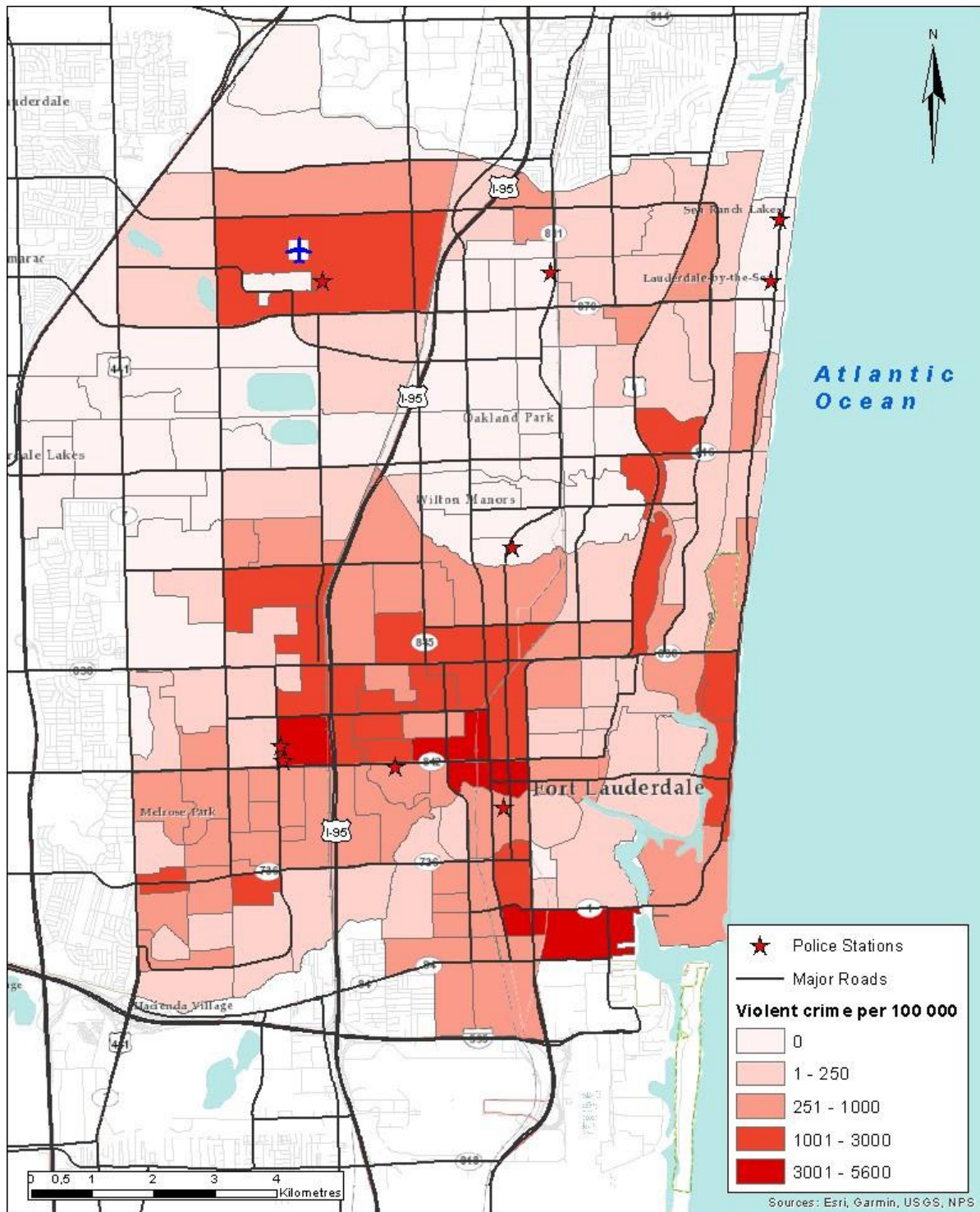


Figure 6.3: Spatial distribution of violent crime per 100 000 population in Fort Lauderdale, 2015-2018 (n= 197 Block groups)

Table 6.2 gives the descriptive statistics of violent crime in Khayelitsha and Fort Lauderdale. There is considerable difference in crime levels between the SALs in Khayelitsha as evident in the large range (min = 0 and max = 12 500) and the standard deviation (1030). An average of 1194 violent crimes per year were recorded in Fort Lauderdale over the four-year study period, or 450 violent crimes per 100 000 population. Nine murders per 100 000 population were recorded in Fort Lauderdale between 2015-2018 which is nine times less than Khayelitsha. The murder rate in Fort Lauderdale is however almost double that of the national average in the US.

Table 6.2: Violent crime per 100 000 population (SAPS, 2011; Fort Lauderdale Police Department, 2018)

Violent crime per pop (100 000)	Mean	Std Dev	Min	Max
Khayelitsha (n= 581 SAL's)	680	1030	0	12 500
Fort Lauderdale (n= 197 Block groups)	450	793	0	5528

6.3.3 The Independent Variables Guided by ISO Standards

6.3.3.1 Socio-economic Deprivation

Socio-economic deprivation was operationalised using five independent variables namely the percentage population living in poverty, the unemployment rate, the percentage households with no Internet access, the percentage households with no motor vehicle and the percentage households with no electricity.

Population living in poverty: ISO 37120 indicator

According to the ISO (2014) poverty is an indicator of social equity and reflects levels of economic and social marginality and/or inclusiveness of a city. The percentage of the population living in poverty is calculated as the number of people living below the poverty threshold divided by the total current population. The definitions of a poverty threshold vary by country. According to the World Bank (2015) approximately 10% of the world's population live on less than US\$1.90 a day, which serves as the international measure of poverty. In South Africa the upper-bound poverty line is R779 (US\$50) per month per person. In the US poverty levels are defined nationally by the Census Bureau by family size and composition. In 2018 the poverty threshold for a single person in a household was US\$12 140 per year and for a family of four with two children it was US\$25,100 (United States Census Bureau, 2018). The poverty line for each country was obtained and the variable calculated per respective unit of analysis.

Khayelitsha

In this analysis, and in accordance with the ISO 37120 guidelines, any household earning less than R3200 (US\$200) per month or R38 400 (US\$2400) per year is regarded as living in poverty in Khayelitsha.¹ Figure 6.4 shows that poverty is largely concentrated in the informal areas on the periphery and in large parts of northern and southern Khayelitsha. In the more established neighbourhoods in the centre of Khayelitsha where poverty levels are less severe, up to 40% of the population are living below the poverty line.

Fort Lauderdale

Some 16.5% of the population live below the poverty line in Fort Lauderdale. This figure is considerably higher compared to the state of Florida where 12% of the population had incomes below the poverty threshold (United States Census, 2018). Poverty levels have been steadily increasing in the Broward County since the 1980s. The US census data related to poverty include two categories, namely income below or above the poverty level in the past 12 months (United States Census, 2018). Figure 6.5 shows the distribution pattern of the percentage of the Fort Lauderdale population living below the poverty threshold. There is clearly a greater occurrence of people living in poverty inland, away from the coast.

¹Refer to section 3.3.2.1 for more information on poverty lines in South Africa in 2011.

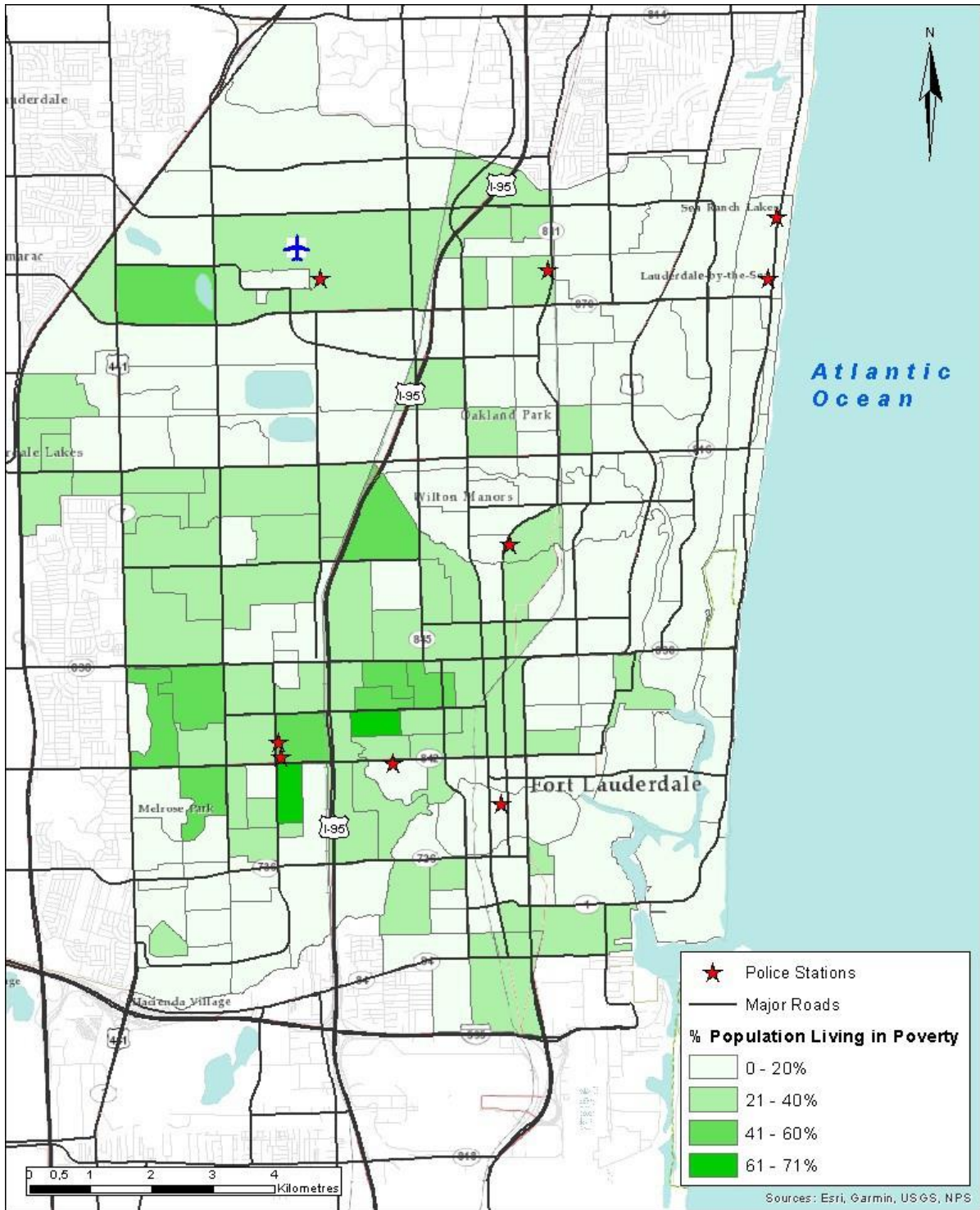


Figure 6.5: Spatial distribution of the population in Fort Lauderdale living below the poverty threshold (n= 197 Block groups)

Unemployment rate: ISO 37120 indicator

According to ISO (2014) unemployment refers to individuals without work, actively seeking work in a recent past period and currently available for work. Persons who were not looking for work but had a future labour market stake (arrangements for future employment) are counted as unemployed. Discouraged workers or the hidden unemployed are not counted as unemployed or as part of the labour force. Discouraged workers are persons who are not actively seeking work because they believe the prospects of finding it are extremely poor or they have restricted labour mobility, face discrimination, and/or structural, social, and cultural barriers. People who are not actively seeking work include those people who have not taken active steps to seek work (for example job searches, interviews or informational meetings) during a specified recent period (usually the past four weeks). According to ISO (2014) unemployment is calculated as the number of working-age city residents who, during the survey reference period, were not in paid employment or self-employment, but were available for work and seeking work, divided by the total labour force and expressed as a percentage.

Khayelitsha

In South Africa the definition of unemployment is aligned with the ISO definition, that is a person of 15 years and older is strictly defined to be unemployed only if they seek employment but cannot find a job. In this analysis, in accordance with the ISO 37120 guidelines, unemployment was calculated as the percentage of the labour force who are unemployed. Figure 6.6 shows that unemployment appears to be widespread in Khayelitsha, where 36% of the labour force are unemployed (Statistics South Africa, 2011).

Fort Lauderdale

In contrast, roughly eight per cent of the population in Fort Lauderdale are unemployed. The unemployment rate in the state of Florida is 3.1% and 3.9% of residents in the US are unemployed (United States Census, 2018). The US census data distinguishes the employment status (employed and unemployed) of the labour force. Figure 6.7 shows that low unemployment is widespread in Fort Lauderdale with only several block group areas around the airport and in the central area around the I-95 highway having slightly higher unemployment rates between 20% and 40%.

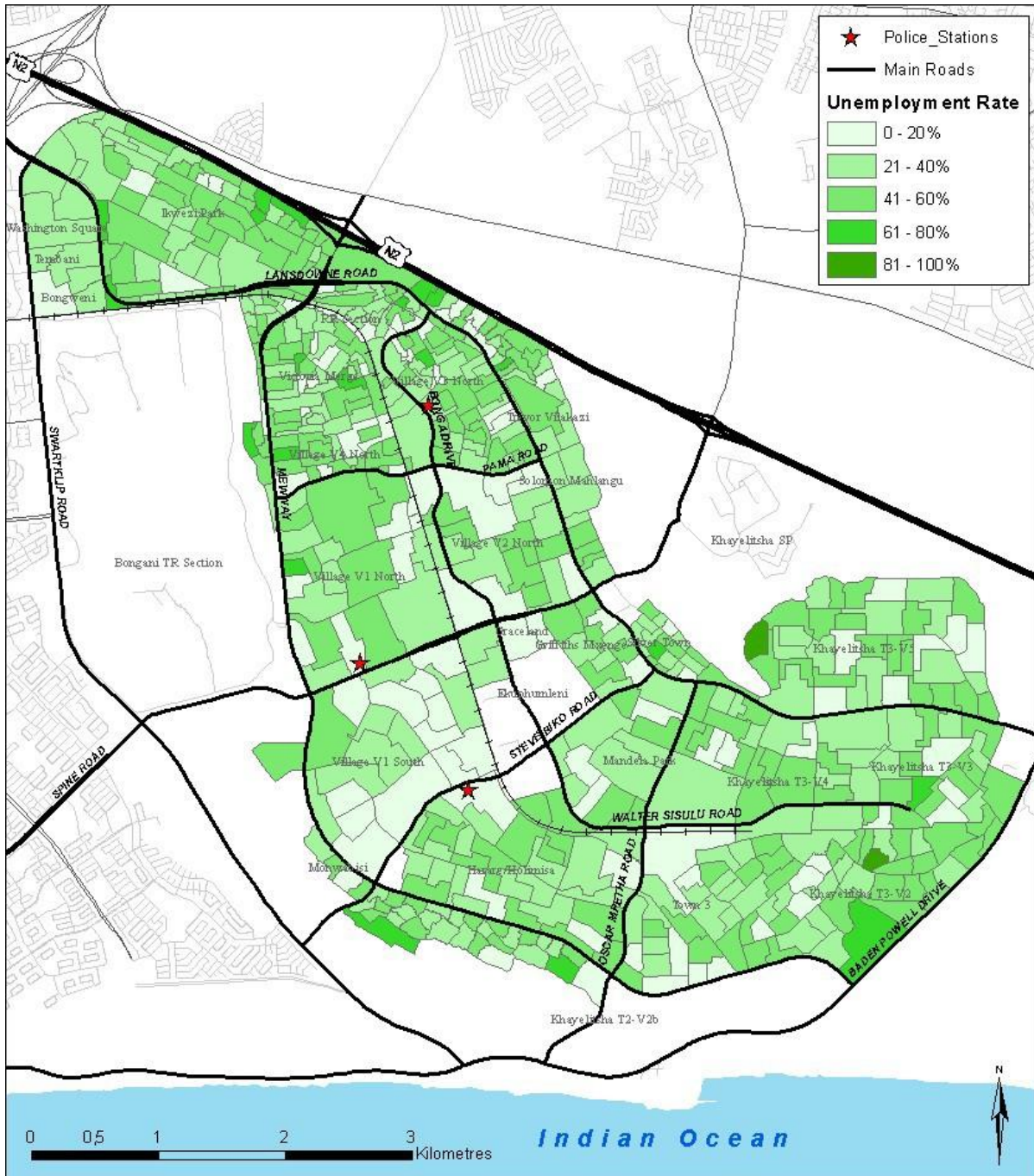


Figure 6.6: Spatial distribution of the percentage population in Khayelitsha that are unemployed (n= 581 SAL's)

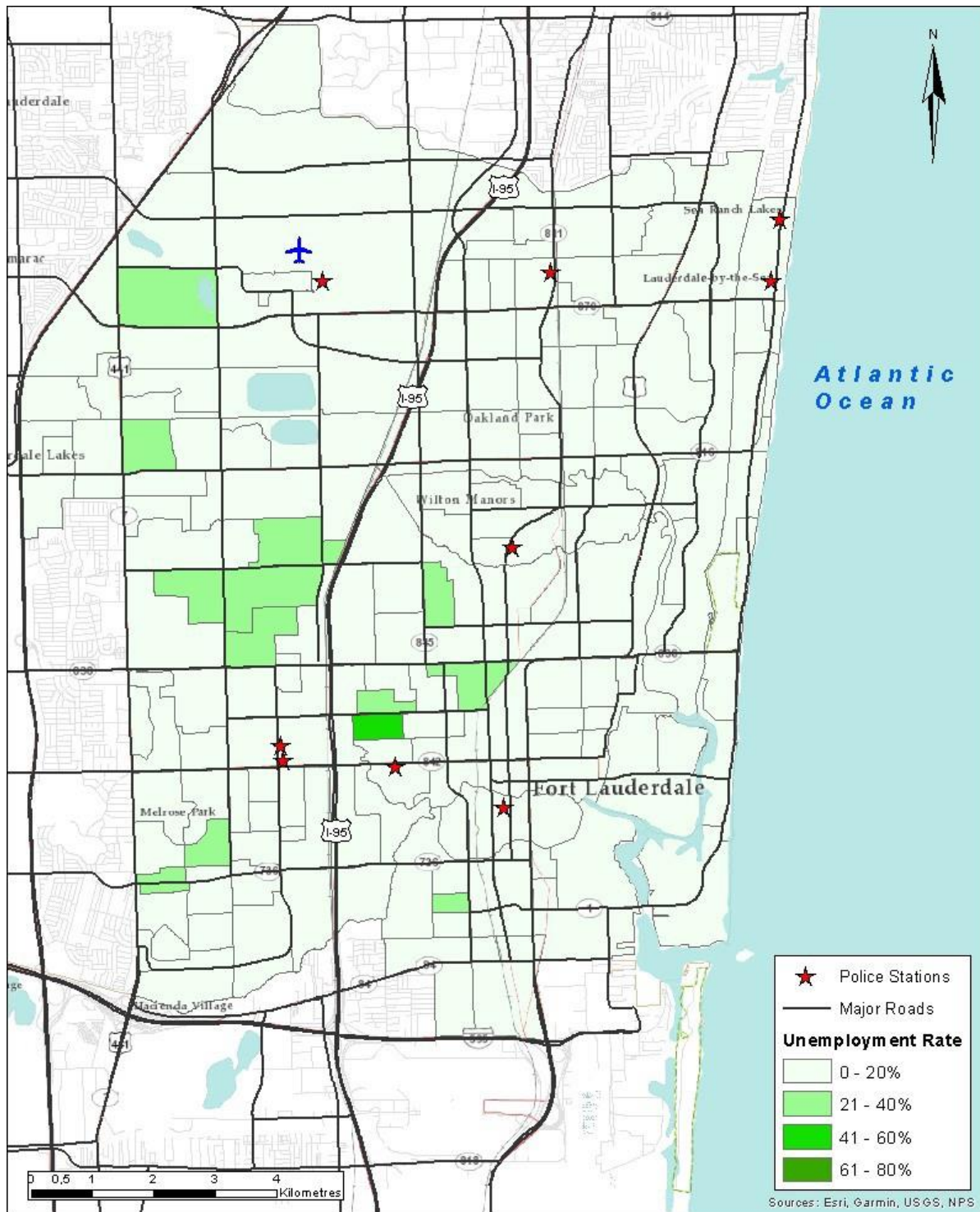


Figure 6.7: Spatial distribution of the percentage population in Fort Lauderdale that are unemployed (n= 197 Block groups)

Percentage of the population with no Internet connection: ISO 37120 indicator

According to the ISO (2014) access to the Internet is calculated as the number of Internet connections divided by total population. It serves as an indicator of access to information and communication connectivity. This unconventional variable is included in the analysis as a proxy for social isolation and marginalisation. A similar variable has been used in Colombia by Escobar (2012) defining socio-economic deprivation as ‘concentrated disadvantage and social isolation’ and operationalising it using a measure of the lack of telephone service. She argued that social isolation hinders future opportunities through segregating and alienating disadvantaged communities from mainstream society.

Khayelitsha

Statistics South Africa (2011) includes data pertaining to access to the Internet. In Khayelitsha 35% of households have access to the Internet, although only three per cent have access to the Internet from home, while most households (16%) access the Internet from a cell phone or work, or elsewhere (15%). The remaining 65% of households in Khayelitsha have no access to the Internet (Statistics South Africa, 2011). For the purposes of this analysis, all households without Internet access were included in the calculations.¹ Figure 6.8 shows that the percentage of households with no access to the Internet appears to be widespread throughout the township. Around the fringes in the informal areas high percentages of between 80% and 100% of households have no Internet access.

Fort Lauderdale

Census data provided by the United States Census Bureau (2018) includes households with Internet subscriptions, including dial-up alone, broadband such as cable, fiber optic, DSL, satellite Internet service and households without Internet access. Only 13% of households do not have Internet access in Fort Lauderdale. Figure 6.9 shows that this cohort is largely concentrated in the south-central area around the I-95 highway.

¹The ISO indicator refers to percentage population, however several of the variables used in this study are presented in terms of percentage households, based on the format in which the census data for both countries are provided.

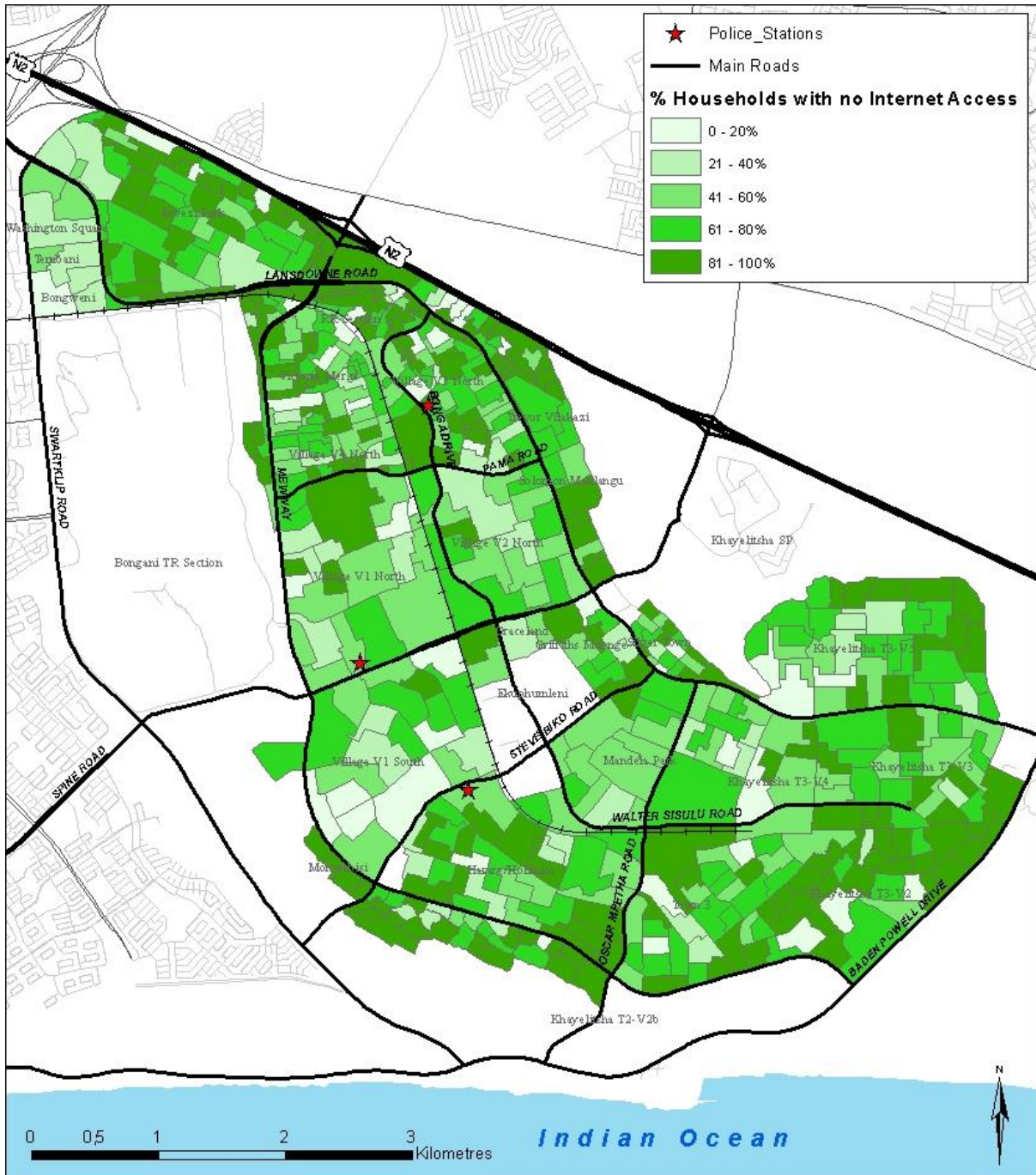


Figure 6.8: Spatial distribution of the percentage of households in Khayelitsha with no Internet access (n= 581 SAL's)

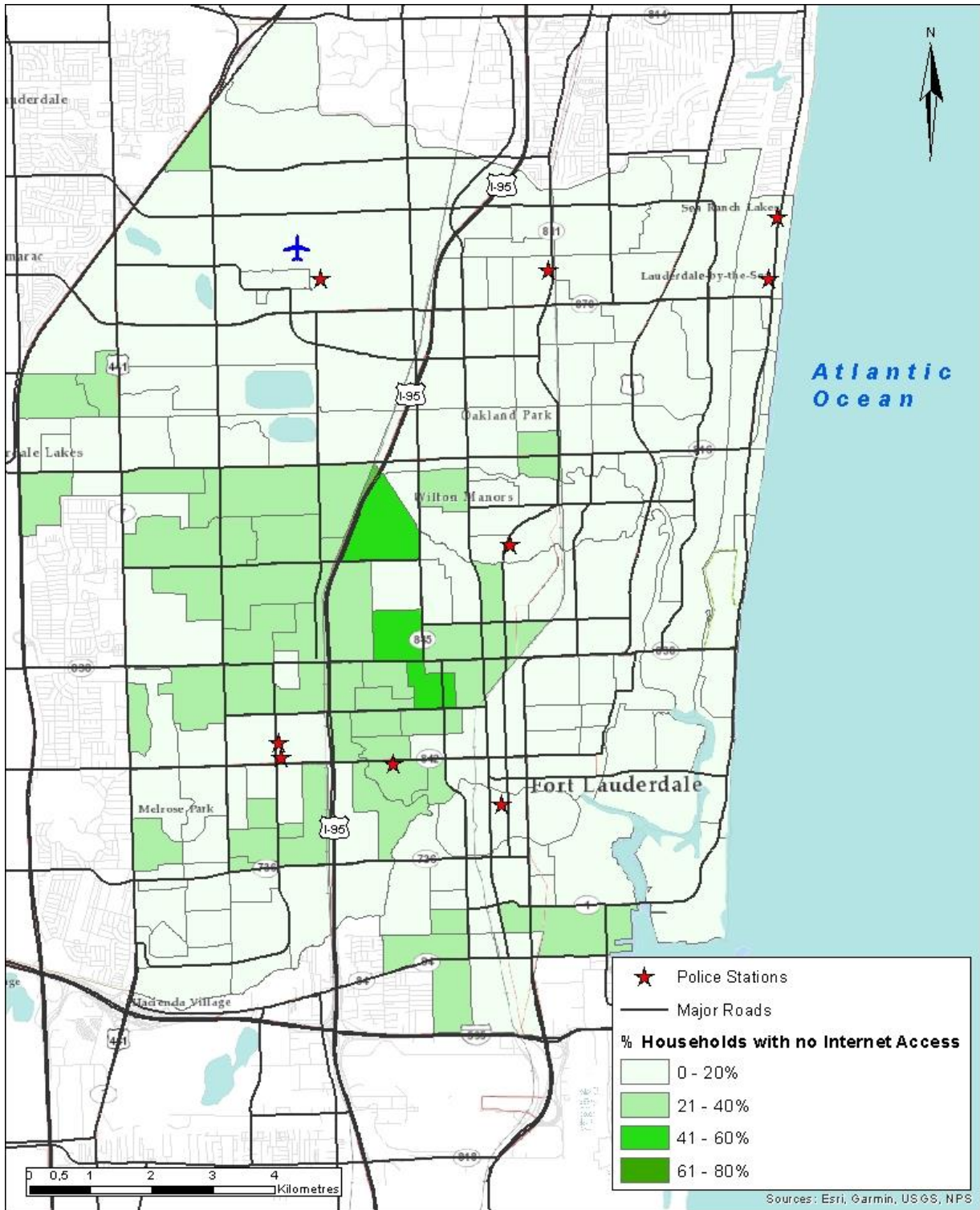


Figure 6.9: Spatial distribution of the percentage of households in Fort Lauderdale with no Internet access (n= 197 Block groups)

Percentage of the population not owning a motor vehicle: ISO 37120 indicator

According to the ISO (2014) the use of automobiles as a travel mode provides access to work, shopping, school and other community services. The ISO indicator for transport refers to the percentage of the population who do not own a personal automobile. It is calculated as the total number of registered personal automobiles divided by the total population.

The ownership of a motor vehicle has been included in studies of social disorganisation as a measure of absolute deprivation (Kassahun, 2005), but it is also feasible to use as a measure of social isolation. Several scholars have argued for the need to incorporate measures related to geographic isolation and marginalisation (often related to specific racial or ethnic groups) in studies of social disorganisation (Sampson & Wilson, 1995; Zahnow et al., 2013).

Khayelitsha

The South African census captures ownership of a motor vehicle as one of several categories of household goods and services (Statistics South Africa, 2011). The percentage households who do not own a motor vehicle was extracted for the analysis. Approximately 87% of the residents of Khayelitsha do not own a motor vehicle. Figure 6.10 shows that the incidence of motor vehicle non-ownership in Khayelitsha is predominant all over, except in the older more established neighbourhoods such as Village V1South, Ekuphumleni, Washington Square, Tembani and Bongweni.

Fort Lauderdale

Whereas the South African census only includes information related to the ownership of a motor vehicle (or not), the data captured by the United States Census Bureau (2018) contains details regarding the number of vehicles available per household, in categories of up to five motor vehicles per household. Figure 6.11 shows the percentage of households that do not own a motor vehicle in Fort Lauderdale. Non-ownership is uncommon in Fort Lauderdale where only eight per cent of the households do not own a motor vehicle. There are, however, pockets of block group areas in the centre of Fort Lauderdale where up to 38% of households do not own a motor vehicle.

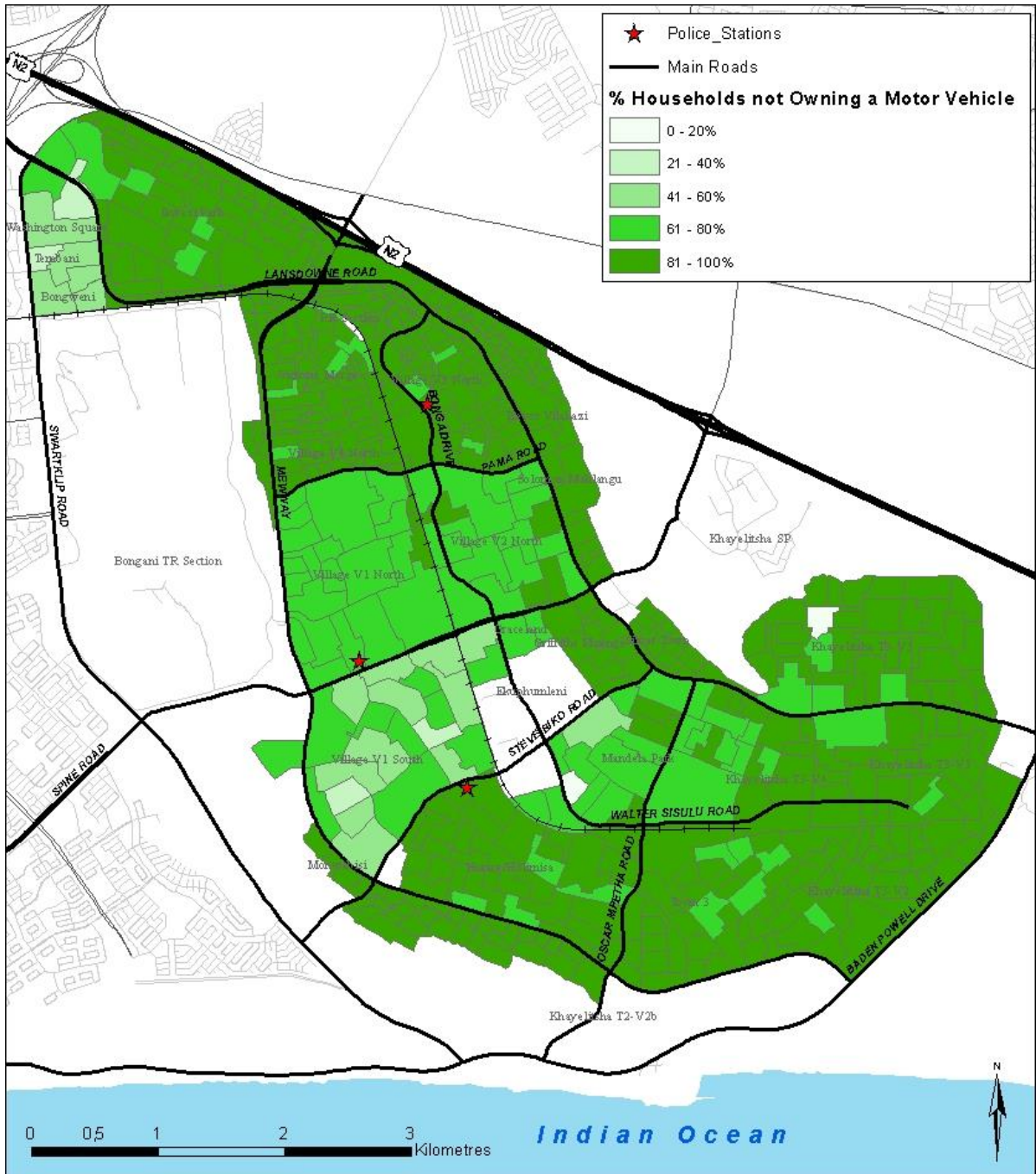


Figure 6.10: Spatial distribution of households in Khayelitsha that do not own a motor vehicle (n= 581 SAL's)

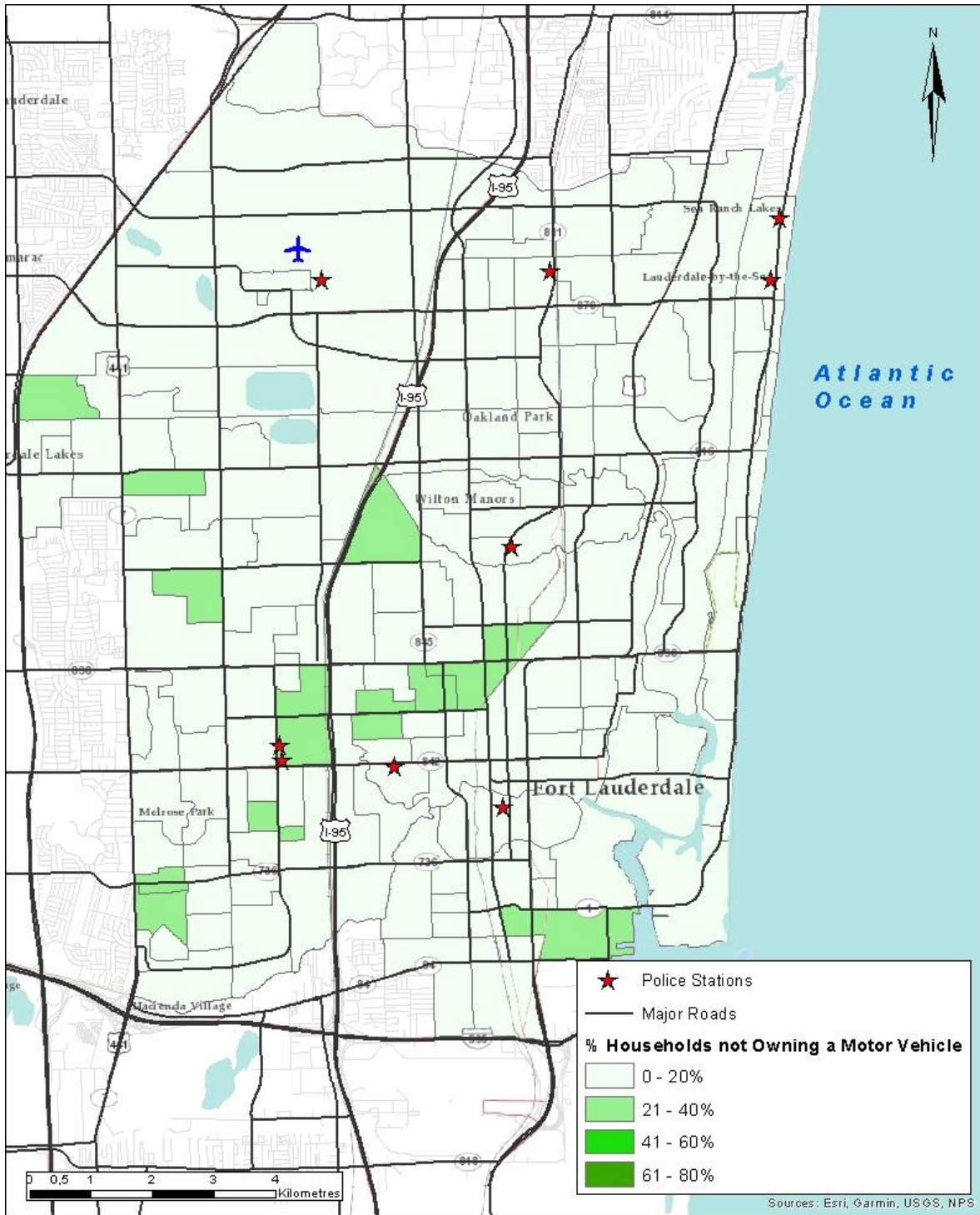


Figure 6.11: Spatial distribution of households in Fort Lauderdale that do not own a motor vehicle (n= 197 Block groups)

Percentage of the population without electricity: ISO 37120 indicator

The percentage of city population with authorised electrical service is calculated as the number of persons with a connection to the official electrical supply system divided by the total population. According to ISO (2014) the percentage of households with a connection to the electricity supply system is an indicator of the provision of a basic urban service which is of particular relevance to cities in the less developed regions of the world.

Khayelitsha

Statistics South Africa (2011) considers electricity to be the primary type of energy used for lighting, cooking and heating. Other types of energy used include gas, paraffin, wood, coal, animal dung and solar power. The use of energy for cooking, heating and lighting has often been used in studies of social disorganisation in the developing world (Breetzke, 2010b; de Melo et al., 2017). For the purposes of this analysis the percentage of households that do not use electricity for any one or all three uses were included. Figure 6.12 shows widespread use of electricity in the township and those who do not are more prominent around the fringes in the predominantly informal areas.

Fort Lauderdale

The types of heating fuel used in occupied housing units include electricity, utility gas, bottled/tank/LP gas, fuel/oil,/kerosene, coal, wood, solar energy, other fuel or no fuel (United States Census Bureau, 2018). The percentage of households that do not use electricity was calculated by combining all the other categories. In Fort Lauderdale eight per cent of households do not make use of electricity (United States Census, 2018). Figure 6.13 shows the percentage of households that do not use electricity, but do use another source of energy. There are a small number of block groups scattered through the study area where between 20% and 40% of households do not make use of electricity.

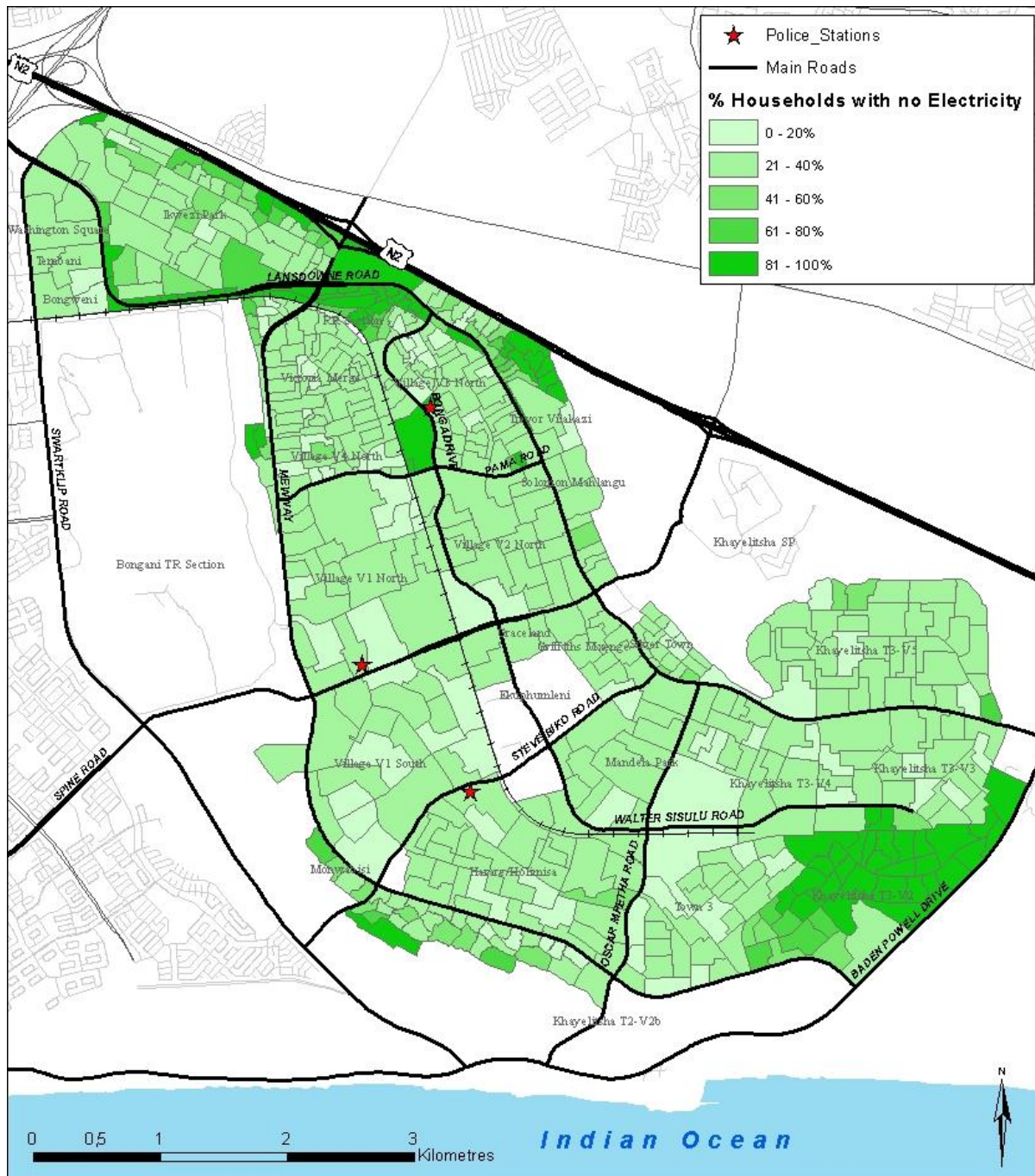


Figure 6.12: Spatial distribution of households in Khayelitsha with no electricity (n= 581 SAL's)

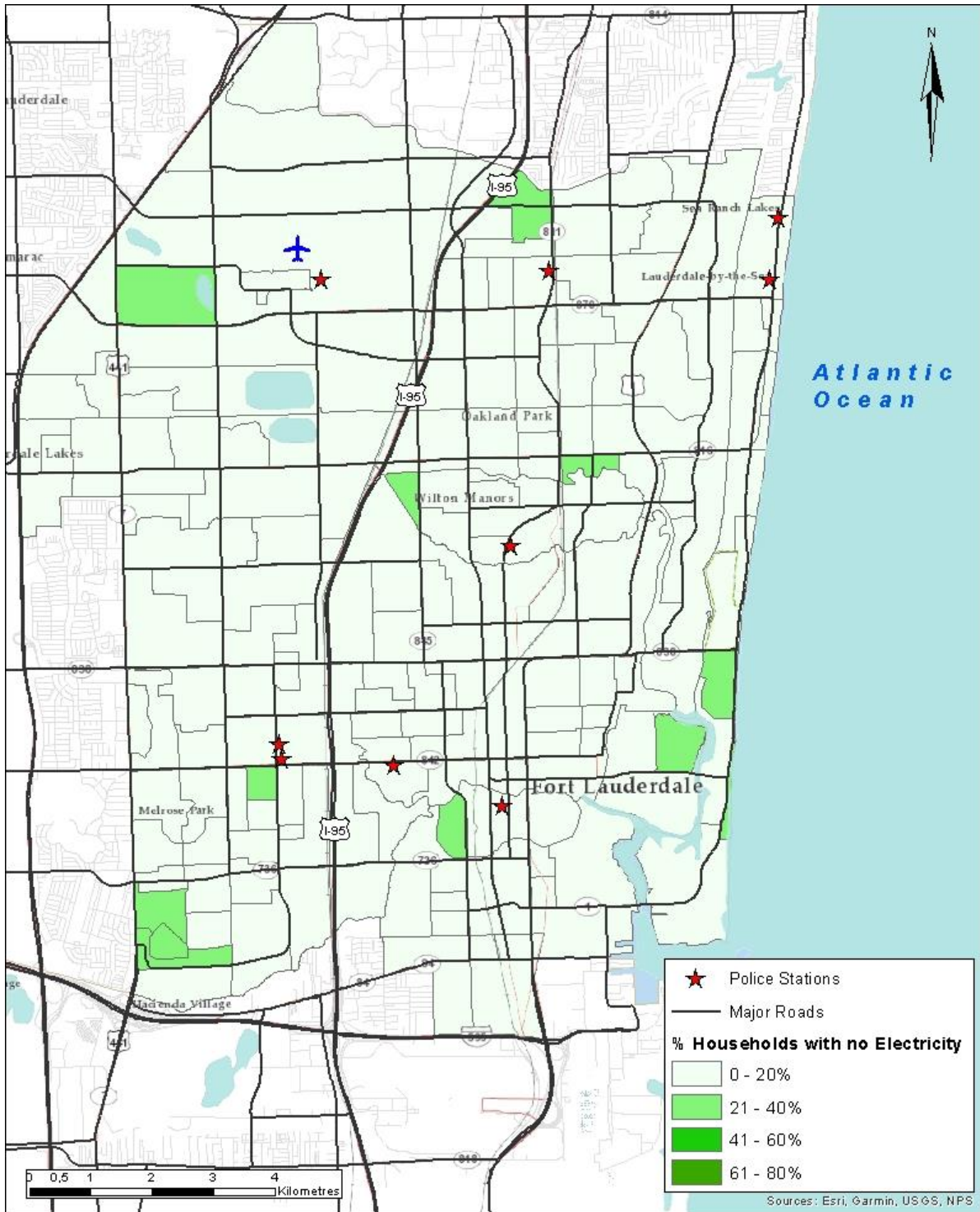


Figure 6.13: Spatial distribution of households in Fort Lauderdale with no electricity (n= 197 Block groups)

6.3.3.2 Urbanisation

In studies of social disorganisation measures of population or residential density have often been used to examine the impact of urbanisation on crime (da Silva, 2014; Escobar, 2012; Lancaster & Kamman, 2016; McCall & Nieuwbeerta, 2007). In The Netherlands, Bruinsma et al. (2013) used a closely related variable, namely structural density to measure residential density. In this analysis one measure was included to capture the level of urbanisation, namely residential density.

Residential density: ISO 37120 indicator

According to ISO (2014) residential density is calculated as the total number of dwellings divided by the surface area in square kilometres.

Khayelitsha

The mean weighted population density of Khayelitsha is 26 000 per km² and broadly comparable to three of the most over-crowded cities in the world, namely Dhaka in Bangladesh (44 500 people per km²), Mumbai in India (31 700 people per km²) and Medellin in Colombia (19 700 people per km²). The weighted per SAL residential density is 8500 dwellings per km² (the average household size is 3.2 people). Figure 6.14 shows the residential density per km² in Khayelitsha, which increases noticeably in the north beyond Palma road and around the fringes in the informal areas.

Fort Lauderdale

Fort Lauderdale has a mean weighted population density (per block group) of 2500 people per km². According to the United States Census Bureau (2018) the average household size in Broward County is 2.5 people per household. The weighted residential density in Fort Lauderdale is 1100 dwellings per km². Figure 6.15 shows residential density in Fort Lauderdale is low compared to Khayelitsha. The city's residential density is higher towards the south-west and also includes a number of areas along the coast in the northern part of the city.

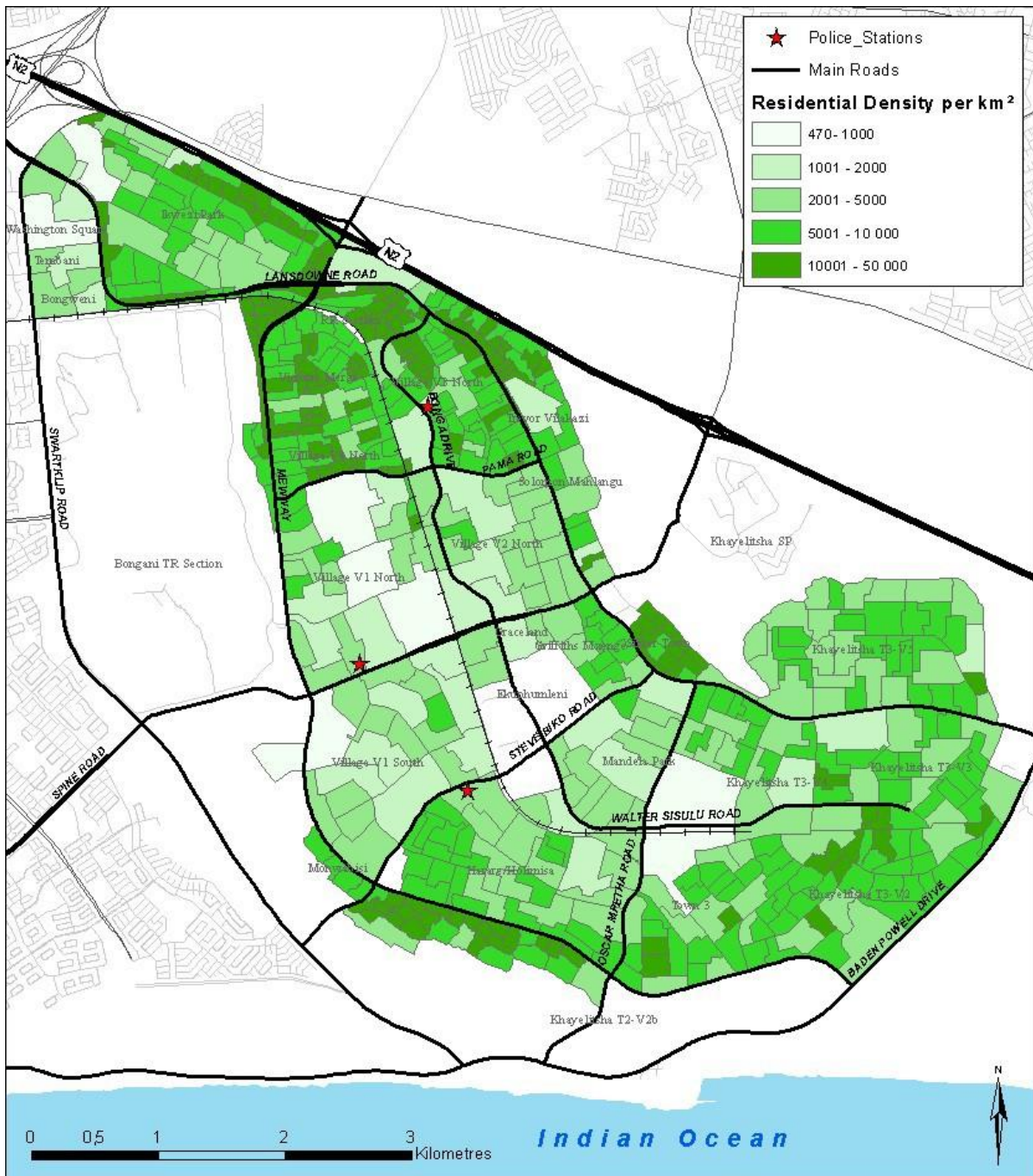


Figure 6.14: Residential density (dwellings per km²) in Khayelitsha (n= 581 SAL's)

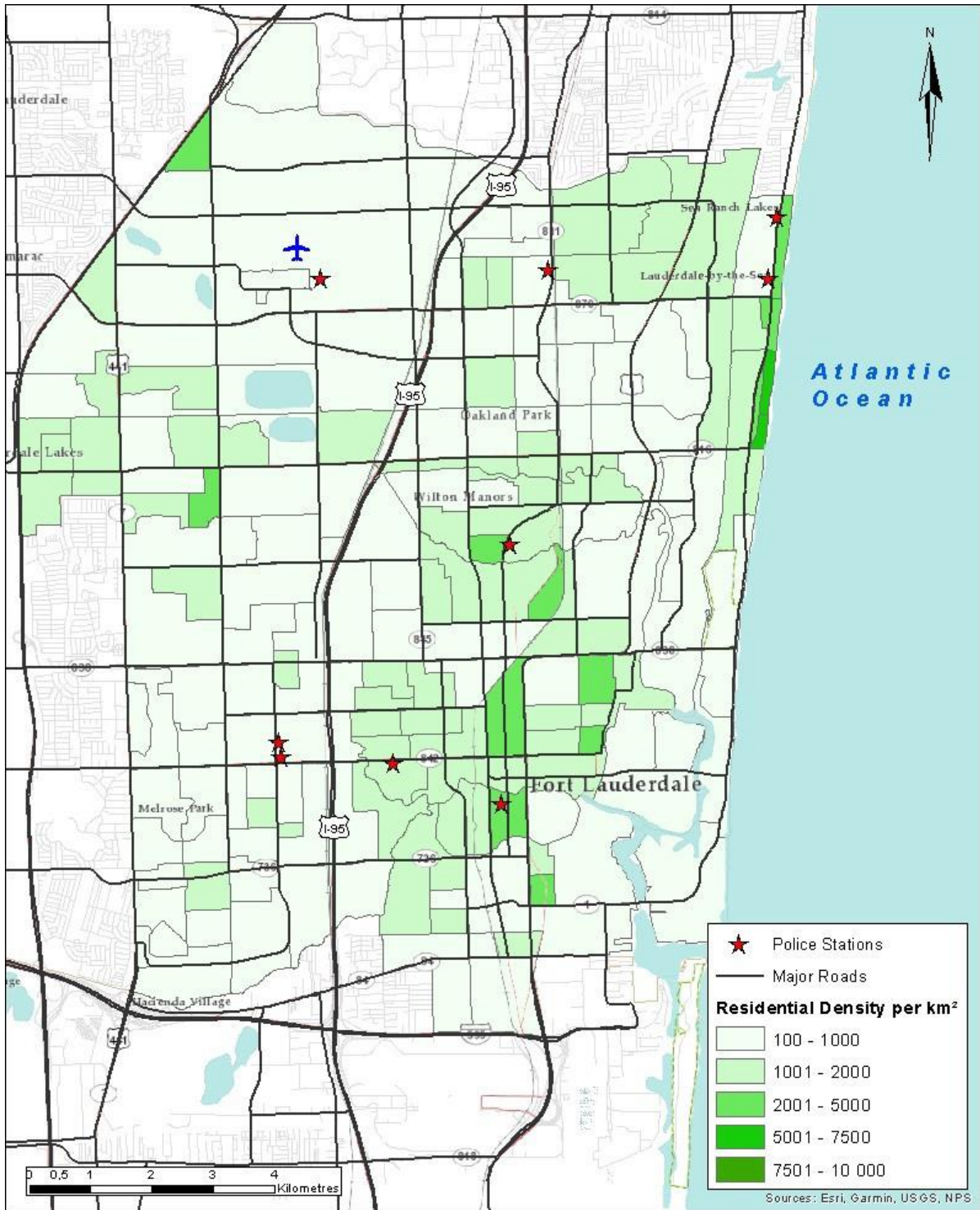


Figure 6.15: Residential density (dwellings per km²) in Fort Lauderdale (n= 197 Block groups)

6.3.4 Non-ISO Independent Variables

For a more complete dataset two non-ISO defined variables were included in the analysis. In these instances where there are insufficient ISO-defined variables available, variables were included only on condition that the variable under consideration had an identical definition in each respective country's census data. As previously mentioned, in some instances it was simply not possible to use the ISO standards to represent a social disorganisation concept as no applicable indicator existed within the ISO 37120. Whilst I readily acknowledge that this may bring some uncertainty into the direct comparability of results for these two variables in particular, I believe that the benefit of a standardised comparison between the bulk of the indicators, outweighs the possible drawbacks.

6.3.4.1 Residential Mobility

Percentage of households renting

The percentage of households that rent was included as a measure of residential mobility. There is no existing ISO indicator, but the variable was included because of the identical census definitions used in both countries.

Khayelitsha

Statistics South Africa (2011) captures data on the tenure status of households, including properties that are rented, owned or occupied rent-free. In Khayelitsha 12% of households are renting. Figure 6.16 shows that the proportions of households renting are low (0-25%) in the informal settlements around the fringes of the township. There are concentrations of greater proportions (25%-50%) rented households in the older, established neighbourhoods of Washington Square, Tembani and Bongweni in the north and in neighbourhoods south of Spine Road towards the west.

Fort Lauderdale

Data relating to tenure status captured by the United States Census Bureau (2018) distinguishes between owner- and renter-occupied housing units. Forty-five per cent of households in Fort Lauderdale are renting with their spatial distribution showing a pattern of relatively widespread renting in excess of 25% (Figure 6.17).

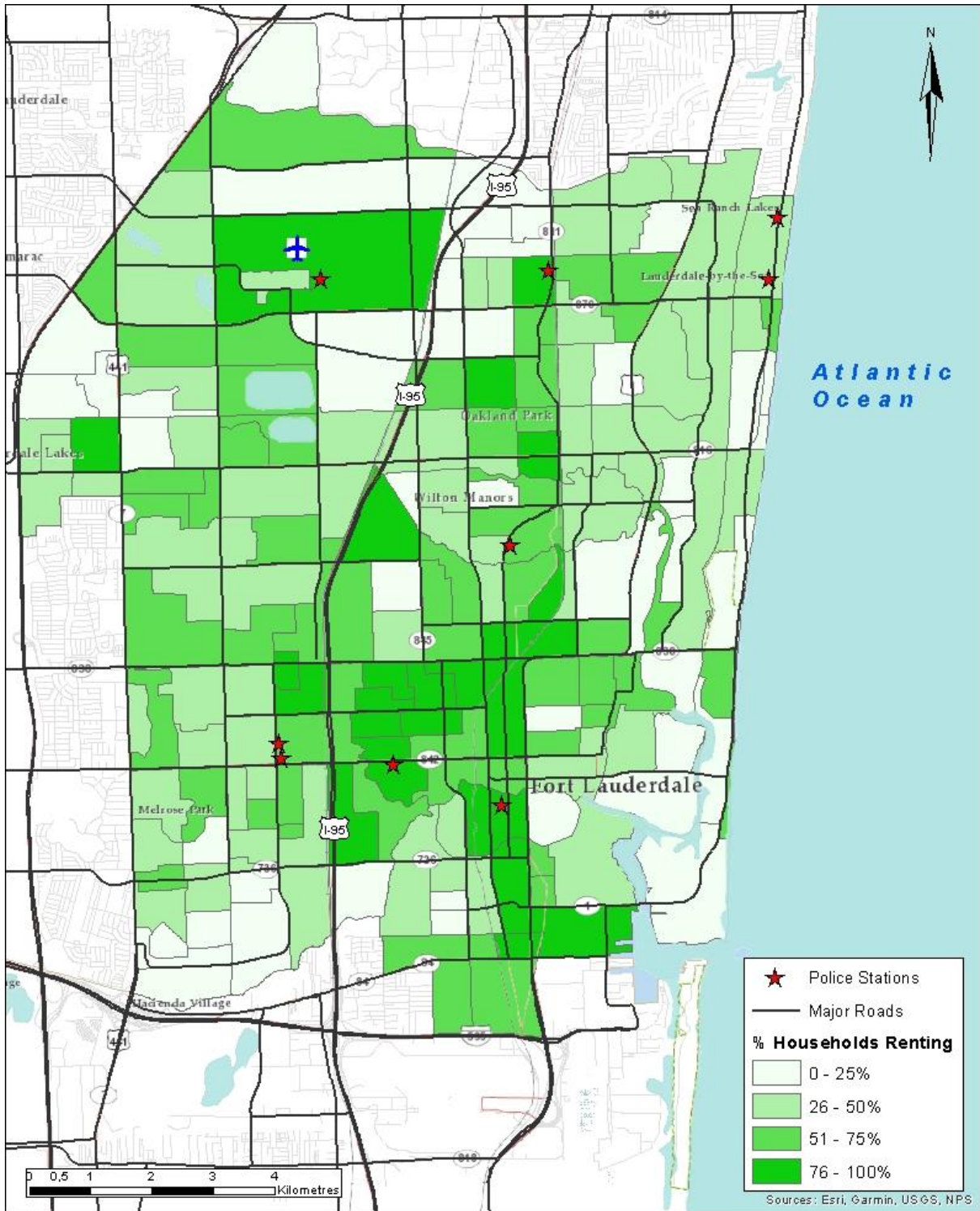


Figure 6.17: Spatial distribution of households in Fort Lauderdale that are renting their property (n= 197 Block groups)

6.3.4.2 Racial/ethnic Heterogeneity

Language diversity index

In studies of social disorganisation, measures of linguistic variability are often used as proxies for racial or ethnic heterogeneity (Danielsson, 2016; Varano et al., 2009; Wickes et al., 2013). Other studies have also used diversity indices to capture language diversity (Graif & Sampson, 2009; Hipp & Wickes, 2017; Zahnow et al., 2013). In this analysis a measure of language diversity, using the Blau index, is included.¹ This is not an existing ISO indicator per se, but it was included because the index captures variations of a specific characteristic (in this case language) and it is applicable in different contexts, regardless of the given languages or the number of different languages spoken in an area. The Blau index is defined as:

$$1 - \sum p_i^2$$

where p is the proportion of members in a given category and i the number of different categories (languages). A perfectly homogeneous group will score zero and a completely heterogeneous group will score one.

Khayelitsha

The township of Khayelitsha is linguistically homogeneous with isiXhosa being the most common home language (90%), followed by English (three per cent). The mean Blau index score for Khayelitsha is 0.2, which confirms it to be a relatively homogeneous community regarding language. Figure 6.18 shows greater language diversity in the central and older parts of the township. It is noticeable that there is a relative absence of people who speak a language other than Xhosa, as their first language in the informal areas around the fringes.

Fort Lauderdale

The United States Census Bureau (2018) captures various categories of household languages spoken, including only English, predominantly Spanish, Indo-European or Asian and Pacific Island languages or one of the above and limited English. In Fort Lauderdale 31% of households do not speak English as a first language, compared to the rest of the US where close to 80% speak English as their first language. Figure 6.19 shows that Fort Lauderdale has a relatively heterogeneous population in terms of language, with its mean diversity score of 0.7.

¹This is a replication of the measure applied in Chapter 4.

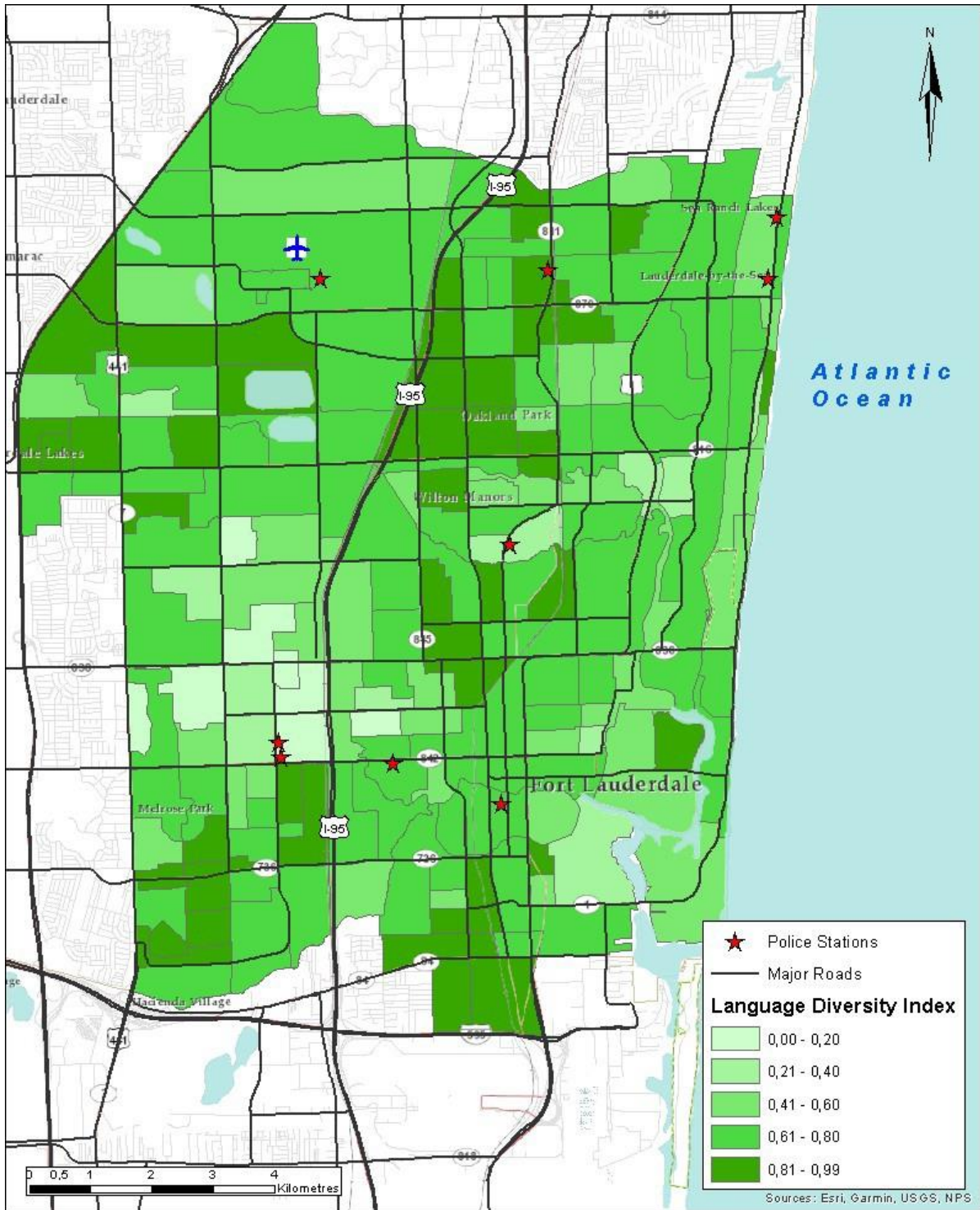


Figure 6.19: Language diversity in Fort Lauderdale (n= 197 Block groups)

The descriptive statistics for the dependent variable and the eight independent variables in Khayelitsha and Fort Lauderdale are shown in Table 6.3.

Table 6.3: Descriptive statistics of variables

	Khayelitsha (n=581 SAL's)				Ford Lauderdale (n=197 block groups)			
	Mean	Std Dev	Min	Max	Mean	Std Dev	Min	Max
Violent crime per 100 000	6.8	10.3	0	125	5.2	9.2	0	69.7
Socio-economic status								
% Population living in poverty	73.3	15.6	15.3	99.3	16.5	13.3	0.01	71
Unemployment rate	36	15.2	0	90	7.8	7.1	0	41
% Households with no Internet access	66	25.3	1	100	13	10.3	0	46.5
% Households with no motor vehicle	86.3	12.4	9.8	100	8	7.5	0	37
% Households with no electricity	39.3	25.7	0	100	7.8	6.1	0	34
Urbanisation								
Residential density/km ²	8576	6232	474	45 873	1074	794	128	7461
Residential Mobility								
% Households renting (non-ISO)	11.6	13.1	0	100	45.3	24.3	0	100
Racial Heterogeneity								
Language diversity Index (non-ISO)	0.2	0.1	0.01	0.66	0.74	0.15	0	0.94

6.3.4.3 Family Disruption (not included)

There are no existing ISO guidelines or indicators to measure family disruption, a fundamental component of social disorganisation theory. An often used proxy for family disruption, the percentage female-headed households, was considered for the analysis but was dismissed because of the different census definitions used in the two countries. For instance, the data related to household heads collected by Statistics South Africa includes the percentage of male or female heads of all households, that is to say their definition encompasses single-occupant and non-family households. The United States Census Bureau (2018) considers only family households when capturing data relating to the gender of the household head. The US data set is therefore incompatible with South African census data, which makes no distinction between family and non-family households.

Concerning marital status, Statistics South Africa captures data on persons in households who are married, living together like married partners, are widowed, are separated or divorced or have never married. According to the census metadata this

data set is extracted from the entire population, including children who are mostly classed as 'never married'. The data relating to marital status captured by the United States Census Bureau covers the population aged 15 years and older. The set includes people who are currently married with a spouse present or absent as well as the non-married population of people who were never married, and are widowed or divorced. These incompatibilities also prohibited the use of this variable.

6.3.5 ISO Variables Not Included

Five variables informed by ISO guidelines were considered for inclusion in this analysis but were ultimately excluded because of the incompatible census data or socio-demographic differences. The census definitions between the countries often seem similar while describing the same concept, but the definitions can include many subtle differences, such as the categories included or the universe from which data is selected. These differences illustrate the difficulties in standardising variables particularly across contexts which differ greatly in terms of their socio-demographics and underscore the need for well-defined indicators. Future cross-national comparative research could examine whether there is greater similarity in terms of contexts and possibly include these variables in their study.

6.3.5.1 Socio-economic Deprivation

The census data for both the percentage of population with potable water supply service and the percentage of population with access to sanitation are incompatible. The ISO guidelines are outlined below.

1: Percentage of population with potable water supply service: ISO 37120 indicator

According to the ISO (2014) the percentage of the city population served by a potable water supply is an indicator of city health and quality of life. The ISO indicator for the percentage of city population with potable water supply service is calculated by dividing the total number of people with potable water supply service with the total population. Potable water refers to water that is treated or confirmed safe for human

consumption and delivered through a pipeline that is connected to a network, ensuring a continuous supply to the household or group of houses.

2: Percentage of population with access to improved sanitation: ISO 37120 indicator

The ISO indicator for sanitation is the percentage of population with access to improved sanitation. It is calculated by dividing the total number of people using improved sanitation facilities by the total population. According to the ISO (2014) 'improved' sanitation facilities range from simple, but protected pit latrines to flush toilets with a sewerage connection. The facilities must be correctly constructed and properly maintained to be effective. Sanitation facilities are, however, not considered 'improved' when open to public use or shared with other households.

There are several reasons for the omission of these variables. First, Statistics South Africa (2011) capture a number of categories that provide an indication of the level of access to piped water for households. They include access to piped water inside a dwelling or in a yard, access to piped potable water on a community stand a distance of up to a kilometre away from the dwelling, and no access to piped water. It is unclear whether only households with access to water in the yard and/or inside the house should be included, considering that community stand points provide potable water. Therefore according to ISO guidelines, all households with access to potable water may well be considered for inclusion in the calculation of the variable.

Second, categories of toilet facilities in households captured by Statistics South Africa (2011) are flush toilets (connected to sewerage system), flush toilets (with septic tank), chemical toilets, pit toilets with ventilation, pit toilets without ventilation and bucket toilets. According to O'Regan and Pikoli (2014) the approximately 5000 chemical toilets and portable flush toilets in Khayelitsha are shared communal facilities that are not well-maintained. The census data does not specify whether the facility is shared or not and could therefore not be included in the analysis.

Third, by comparison, the US census data is defined quite differently with a combined category for water and sewerage services termed 'plumbing facilities' for all housing units. It defines complete plumbing facilities such as piped hot and cold water, a flush toilet, and a bathtub or shower, all located within the housing unit and used only by the occupants. The construction of a comparable and standardised variable for the

two study areas therefore requires the extraction of several detailed data categories and the combination of potable water supply and sanitation services in Khayelitsha. The results presented of the previous chapter (Table 4.6 and Figure 4.16) showed that these two variables behave very differently regarding significance and the direction of the coefficient in regression models. Moreover, it is quite likely that the combination of these two variables will produce results that disguise the significance and type of associations the individual variables will have. Finally, while one third of households in Khayelitsha live without these two basic services, the majority of households (more than 99%) in Fort Lauderdale have access to a potable water supply and sanitation inside their dwellings. Such inconsistencies accentuate the complexity of comparing social disorganisation between different world contexts.

3: The percentage of students completing secondary education: ISO 37120 indicator

According to the ISO (2014), education is one of the most important aspects of human development as this indicator addresses the issue of opportunity. The ISO indicator for education is the percentage of students that have completed secondary school education. This is calculated as the total number of students belonging to a school cohort who complete the final grade of secondary education divided by the total number of students belonging to a school cohort, i.e. those originally enrolled in the first grade of secondary education (ISO, 2014). The ISO (2014) education indicator therefore refers to students who enrolled but did not finish the final grade of secondary education. This information was not available in either of the census data sets, thus this variable was excluded.

Census data of Statistics South Africa (2011) includes the highest level of education that a person has completed, but does not highlight the number of children who belong(ed) to an initial school cohort. Likewise, the United States Census Bureau (2018) captures a number of different categories related to educational attainment, including the population of three years and older currently enrolled in school and the specific grade. Another data set indicate the highest level of education attained, including all school grades and higher education qualifications, but it only registers educational attainments of the population aged 25 years and older. Like the South African census data it has no information specifically related to enrolment at secondary educational level. This census data was therefore deemed unsuitable for inclusion.

6.3.5.2 Residential Mobility/ Racial/ethnic Heterogeneity

4: Immigration: ISO 37120 indicator

ISO (2014) includes two indicators that could be used as proxies for immigration. These indicators are the percentage of population that are foreign born and the percentage of population that are new immigrants. The United States Census Bureau (2018) contains information relating to immigration and distinguishes between the population who were native born and the population who were foreign born. In Fort Lauderdale 27% of the population are foreign born. According to Statistics South Africa (2011) only 1.5% of residents in Khayelitsha were born outside South Africa, and the variable could therefore not be included for statistical analysis with such a low percentage.

It is also necessary to consider whether data related to immigration can potentially be more widely interpreted to include interprovincial or interstate migration, and not just immigration or migration from other countries. Studies of social disorganisation, specifically in the developing context, have often included measures related to rural-urban migrations (Arias & Montt, 2017; Chen et al., 2017). The South African census data on migration does include information on the province of birth for all persons in all households. These data categories include the nine provinces in South Africa as well as persons born outside South Africa (Statistics South Africa, 2011). In Khayelitsha 58% of the residents were not born in the Western Cape province in which Khayelitsha is situated. The United States census information relating to migration patterns within the country, distinguishes between residential moves from the same or a different micropolitan area¹ or metropolitan area. The census data at the block group level does however not include information related to interstate or intercounty moves.

6.3.5.3 Urbanisation

5: Population living in slums: ISO 37120 indicator

Slum settlements exist in countries all around the world where they are known by various names like favelas, shacks, shanty towns and squatter settlements (United Nations, 2015a). This ISO (2014) indicator is the percentage of population living in slums.

¹A population area that includes a city with 10 000 to 50 000 residents and its surrounding communities.

Slum environments lack one or more of the following five conditions: durable housing, sufficient living areas, access to improved water, access to sanitation, and secure tenure or evidence of documentation that can be used as proof of secure tenure status. It is calculated by dividing the number of people living in slums by the population.

The data on housing available from Statistics South Africa refer to the type of dwelling and comprise four basic groupings, namely formal, traditional, informal and other. Formal dwellings include houses (brick or concrete block structures) on a separate stand or yard or on a farm, apartments, cluster houses in a complex, semi-detached houses, houses/flats/rooms in a backyard or servant's quarters or granny flats. Informal dwellings include shacks in a backyard, or an informal dwelling (shack) in an informal or squatter settlement or on a farm. More than 50% of the population in Khayelitsha live in shacks, usually in large informal areas on the fringes of the township. Another 10% of the shacks are situated in the backyards of properties.

The US Census Bureau (2018) collects housing data on single-family houses not attached to any other structure; single-family houses attached to another structure (usually other homes); single-family detached homes; units in apartment buildings; mobile homes (also called 'manufactured housing'); and 'other' housing which includes boats, recreational vehicles and vans. Using this categorisation there are no official 'slums' in Fort Lauderdale based on the ISO definition. By assuming that mobile homes and 'other' are temporary or substandard housing, then only two per cent of the population in Fort Lauderdale live in temporary housing and was therefore not considered in the analysis. It is noteworthy that informal housing, which forms an integral part of the South African census data gathered about the type of housing, does not feature as a category in US Census data.

The stark contrasts between these two international contexts underscores the immense inequalities that exist between the developed and the developing worlds making comparative research a demanding and challenging endeavour. The set of consistently defined variables that could be extracted, despite these difficulties, are applied to analyse and test levels of social disorganisation in these two diverse contexts in the following section.

6.4 RESULTS

As done in the previous chapter, ESDA techniques are initially used to explore the spatial distribution of violent crime in Khayelitsha and in Fort Lauderdale. Bivariate correlation analysis is employed to test the strength of the relationships between the individual variables, and to identify potential multicollinearity. This is followed by the application of spatial regression analysis to model and compare the association between crime and the various selected structural neighbourhood characteristics in Khayelitsha and Fort Lauderdale respectively.

6.4.1 Exploratory Spatial Data Analysis

Significant spatial clustering of violent crime was revealed in both study areas. The global Moran's I statistic for the violent crime rate in Khayelitsha was 0,126 ($p < 0.00$) and 0,299 ($p < 0.00$) in Fort Lauderdale, both scores indicating highly clustered spatial patterns in the distribution of violent contact crimes. Localised clustering patterns are shown for Khayelitsha and Fort Lauderdale in Figures 6.20 and 6.21 respectively. In Khayelitsha several prominent high-crime clusters (high-high) are evident, and concentrated in the west, north of Spine Road, in the north in Bongweni, Ikwezi Park and north of Pama road around the railway line. The latter two are surrounded by spatial outliers (low-high) indicating high crime rates surrounded by areas exhibiting significantly different lower violent crime rates. A similar high-crime cluster surrounded by spatial outliers is visible at the intersection of Walter Sisulu and Oscar Mpeta Roads. The cold spot clusters (low-low) are prominent in the south and scattered along the fringes of the township. In Fort Lauderdale a large hot spot (high-high cluster) is visible in the central areas south and east of the I-95 highway, and surrounded by spatial outliers. The area where the airport is situated represent a spatial outlier and there is a large cold spot (low-low) towards the northern-central parts just south of the airport.

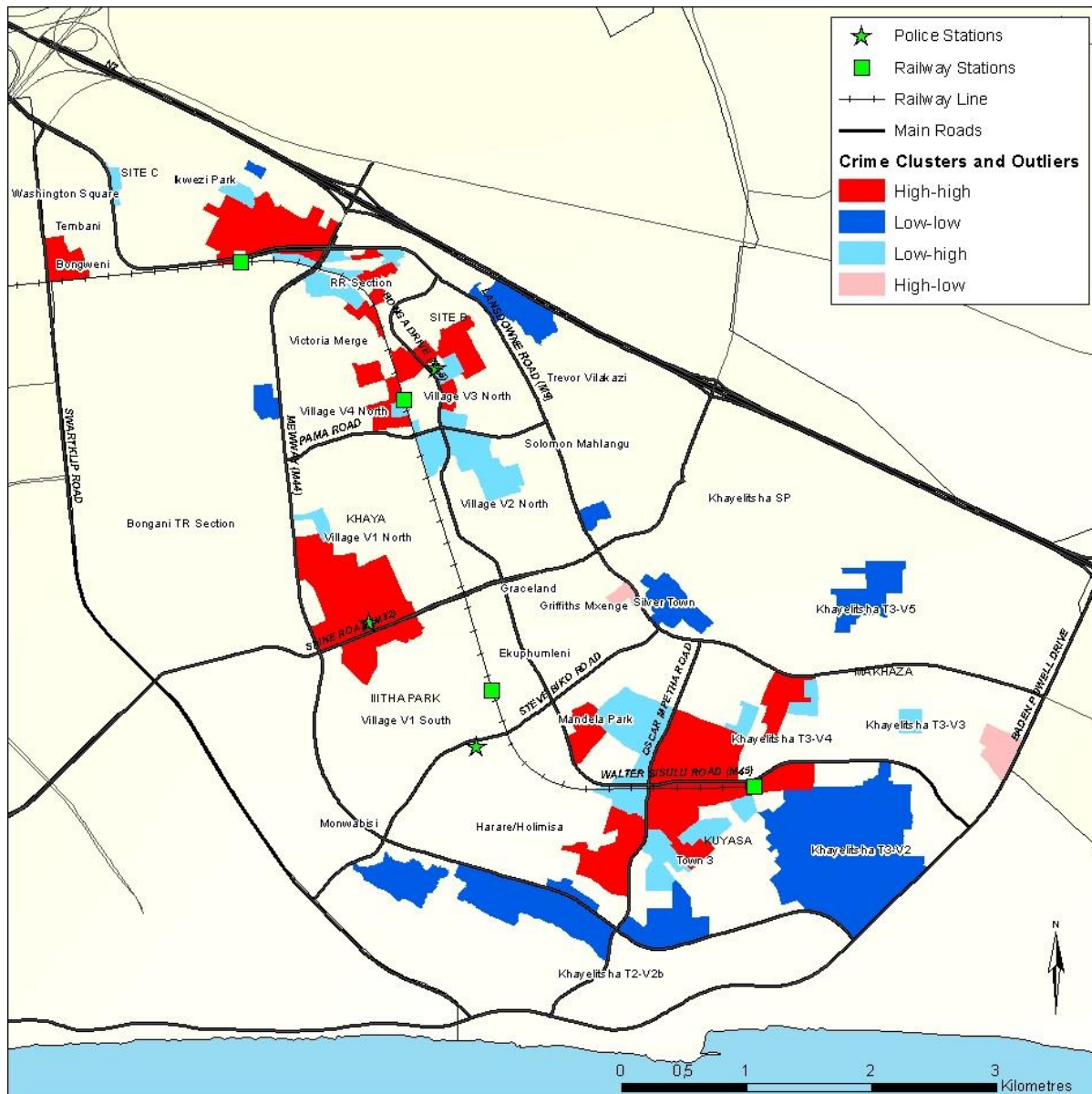


Figure 6.20: Local indicators of spatial association of violent crime in Khayelitsha

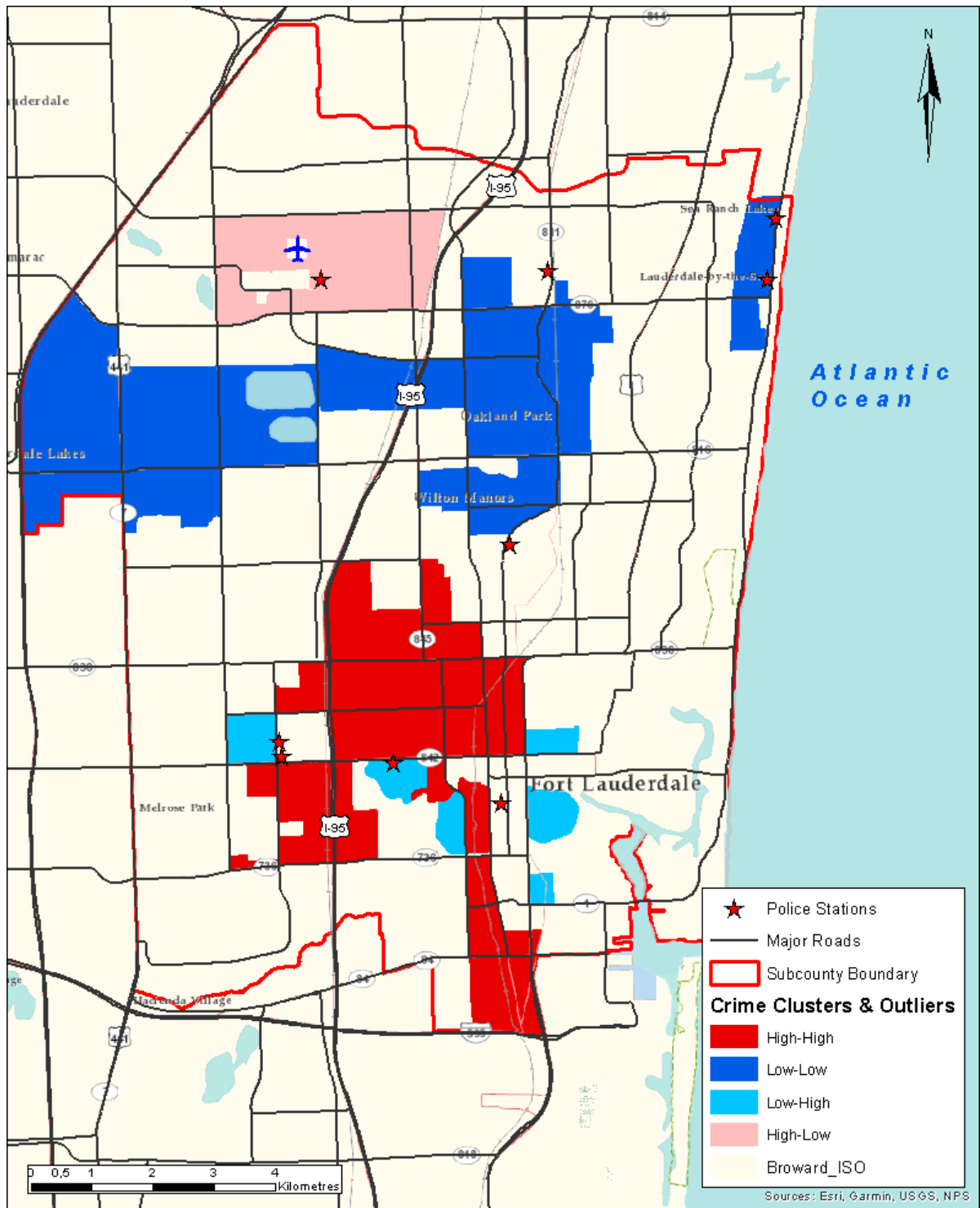


Figure 6.21: Local indicators of spatial association of violent crime in Fort Lauderdale

6.4.2 Correlation Analysis

The bivariate correlation coefficients showing the relationships between the dependent variable and the independent variables for Khayelitsha are presented in Table 6.4.

Table 6.4: Correlation coefficients for the dependent and independent variables analysed in Khayelitsha

Variables	1	2	3	4	5	6	7	8	9
1 Violent Crime per 100 000 pop	1.00								
2 % Population living in poverty	-0.17**	1.00							
3 Unemployment rate	-0.05	0.28**	1.00						
4 % Households with no Internet access	-0.12*	0.35**	0.07	1.00					
5 % Households with no motor vehicle	-0.20**	0.79**	0.21**	0.37**	1.00				
6 % Households with no electricity	-0.07	0.45**	0.20**	0.28**	0.43**	1.00			
7 Residential density/km ²	-0.30**	0.48**	0.06	0.26**	0.51**	0.20**	1.00		
8 % Households renting	0.16**	-0.52**	-0.16**	-0.21**	-0.47**	-0.35**	-0.43**	1.00	
9 Language diversity index	0.1	-0.33**	-0.17**	-0.13**	-0.31**	-0.19**	-0.27**	0.36**	1.00

** $p < 0.001$; * $p < 0.01$

Interestingly no independent variables were found to be significantly and positively correlated with violent crime in Khayelitsha. Regarding the interrelationships between the independent variables themselves, the percentage of residents living in poverty was found to be positively and significantly correlated with the percentage of residents who do not have electricity and with areas of high residential density. Poverty, however, was found to be negatively correlated with the percentage of residents renting their property. Not owning a motor vehicle was found to correlate positively and significantly with poverty and with not having electricity, and living in residentially dense areas. By contrast, not owning a motor vehicle was found to correlate negatively and significantly with the incidence of residents renting their property.

As with Khayelitsha, the bivariate correlation coefficients for the relationships between the dependent and independent variables for Fort Lauderdale are shown in Table 6.5.

Table 6.5: Correlation coefficients for the dependent and independent variables analysed in Fort Lauderdale

Variables	1	2	3	4	5	6	7	8	9
1 Violent Crime per 100 000 pop	1.00								
2 % Population living in poverty	0.30**	1.00							
3 Unemployment rate	0.15	0.39**	1.00						
4 % Households with no Internet access	0.27**	0.53**	0.36**	1.00					
5 % Households with no motor vehicle	0.40**	0.59**	0.39**	0.60**	1.00				
6 % Households with no electricity	0.01	-0.11	-0.16	-0.23**	-0.09	1.00			
7 Residential density/km ²	-0.13	-0.11	-0.09	-0.07	-0.07	-0.04	1.00		
8 % Households renting	0.35**	0.52**	0.2*	0.42**	0.50**	-0.17	0.06	1.00	
9 Language diversity index	-0.13	-0.12	-0.18*	-0.15	-0.09	0.02	0.03	0.03	1.00

** $p < 0.001$; * $p < 0.01$

In Fort Lauderdale the population without a motor vehicle was found to be significantly and positively correlated with violent crime. Other significant and positive correlations were found between violent crime and the percentage of the population living in poverty and residents with no Internet, no motor vehicle and those renting. The population without a motor vehicle was also positively correlated with having no Internet and the percentage renting. The descriptive analyses make it apparent that the correlations in Fort Lauderdale are roughly in accordance with expectations of the theory. This is, however, not the case with Khayelitsha.

6.4.3 Spatial Regression Analysis

A spatial error regression model was employed. First-order queens' case contiguous spatial weights were specified.

The general form for the spatial error regression model is:

$$y = X\beta + \varepsilon \text{ with } \varepsilon = \lambda W \varepsilon + u$$

Where y represents the number of violent crimes per 100 000 population; X the set of independent variables; β the coefficient; ε the error term; W the spatial weights matrix; u a vector of errors; and λ a parameter.

The results of the spatial error regression models are summarised in Table 6.6 where only the statistically significant variable coefficients are shown to ease readability.

Where necessary, several variables were transformed in the Khayelitsha data set¹ and in the Fort Lauderdale data set² to better fit a normal distribution. Overall, the models performed reasonably well with a pseudo R² of 50% in the Khayelitsha model, and close to 60% in Fort Lauderdale.

Table 6.6: Results of the spatial regression models for Khayelitsha and Fort Lauderdale

Independent variables	Khayelitsha	Fort Lauderdale
Spatial Lag	0.658***	0.762***
% Population living in poverty	-	-
Unemployment rate	-	-
% Households with no Internet access	-	-
% Households with no motor vehicle	-	-
% Households with no electricity	-	0.132*
Residential density (km ²)	-1.764***	-0.767***
% Households renting	0.22*	0.005***
Language diversity index	-	-
Pseudo R ²	48%	58%

***p < 0.001; **p < 0.01; *p < 0.05

The percentage of the population living in poverty and the unemployment rates were notably non-significant in both areas, while these variables have consistently been associated with higher levels of violent crime in studies in both the developed and developing contexts (Andresen, 2006; Strom & MacDonald, 2007; Swart et al., 2016). Notably, the variables that were significantly associated with violent crime are remarkably similar in Khayelitsha and Fort Lauderdale. In both the models the percentage of households renting was positively significant, indicating an association between higher violent crime rates and higher proportions of residents renting. Residential density was found to be highly significant in both models, but negatively so, indicating that increased

¹Transformed variables for Khayelitsha are violent crime per 100 000 population, the percentage of households renting and residential density.

²Transformed variables for Fort Lauderdale are violent crime per 100 000 population, the percentage of the population who live below the poverty line, the unemployment rate, the percentage of households without Internet access, the percentage households with no motor vehicle, the percentage households with no electricity and residential density.

residential density is associated with a decrease in violent crime. The percentage residents with no electricity was significantly and positively associated with violent crime, but only in Fort Lauderdale.

6.5 DISCUSSION

The aim of the analysis was to assess the utility of ISO 37120 indicators in spatial crime research. This was done by standardising a set of variables commonly used to operationalise the central tenets of social disorganisation theory and testing the applicability in two diverse contexts. Two sets of variables were carefully selected and calculated in exactly the same manner for both study areas in order to compare results. Six of the eight independent variables, together with the dependent variable, were based on ISO guidelines. The two variables not informed by ISO (households renting and the language diversity index) could be excluded if one were to adhere strictly to ISO (2014) specifications. Whilst this does introduce some subjectivity in the delineation of variables, it was necessary to compile a more comprehensive list of variables to operationalise social disorganisation theory, although I acknowledge that this is less preferred. This also clearly highlights the need for additional standardised guidelines and variables which can be used internationally and in different contexts.

The different ways in which crime and census data are defined in the US and South Africa (and indeed, between any two contexts globally) required some adjustments to be made in order to adhere to the standardised ISO specifications. The extraction of most of the data categories was straightforward, but several required some minor adjustments. For example, according to the ISO 37120 guidelines the violent crime rate (the dependent variable) includes murder and non-negligent manslaughter, rape, robbery and aggravated assault, but excludes common assault. Common assault is, however, classified as a violent contact crime according to the SAPS. The difference in the definition is highlighted when the spatial patterning of this variable produced in Chapter four (when common assault was included in the variable definition) is compared to the product of this chapter (when common assault was excluded). Indeed, different localised clusters and spatial outliers are evident (see Figures 4.14 and 6.20). Although it was foreseeable that an alternative definition of this (or any) variable would produce different results, the actual exercise highlights the inconsistency of the results and the crucial role that variable standardisation plays in the analysis of spatial crime

data. During the process of standardising variables it also became evident that in a number of cases international researchers select variables simply because they are available in local census data as opposed to their being guided strictly by the central tenets of social disorganisation theory. The dissimilarities of censuses across countries emphasises the need for standardised ways of identifying and calculating variables that compel users to adhere to specific standards. This is particularly important if researchers intend to compare and contrast their results with their peers.

Overall, the results of the Fort Lauderdale study were more consistent with the expected outcomes of social disorganisation theory. The spatial regression model performed better in Fort Lauderdale with an R^2 of 60% compared to 50% for Khayelitsha. Undoubtedly any 'typical' expectations derive from the relatively much larger pool of knowledge filled from research in the developed world. In terms of the significance of variables, the same variables in both models were found to be significant and the direction of the associations were also the same. In previous studies of social disorganisation, residential mobility, measured as tenure status has consistently been found to be a strong predictor of violent crime in developed and developing world contexts (Breetzke, 2018; de Melo et al., 2017; He et al., 2017; Lancaster & Kamman, 2016; Thompson & Gartner, 2014; Warner, 2014). This consistency has been attributed to the similar definitions of variables used in the different world contexts. Likewise, in this analysis tenure status, measured as households that are renting, was found to have a direct relationship with violent crime in both contexts. In this sense, the equal definition of this variable across contexts makes a direct comparison possible.

In terms of an explanation of this result, however there are some differences. In the context of Khayelitsha rental housing has a vastly different meaning than in Fort Lauderdale, or the developed world in general. In Khayelitsha close to 50% of households that are renting reside in informal dwellings or in shacks in the backyard of formal dwellings (Statistics South Africa, 2011). Informal backyard shacks represent South Africa's fastest growing housing subsector, more so than free-standing shacks in informal squatter settlements (Lategan et al., 2020; Turok & Borel-Saladin, 2016). According to the 2011 census, the number of households living in informal backyard shacks had increased by 55% over the previous decade from 2001 to 2011 (Statistics South Africa, 2011). According to Turok and Borel-Saladin (2016) it is remarkable that this sector has received very little acknowledgement and attention from the national government. Informal backyard rental housing in South Africa is typically located in

the older neighbourhoods of townships, developed under the apartheid government, where this informal service provides a source of income for poor homeowners acting as landlords (Shapurjee & Charlton, 2013). The population of Khayelitsha that are renters, are predominantly located in these older and more established northern neighbourhoods of the township.

It is noteworthy that in previous studies of social disorganisation, tenure status has been criticised by those who argue that renters in a community are only associated with violent crime because the most deprived residents tend to rent (Lockwood, 2007; Roh & Choo, 2008). In Khayelitsha, informal backyard dwelling is generally accepted to be analogous with high levels of deprivation, high densities, lawlessness, poor hygiene practices, poor-quality structures and low levels of service delivery. The backyard dwellers rely on formal services delivered to the main housing structure. Due to the fact that renters share the services with the landlord from whom they rent a shack, service delivery (refuse removal, water supply, sanitation, electricity) is often overextended resulting in overused toilets and the informal tenants often accessing electricity illegally via informal connections (Gardner & Rubin, 2017; Lategan et al., 2020; Turok & Borel-Saladin, 2016).

In Fort Lauderdale too, a large proportion of the population that are renting are highly deprived. This was confirmed in the correlation analysis where the percentage of the population that is renting was positively and significantly correlated with poverty and service provision, measured as the population with no motor vehicle and with no Internet access (see Table 6.5). According to the Housing and Community Development Division in Fort Lauderdale (2020) roughly 50% of all renters are cost-burdened¹ and therefore qualify for rental assistance from the government. In Fort Lauderdale there are several government initiatives addressing housing needs. The Housing and Community Development Division coordinates programmes for affordable housing to meet the housing needs of low-income households (<https://www.flhousing.org/>). The State Housing Initiatives Partnership (SHIP) focusses on residential rehabilitation by revitalising dilapidated housing to create affordable housing for residents in need.

Like tenure status, residential density was also found to be significantly related to crime in both contexts. In both models the variable was found to have a negative association with violent crime. A limited number of studies have previously found measures of

¹Households that are paying in excess of 30% of their incomes on housing costs, therefore may have reduced expendable income for basic necessities.

residential density to be negatively associated with crime (Bruinsma et al., 2013; Escobar, 2012; York Cornwell & Behler, 2015). Explanations provided for this finding relate to weakened social networks as a result of reduced residential and population densities. In Khayelitsha especially this finding is perplexing given the positive and significant correlation of household density with the population living in poverty and other indicators of deprivation, including the population without Internet access and not owning a motor vehicle (see Table 6.4). As is the case of rental housing, lower levels of residential density occur in the older and more established neighbourhoods of Khayelitsha. Although the housing density levels are relatively low in the latter areas compared to the rest of the township, densities still reach 2000 to 5000 households per km² in these areas (recall Figure 6.14). In a study in Istanbul, Turkey, Ergun et al. (2003) also found crime rates to be higher in the older districts of the city which overall provide better living conditions and service delivery. They attributed the finding to stronger social bonds among new community members in the newer settlements (who generally migrate as groups from the same areas), compared to an increasingly mixed population composition and less social restraint in the older districts. In Fort Lauderdale this negative association can conceivably be explained by the popular and densely populated oceanfront, where high-rise buildings are associated with expensive and luxurious accommodation. A similar situation was found in Changchun, China by Liu et al. (2016) where residential density was negatively associated with crime as a result of newly constructed and luxurious high-rise private property development.

Based on these findings, it is reasonable to conclude that a greater incidence of rented properties are associated with increased levels of violent crime and that higher levels of dwelling densities are associated with reduced levels of violent crime in developed and developing world contexts. Similar comparative studies in other international settings may likely reveal deeper insights into the role these variables play in the occurrence of violent crime. Studies using standardised variables in spatial comparisons coupled to temporal comparisons will work towards verifying the findings in these and other contexts. However, given the current lack of standardisation of variables across contexts, such comparisons are rarely undertaken.

6.6 BENEFITS OF USING STANDARDISED VARIABLES

The ISO 37120 indicators provided the guidelines for creating standardised measurements of social disorganisation which are comparable over space (or time). Such standardisations are currently lacking in studies applying social disorganisation theory across national contexts. In order to gain wider theoretical insight into and make generalised assumptions about socially disorganised communities in the developing context and the effects they have on crime levels, it is imperative to move beyond individual localities at specific periods in time. If it is true that the same factors affect communities around the world in similar ways, it is important to seek that knowledge through comparative analyses. With the many measurable commonalities that exist across contexts, the creation of reliable foundations of globally standardised data can assist in the building of core knowledge around social disorganisation and the root causes of crime, specifically in the developing context where it is so desperately needed.

The advantages of creating measures that are comparable in different localities are highlighted in the chapter. It noteworthy that all of the variables used represent individual concepts, as opposed to combinations of several variables to represent complex concepts. For example, the variables representing socio-economic deprivation are clearly distinguishable constructs like the population living below the poverty line, the unemployment rate or the population with no Internet access, compared to fuzzy concepts such as 'concentrated disadvantage' or 'low socio-economic status' which can include any number or combination of the above variables. The benefit of using distinct variables is that they result in unambiguous conclusions regarding the role of an individual variable.

The use of ISO 37120 indicators to operationalise social disorganisation variables aided in identifying a comprehensive standardised representation of variables specifically related to socio-economic deprivation. The ISO 37120 indicators relate mainly to economic development, education, and access to energy and services. ISO 37120 indicators allowed for the inclusion of two variables that represent social and geographic isolation and marginalisation (access to the Internet and the ownership of a motor vehicle), previously argued to be included in tests of social disorganisation theory (Escobar, 2012; Sampson & Wilson, 1995; Zahnow et al., 2013). This is especially relevant in the isolated and segregated township of Khayelitsha where close to 70% of

the households have no access to Internet and only 13% of the residents own a motor vehicle.

Table 6.7 includes a typology of ISO informed variables with detailed specifications and guidelines given regarding their measurement and calculation to be used in future cross-national comparative spatial crime analyses. It lists several variables that could not be included in this particular analysis, but could be employed in other studies examining crime across international contexts.

Table 6.7: ISO variables for the cross-national study of crime

ISO indicator	Calculation	Notes
Dependent variable		
Violent crime per 100 000 population	Number of violent crimes (numerator) divided by the total population (denominator) * 100 000	Violent crimes include offences that involve force or the threat of force to a person and is classified as one of the following four offences including murder and non-negligent manslaughter, rape, robbery and aggravated assault.
Homicide per 100 000 population	Number of homicides (numerator) divided by the total population (denominator) * 100 000	Homicide shall include intentional and non-intentional homicide.
Crimes against property per 100 000 population	Number of property crimes (numerator) divided by the total population (denominator) * 100 000	Defined as all offences involving the unlawful taking or destruction of property, but without the threat of use of force against a person.
Independent variables		
Socio-economic Deprivation		
Population living in poverty	Number of people living below the poverty threshold (numerator) divided by the total population (denominator).	None
Unemployment rate	Number of working-age city residents who during the survey reference period were not in paid employment or self-employment, but available for work and seeking work (numerator) divided by the total labour force (denominator).	Discouraged workers or hidden unemployed refer to persons who are not actively seeking work because they believe the prospects of finding it are extremely poor or they have restricted labour mobility, face discrimination, and/or structural, social, and cultural barriers are not counted as unemployed or as part of the labour force. Not actively seeking work shall refer to people who have not taken active steps to seek work (i.e. job searches, interviews, informational meetings etc.) during a specified recent period (usually the past four weeks). The labour force refers to the sum of the total persons employed and unemployed who are legally eligible to work.

Table 6.7: ISO variables for the cross-national study of crime

ISO indicator	Calculation	Notes
Population completing primary school education	Number of students belonging to a school-cohort who complete the final grade of primary education (numerator) divided by the total number of students belonging to a school-cohort, i.e. those originally enrolled in the first grade of primary education (denominator).	None
Population completing secondary school education	Number of students belonging to a school-cohort who complete the final grade of secondary education (numerator) divided by the total number of students belonging to a school-cohort, i.e. those originally enrolled in the first grade of secondary education (denominator).	None
Population completing higher education degrees	Number of people holding higher education degrees (numerator) divided by the total current population (denominator).	None
Population with regular solid waste collection	Number of people within the city that are served by regular solid waste collection (numerator) divided by the total population (denominator).	Regular solid waste collection is defined as having the solid waste picked up from the household, transported and dropped at a proper treatment facility (recycling or landfill sites) on at least a weekly basis or every two weeks.
Population with potable water supply	Number of people with potable water supply service (numerator) divided by the total population (denominator).	Potable water shall refer to water that is treated or confirmed safe for human consumption.
Population with access to improved sanitation	Number of people using improved sanitation facilities (numerator) divided by the total population (denominator).	Improved' facilities range from simple, but protected pit latrines to flush toilets with a sewerage connection. To be effective, facilities must be correctly constructed and properly maintained.

Table 6.7: ISO variables for the cross-national study of crime

ISO indicator	Calculation	Notes
Population with internet connections	Number of internet connections (numerator) divided by total population (denominator).	None
Population with cell phone connections	Number of cell phone connections (numerator) divided by total population (denominator).	None
Population with personal automobiles	Number of registered personal automobiles (numerator) divided by the total population (denominator).	None
Population with access to electricity	Number of people with a connection to the official electrical supply system (numerator) divided by the total population (denominator).	None
Racial/ethnic Heterogeneity		
Population that are foreign born	Number of population that are foreign born (numerator) divided by total population (denominator).	None
Urbanisation		
Population living in slums	Number of people living in slums (numerator) divided by the city population (denominator).	None
Dwelling density	The total amount of households (numerator) divided by the surface area in km ² (denominator).	None

Table 6.7: ISO variables for the cross-national study of crime

ISO indicator	Calculation	Notes
Population density	The total population (numerator) divided by the surface area in km ² (denominator).	None

Note- ISO indicators refer most often to individual variables like 'number of population' or 'number of people', while several of these variables are typically collected by census bureaus by household level. These variables can be measured by multiplying the amount of households by the average household size to get an individual approximation of the variable.

CHAPTER 7: CONCLUSION

7.1 INTRODUCTION

In this thesis I present a standardised approach for future cross-national spatial crime research. This was done by initially examining the socio-spatial dimension of violent crime in Khayelitsha, South Africa and later undertaking a cross-national comparison of crime using Khayelitsha and Fort Lauderdale as study sites, whilst employing ISO indicators to guide variable selection. In the first part of this concluding chapter I present an overview of the initial study objectives and highlight how each objective was achieved. Thereafter, several implications and recommendations are presented.

7.2 CHAPTER OVERVIEW AND ACHIEVEMENT OF STUDY OBJECTIVES

The primary objective of this research was to propose a standardised approach in cross-national spatial crime research. The following chapters outline the approach that was undertaken in order to achieve this aim and, in doing so, make a unique contribution to the spatial crime literature.

Chapter 2

The objective of this chapter was to compare studies of social disorganisation in the developed and developing world and highlight the myriad ways in which social disorganisation theory have been measured and operationalised. In doing so, the inconsistent findings reported in the different contexts were highlighted. It is clear that research applying social disorganisation in the developing world is lagging behind the developed world. Given the high levels of crime in developing contexts the lack of studies

is alarming and should be of concern, especially since it is in this context where knowledge regarding the crime causation is most needed. The developing context also requires suitable crime prevention and reduction strategies guided by theory.

By reviewing the literature, it became increasingly evident that there are numerous discrepancies regarding the way in which the structural neighbourhood characteristics of social disorganisation theory are defined and operationalised. Notably, this applies to the literature on studies in *both* the developed world and the developing world contexts. Furthermore, the ways in which the central tenets of social disorganisation theory are operationalised also differ significantly between the two contexts. The inconsistencies evident between variables applied as proxies for the central tenets of social disorganisation theory could potentially also affect the findings of research produced, although no previous study has examined how the different ways in which certain social disorganisation characteristics are defined could potentially impact the results of analyses. The conclusion drawn from reviewing the literature is that while social disorganisation theory provide a sound theoretical framework within which to study the spatial patterning of crime in a developing context, the challenge lies in accurately assessing its causation in unique contexts given the non-standardised way in which the central tenets of the social disorganisation theory are operationalised.

Chapter 3

The aim of this chapter was to provide an overview of the main study site for this research, namely Khayelitsha. The history of the township was outlined and the extreme levels of social disorganisation and crime prevalent in the community highlighted. The formerly segregated township is located on the urban periphery and is the result of apartheid's racist spatial planning policies which continue to haunt South Africa. Khayelitsha is characterised by widespread poverty, poor education in ill-equipped and overcrowded schools, and high levels of unemployment. More than 50% of residents live in substandard informally constructed shacks, and many do not have access to the most basic of services like water, sanitation and electricity. Violent crime is rife and the management and understanding of crime in this unique context proves to be particularly challenging. It is obvious that there is a desperate need for a more thorough understanding of crime and the underlying causes and for informed interventions to alleviate the crime levels.

Chapter 4:

The aim of this chapter was to demonstrate that the inconsistent way in which the

structural neighbourhood characteristics of social disorganisation theory are defined and operationalised (particularly in the developing world contexts) can alter results produced when testing the theory.

It was clear based on the results generated that different combinations of variables produce different results. Indeed, the multitude of variable definitions, the combinations of variables and the subsequent contradictory results limit the possibility of producing sound comparative empirical evidence. The results of this chapter show, for the first time, how subjectivity can play a role in studies in which the social disorganisation theory is used as the guiding theoretical framework. The results also suggest there is a need for a more 'standardised' way of operationalising the social disorganisation theory in order to inform cross-comparative spatial studies of crime.

Chapter 5

The aim of this chapter was to motivate for the relevance and appropriateness of applying sustainable development standards in future studies of social disorganisation. For this purpose, a theoretical background pertaining to widely recognised and accepted international policy on urban safety and sustainable development was outlined. This illustrated the interrelatedness between urban safety and social disorganisation, which are fundamentally two sides of the same coin. The output of the chapter was a table indicating overlap between the neighbourhood characteristics commonly used to represent the central tenets of social disorganisation theory and the comparable ISO 37120 indicators developed to assist in the monitoring and evaluation of the 2030 sustainable development goals. This represents the first attempt to empirically merge the theory and indicators of sustainable development.

Chapter 6

The aim of this chapter was to test the applicability of ISO informed variables used as proxies for the central tenets of social disorganisation theory. The use of ISO 37120 indicators allowed for the standardisation of several variables that represent complex social processes that are at the foundation of understanding social disorganisation and crime. It furthermore allowed for a comprehensive representation of variables that related specifically to socio-economic deprivation. The construction of two sets of exactly the same standardised variables allowed for the direct comparison of two vastly different contexts (namely Khatyelitsha and Fort Lauderdale) in terms of its crime causation. The results of the spatial regression analysis were remarkably similar in terms of variable significance and the types of associations. The use of ISO-informed

variables provided an opportunity for international and local benchmarking to measure and compare crime causation across contexts.

7.3 LIMITATIONS

There are a number of limitations of this work that need to be considered. The ISO 37120 indicators were specifically developed to promote international comparisons. The comparison of a single international location with Khayelitsha, sheds some light on factors of crime causation across contexts, but presumably additional (local and international) comparisons in more contexts will contribute to the ability to validate and generalise assumptions of the theory in the context of Khayelitsha.

Essential characteristics of social disorganisation like family disruption and residential mobility are not represented using any of the available ISO 37120 indicators. The ISO 37120 indicators were originally developed to assist in the monitoring and evaluation of city services and quality of life and not to examine crime causation per se. Although certain variables defining socio-economic deprivation and urbanisation are well represented, others are not and this limits the ability of researchers to fully represent the social disorganisation theory using this approach. In the absence of such variables, it was necessary to include variables not informed by ISO (the percentage of households renting and the language diversity index) for a more complete data set to be used. This highlights the need for additional standardised guidelines and the development of additional ISO variables to represent the other structural neighbourhood characteristics which can be used internationally and across contexts.

Several difficulties emerged in aligning ISO defined variables with census data in two vastly different contexts. A number of ISO informed variables could not be included in the analysis due to the vast differences between the two study areas. These included the lack of access to water and sanitation services and the percentage of population living in slums, which can be measured in Khayelitsha but effectively does not exist in Fort Lauderdale. Other indicators could not be included due to the incompatibility of census data in either (or both) countries such as the level of educational attainment.

Although it would have been ideal to compare spatial crime causation in Fort Lauderdale with that of Khayelitsha from the exact same time period, data constraints notably the availability of non-aligned crime data prevented this. Furthermore, census data for both countries are collected on a decennial basis, but in the US the data is updated annually

through the American Community Survey (ACS) programme which provides additional yearly estimates. The result is that the census data used for Fort Lauderdale was more recent (2018) compared to the data used for Khayelitsha (2011). However, while the time periods used were different for the study areas, the crime data coincided with the census data for each study area respectively. This was preferable since the temporal alignment of crime data and socio-demographic data remains a major challenge of measuring social disorganisation in the developing context (Breetzke, 2010b; Ceccato et al., 2007; Escobar, 2012; Gaviria & Pagés, 2002; Yirmibesoglu & Ergun, 2007).

Another concern in this study was around the integrity of the crime data in South Africa in particular. It is estimated that around 40% of crime are under reported in Khayelitsha, presumably more so with regards to gender-based violence, but also less serious contact crimes like domestic violence (O'Regan & Pikoli, 2014). Several reasons for under-reporting include a lack in confidence in the police who are largely perceived to be inefficient and corrupt as well as a fear of repeat victimisation. Other reasons include insufficient police resources to handle the work load (Freeman & McDonald, 2015), and informal policing structures and gangsterism further complicating formal policing (Stone & Howell, 2019; Super, 2016). The extensiveness of informal infrastructure also affects data quality. A recent study by Edelstein and Arnott (2019) questioned the spatial accuracy of crime data in Khayelisha. This issue is particularly relevant in the more informal locations in the township and is largely a result of incorrect geo-tagging of crime locations where no street addresses exist, and crimes are consequently mapped to adjacent locations with formal street addresses. It is acknowledged that both the under reporting and imprecise spatial recording of crime may have an influence on the output of the regression models used. While unfortunate, this data limitation is simply a reality in a number of less developed contexts. Besides, crime data obtained from the SAPS is the only official and spatially replete data available in the country by which to conduct analysis and draw inferences.

7.4 IMPLICATIONS

7.4.1 Theoretical Implications

An expanding group of researchers from the developing world are questioning the applicability of social disorganisation theory in their particular context (Arias & Barnes, 2017; Breetzke, 2010b; Ceccato & Ceccato, 2017; de Melo et al., 2017; Escobar, 2012; Liu et al., 2016; Zhang et al., 2007). These researchers have tested and adapted the theory in order to suit their unique local context, and have identified alternative predictor variables deemed more appropriate in order to understand the geography of crime in their context. Some measures applied can be altogether unorthodox, for example households with exclusive bathrooms (de Melo et al., 2017) or child-headed households (Swart et al., 2016). The results of their research have shown how significant predictors of crime can vary depending on the local context whilst the meaning of variables also alter depending on the context within which they are being measured. For example, in the developed context the level of education have been measured in terms of the highest educational attainment including a Bachelor's degree (Porter & Purser, 2010) and college education (Sun et al., 2004), while, contrastingly, education have been measured in terms of literacy levels in the developing context (Escobar, 2012; Kassahun, 2005). Another example is the effect of measures of racial or ethnic heterogeneity which have often been found to be insignificant in predominantly racially homogeneous communities in the developing context (Chen et al., 2017; Escobar, 2012; Xiong, 2016) contrary to the developed context.

In this study, levels of social disorganisation were compared in two vastly different international settings where the contextual differences became blatantly obvious. For example, the level of poverty is much more extensive in Khayelitsha where 73% of the population live below the poverty line, compared to Fort Lauderdale where 16% live below the poverty line. A closer look at the data revealed that roughly 20% of these residents in Khayelitsha, in actual fact, earn no income. Similarly, compared to Fort Lauderdale, in Khayelitsha close to 50% of renters are also informal dwellers who live in shacks. The distinction in this study is, however, that while these differences are significant, the variables used as proxies for poverty and tenure status, were defined in exactly the same manner and were therefore comparable. This results in the creation of reliable and valid knowledge of crime across these two contexts that are consistent,

accurate and systematic. To create such knowledge about the spatial dimensions of crime it is crucially important to standardise measures of social disorganisation. It was illustrated here that through the use of ISO standards, the creation of robust predictors of crime causation across contexts is feasible. It was also illustrated that the use of ISO standards in studies of social disorganisation can allow for the consideration of local contexts, while simultaneously promoting the creation of accurate spatial crime data.

7.4.2 Practical Implications

South Africa is in dire need of strategies to help guide programmes of crime intervention, reduction and ultimately prevention. Several crime prevention policies both locally (Civilian Secretariat for Police, 2016; National Planning Commission, 2013) and internationally (United Nations, 2010) stress the importance of understanding and addressing the root causes of crime and developing holistic strategies focused on safety instead of solely focusing on policing when attempting to reduce crime. There is however a detachment between theory and the practical implementation of policy in the fight against crime, particularly in South Africa, where much emphasis is put on role players in the justice and security cluster, but little on addressing the issue of urban safety.

Social disorganisation theory focuses specifically on the extent to which the socio-economic characteristics of neighbourhoods create social disorganisation and increase the risk of crime. Numerous studies have shown the relevance and importance of understanding social disorganisation and its association with crime in a local context, but there is also a need to generalise the findings of these studies beyond individual locations and specifically in the developing context. In previous studies researchers have often argued for the necessity of additional research (Andresen, 2006; Graif & Sampson, 2009; He et al., 2015; Jones-Webb & Wall, 2008; Lowenkamp et al., 2003), in other contexts and over time, to test the broader applicability of the theory. Arguably, only by standardising variables used as proxies when measuring social disorganisation, and testing social disorganisation and crime across a variety of contexts, can the general relevance of the theory and related implications for practical crime prevention policy be determined.

Although the management of crime and violence certainly requires knowing how, when and where it occurs, its reduction furthermore involves an explanation of why crime

occurs and tailoring responses accordingly (Faull, 2019). By being able to test the applicability of social disorganisation theory in a uniform and standardised way, the causes crime in South Africa can be established with some greater degree of certainty. In this way it becomes possible for crime management interventions to be based on one of most influential theories concerned of crime and place. For example, knowing that renting is a key risk factor for crime in both Fort Lauderdale *and* Khayelitsha (using standardised methods) can allow key role players tasked with reducing crime in South Africa to use knowledge from US policing agencies to address this risk factor. South African role players can see how this issue is managed and addressed in the US and use similar practical interventions in Khayelitsha.

The SAPS are under immense pressure to combat the overwhelming scourge of crime in South Africa, and more so in the country's townships, like Khayelitsha, where crime is disproportionately concentrated (Breetzke, 2018; Swart et al., 2016). With the mounting crime levels and pressure from the public to find solutions, any assistance to help reduce crime rates should be welcomed. Knowledge regarding the spatial dimension of the root causes of crime, can help prioritise interventions and identify targets for programmes. It can assist in focused policing and limiting resources being directed to areas where it is most needed and where it is likely to be most effective. The methods proposed here to produce standardised data and conceivably generalised knowledge regarding crime and crime causation across contexts, provide cost effective and relatively straightforward solutions.

7.5 RECOMMENDATIONS

Based on the findings of the study, several recommendations can be made.

1. Recommendation: The need to view social disorganisation from a developing world perspective

Researchers in the developing world emphasise the importance of applying local knowledge when examining the spatial patterning of crime (Breetzke, 2010b). There is a growing need to view social disorganisation theory from a Global South perspective and it is pertinent because social disorganisation and crime are more prevalent in these contexts compared to the global North. According to Oldfield (2014) cities of

the developing world reflect the most critical global urban problems and issues of the 21st century. Consequently, this is where the greatest need for interventions in social disorganisation and crime exist. This warrants dedicated examinations of the theory in developing contexts and perhaps requires a different approach when examining the theory's applicability to contexts outside those in which the theory was originally developed.

2. Recommendation: Use a standardised set of variables to measure and represent social disorganisation theory

There is evidence in this study of numerous inconsistencies presented when operationalising social disorganisation characteristics in different contexts. This allows researchers a great measure of flexibility to operationalise these characteristics in practice. The lack of standardisation of measures can have far-reaching effects on the results of research involving social disorganisation theory. This limits the ability of researchers to compare and validate the results across contexts. In the developing context standardisation could prove to be invaluable and it is crucial to enable comparison of localities to tap into the wealth of available information and to learn from the knowledge previously generated in this field.

3. Recommendation: Use ISO standards in cross-comparative spatial studies of crime using social disorganisation

The ISO 37120 indicators provide a globally agreed upon framework which is a useful basis for guiding the selection of variables, thereby allowing for comparisons of spatial crime research in disparate contexts. Importantly, the use of standardised measures is not intended to replace existing variables. Instead, the application of these standards presents simple and inexpensive ways to create consistent and comprehensive databases and a foundation of globally standardised data for investigating the spatial causes of crime across contexts. The use of standardised variables presents an excellent opportunity to add value to research, and aid researchers in conducting comparative international and local studies on crime. Standardisation will, particularly in developing contexts, allow researchers to contextualise the levels of social disorganisation in communities and, ultimately, promote informed management concerning crime prevention policies. Without globally standardised measures, the

different and often incompatible interpretations of social disorganisation variables will continue to remain a hindrance to the identification of consistent predictors of crime across international contexts.

4. Recommendation: Employ additional ISO indicators when able

Neighbourhood characteristics related to socio-economic deprivation and urbanisation are well represented among the ISO 37120 indicators. These indicators include measures of safety, poverty, unemployment, education, service provision, shelter, immigration and population density, which can all be used to operationalise socio-economic deprivation, ethnic heterogeneity and urbanisation. ISO 37120 indicators that measure telecommunications and transportation, provide the possibility to include additional measures of social exclusion or geographic marginalisation. Other structural neighbourhood characteristics specifically family disruption and residential mobility were not well represented among the ISO indicators, however as new ISO indicators are developed there is an opportunity to add additional indicators in future analysis.

5. Recommendation: The management of crime reduction must be based on sound empirical evidence

According to the United Nations (2010), crime prevention strategies should be based on a comprehensive foundation of knowledge about crime and its possible causes. They stress the importance of knowledge sharing among researchers and other relevant role players, as well as emphasise the importance of transparency and open data in order to generate cost-effective solutions to the scourge of crime. Regarding local policy strategies to address crime, the Integrated Social Crime Prevention Strategy of South Africa (2011) stresses the importance of primary crime intervention strategies aimed at addressing the risk factors associated with the occurrence of and trends in crime. The South African White Paper on Safety and Security also emphasises a 'knowledge-based' approach to crime prevention based on reliable and accessible data (Civilian Secretariat for Police, 2016). The National Development Plan (NDP) (National Planning Commission, 2013) recognises that crime is a complex issue that encompasses much more than security, as it has deep social and economic roots, such as poverty, inequality and unemployment, that need to be tackled holistically. According to the NDP the achievement of long-term and sustainable safety requires an integrated approach focused on the fundamental and root causes of crime.

Despite the many local policies aimed at addressing crime in South Africa, their implementation remains weak (O'Regan & Pikoli, 2014; Ugur, 2014). Indeed, crime in South Africa is a problem of epidemic proportions and an understanding and addressing of the root causes remains ever elusive (Altbeker, 2007). This is even more relevant in the nation's townships which experience disproportionately high rates of crime (Breetzke, 2018; Swart et al., 2016). Since international and national policies clearly stipulate the importance of a knowledge-based approach to crime prevention and the use of 'scientifically reliable and valid' knowledge (United Nations, 2010, 7), the need to compare and benchmark local crime knowledge with international best-practice approaches to crime prevention has never been more urgent.

Previous strategies implemented in Khayelitsha to combat crime were found to be ineffective (O'Regan & Pikoli, 2014; Ugur, 2014), and the township now desperately requires crime reduction and prevention interventions based on sound empirical evidence. The use of ISO 37120 standardised indicators specifically promote international comparison and in spatial studies of crime evidence can emanate from comparative knowledge sharing with other international studies which can arguably only be achieved through international and local benchmarking.

6. Recommendation: The need for GIS in crime prevention strategies

The South African government acknowledges that crime reduction and management interventions require coordinated efforts and high levels of analysis of crime patterns and trends (National Planning Commission, 2013). They further acknowledge the need for information and data management systems, complemented by reliable and up-to-date spatial data (Civilian Secretariat for Police, 2016). The Western Cape Safety Strategy Plan (2020) accentuate the importance of identifying the time and place of crime incidents and the significance of analyses of spatial crime data to inform law enforcement, as the cornerstones of successful crime reduction interventions.

The development and proliferation of technologies such as GIS have triggered a revival of the testing and application of social disorganisation theory since the turn of the century (Anselin et al., 2000; Johnson, 2016). As a result, the use of geo-spatial solutions for the analysis of crime has become relatively commonplace, and indeed an essential tool required for mapping crime (Chainey & Ratcliffe, 2006). The importance

of geographic distributions and spatial dynamics in the analysis of crime is well established in crime research (Brunton-Smith et al., 2013; Ferreira et al., 2012; Ratcliffe, 2010; Weisburd et al., 2014) and internationally, GIS has been used successfully in helping law-enforcement agencies with crime-management strategies.

In Fort Lauderdale where the murder rate is roughly seven times lower than in Khayelitsha, the police department (FLPD) frequently use GIS technology in the fight against crime. For example, the Police Department has an open-data portal from which all crime incident data can be downloaded. The department provides a 'statistics gateway' which includes crime analysis reports detailing crime and service statistics, along with detailed instructions on crime prevention. Several crime reduction and prevention initiatives are also outlined. For example, the FLPD created a cell phone application whereby communities can communicate about neighbourhood safety. The FLPD uses the platform to share crime and safety alerts with communities in real time.

While initiatives like these and the use of GIS and spatial data can effectively support the fight against crime in South Africa, their under-utilisation remains baffling and problematic. Over a decade ago when Breetzke (2006) explored the use of available technology, including GIS, in assisting policing in South Africa, he confirmed a multitude of obstacles, including limited knowledge and capacity to putting these technologies to use. Not much has improved these past 15 years, such that Faull (2019) recently strongly advocated the use of alternative sources of crime data and crime-mapping solutions in the absence of reliable open crime data and crime interventions driven by the SAPS. The under-utilisation of GIS technology is further confirmed by recent proposals in the Western Cape Safety Strategy Plan (2020) which includes the undertaking of spatially-based crime research and analysis in the province. This is a strategy that should have been adopted years ago.

In developing world contexts insufficient and unreliable spatial crime data remain a great hindrance in the examination of the spatial distribution of crime patterns (Breetzke, 2010b; Ceccato et al., 2007; Edelstein & Arnott, 2019; Escobar, 2012; Gaviria & Pagés, 2002; Yirmibesoglu & Ergun, 2007). The use of standardised variables informed by ISO indicators at an aggregated level can greatly improve the successful utilisation of GIS technology where the accuracy of data is less of an issue. The ISO indicators are inherently spatial and are clearly defined and delineated with detailed specifications and guidelines regarding the measurement and calculation. This should ultimately contribute towards the creation of a GIS database of crime in South Africa.

7. Recommendation: Additional and similar studies across contexts and on a temporal scale

This study demonstrated that utility of ISO-defined and -standardised variables for comparing levels of social disorganisation and crime in two widely different international contexts. Confirmation of the applicability of social disorganisation theory in a South African context by using a standardised cross-national comparative methodology would allow for the prescription of policies to reduce crime. Studies that compare other international and national contexts should be conducted to add to the growing knowledge base.

7.6 SUMMARY

Through the use of ISO guidelines and the application of standardised measures, this study highlights a way in which comparative analyses of social disorganisation and crime across international contexts can be undertaken. This, for the first time, provides researchers with a methodological framework to move beyond individual localities at specific periods in time, and seek common ground. In order to gain wider theoretical insight into the understanding of crime patterns and the way they relate to the social and economic environment, the comparison of research is imperative. Global criminology can learn from this, and the application of ISO indicators could prove invaluable in the developing context. The ISO 37120 indicators provide a unique opportunity to shared core knowledge of the social and spatial dimension of crime.

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Appendix A



20 May 2019

Dear Mrs G Groeneveld

Project Title: Analysing Urban Safety and Crime Generators in Khayelitsha, Cape Town: A Geo-Spatial and Temporal Analysis
Researcher: Mrs G Groeneveld
Supervisor: Prof GD Breetzke
Department: External department
Reference number: 18332082 (HUM011/0419)
Degree: Doctoral

Thank you for the application that was submitted for ethical consideration.

The Research Ethics Committee notes that this is a literature-based study and no human subjects are involved.

The application has been **approved** on 20 May 2019 with the assumption that the document(s) are in the public domain. Data collection may therefore commence, along these guidelines.

Please note that this approval is based on the assumption that the research will be carried out along the lines laid out in the proposal. However, should the actual research depart significantly from the proposed research, a new research proposal and application for ethical clearance will have to be submitted for approval.

We wish you success with the project.

Sincerely



Prof Maxi Schoeman
Deputy Dean: Postgraduate Studies and Ethics
Faculty of Humanities
UNIVERSITY OF PRETORIA
e-mail: PGHumanities@up.ac.za

Fakulteit Geesteswetenskappe
Lefapha la Bomotho

Research Ethics Committee Members: Prof MME Schoeman (Deputy Dean); Prof KL Harris; Mr A Bizos; Dr L Blokland; Dr K Booysens; Dr A-M de Beer; Ms A dos Santos; Dr R Fassel; Ms KT Govender; Andrew; Dr E Johnson; Dr W Kelleher; Mr A Mohamed; Dr C Putterill; Dr D Reyburn; Dr M Soer; Prof E Tallard; Prof V Thebe; Ms B Tsebe; Ms D Mokalao