Section One

Quantitative methods

2 Non-experimental research designs: Investigating the spatial distribution and social ecology of male homicide

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Introduction

Quantitative research primarily intends to make causal inferences concerning two or more variables of interest. This is largely achieved through experimentation. The more controlled the experimentation process, the better able researchers are to infer causality (Shadish, Cook & Campbell, 2002). Experimental control is accomplished using random assignment, variable manipulation and a comparative control group. However, when variables are pre-existing, they cannot be manipulated. Additionally, randomisation and participant assignment to control and experimental groups is not always possible and is sometimes unethical. In these situations, we use non-experimental research designs, which are typically descriptive and, at best, correlational (Sousa, Driessnack & Mendes, 2007). Whilst non-experimental research designs by themselves are unable to make any claims relating to causality, and thus suffer from poor internal validity, they are able to better generalise than their experimental counterparts and as such tend to have relatively stronger elements of external validity (Shadish et al., 2002).

Homicide research most often draws upon non-experimental methodologies given that it is not possible or ethical to randomise victims or to create control and experimental groups. This research usually takes the form of model testing correlational non-experimental designs as a means to examine and discuss a proposed model for particular predictor and outcome variables, most often arising from secondary data sources (Sousa et al., 2007). For example, we know that homicide tends to occur more regularly in particular geographical areas (such as specific countries, cities and neighbourhoods) than others. A large body of work from the United States has examined the spatial distribution of homicide, particularly at the neighbourhood level (e.g. Becker, 2016; Hannon, 2005; Kubrin, 2003; Mares, 2010; Wang & Arnold, 2008), and suggests that neighbourhood socioecological conditions, such as socioeconomic disadvantage, are key explanatory factors and could have important implications for violence prevention and control. This chapter presents a neighbourhood analysis of the spatial distribution and social ecology of male homicide in Johannesburg in order to demonstrate the utility of a non-experimental methodological approach. The

unit of analysis in this case study is the geographical area rather than the individual, and a multivariate analysis of secondary spatial data is used to determine the relationship between neighbourhood sociostructural characteristics and male homicide. The chapter thus demonstrates the value of a particular type of non-experimental ecological and multivariate spatial analysis for neighbourhood-level research. We begin with a brief overview of the theoretical approach and empirical evidence used to frame our case study.

Neighbourhood characteristics and homicide: Theory and empirical evidence

Violence is a serious problem in South Africa. The country's annual homicide rate of 31 per 100 000 reported in the *Global Study on Homicide 2013* is five times greater than the global average homicide rate of 6.2 per 100 000 (UNODC, 2014). An emerging body of research has emphasised the predominance of men, particularly young black men, as victims of homicide in the country (Kramer & Ratele, 2012; Matzopoulos et al., 2015; Norman, Matzopoulos, Groenewald & Bradshaw, 2007; Ratele, 2010), with the highest homicide rates reflected among men residing in urban locations (Sherriff et al., 2015). Neighbourhood socioecological conditions may be important contributors to the high levels of violence, and most notably homicide, in urbanised South African contexts (Swart, Seedat & Nel, 2016).

Social disorganisation theory is one of the main theoretical perspectives that has framed research on neighbourhood context and its relation to crime and violence (Bursik, 1988; Sampson & Groves, 1989). The theory stems from Shaw and McKay's (1942) work on juvenile delinquency in Chicago, which concluded that the causes of violent crime are located in the sociostructural context of neighbourhoods. Specifically, socioecological conditions, such as low economic status, racial or ethnic heterogeneity, and residential mobility, are argued to disrupt a community's formal and informal social control processes and, therefore, facilitate crime and violence. Contemporary descriptions of social disorganisation theory have introduced other sociostructural factors, such as family disruption, and have also focused on the role of community organisational processes, such as collective efficacy and informal social control, in mediating the effects of sociostructural factors on crime and violence (Sampson & Groves, 1989; Sampson, Raudenbush & Earls, 1997). Some versions of social disorganisation theory also integrate culture in their explanations of neighbourhood violence. In this regard, sociostructural conditions, and economic disadvantage in particular, are also assumed to limit a neighbourhood's capacity to develop and maintain basic community institutions that link residents, and especially young people, to wider social institutions (Peterson, Krivo & Harris, 2000). These advances in social disorganisation theory call for non-experimental research methods that take particular cognisance of specific contextual, cultural and sociostructural indicators of neighbourhood-level violence.

A substantial body of research in the United States has investigated the effects of key sociostructural measures of social disorganisation, such as socioeconomic

disadvantage, family disruption, population density and size, residential mobility, and racial composition, on homicide rates (e.g. Becker, 2016; Hannon, 2005; Kubrin, 2003; Mares, 2010; Peterson et al., 2000; Wang & Arnold, 2008). In general, these studies have found support for most of the structural measures of social disorganisation, with concentrated disadvantage having demonstrated the most consistent positive relationship with homicide rates in neighbourhoods in the United States (e.g. Hannon, 2005; Wang & Arnold, 2008).

Considering the sociopolitical history and current socioeconomic situation in South Africa, measures of social disorganisation theory may have relevance for understanding the spatial distribution of violence, and particularly of homicide, in the country. Despite efforts towards socioeconomic transformation since democratisation, there has been little growth and development in townships established under apartheid, which remain economically marginalised and racially segregated (Breetzke, 2012). Rapid urbanisation has also contributed to the development of informal settlements in cities, which are typically characterised by socioeconomic disadvantage, inadequate housing, limited facilities and high levels of overcrowding (SACN, 2011). Furthermore, apartheid laws and policies, including the migrant labour system and resultant urban influx, have also had long-lasting effects on family structure, with recent estimates indicating that while 90% of white South African children live with their parents, only about 50% of black children live with theirs (Amoateng, Richter, Makiwane & Rama, 2004).

With the above theoretical approach and empirical evidence in mind, we now turn to a demonstration of the utility of a particular non-experimental type of ecological and multivariate analysis for examining neighbourhood-level characteristics and their implications for the social ecology of male homicide. We do so by drawing on a case study which builds on the aforementioned emerging body of research by having examined the spatial distribution of male homicide victimisation in the city of Johannesburg between 2001 and 2005 in order to determine whether neighbourhood differences in sociostructural characteristics were associated with male homicide levels.

Case study: Spatial distribution and social ecology of male homicide in Johannesburg neighbourhoods

As we were interested in establishing the relationship between sociostructural characteristics and homicide levels as they exist in neighbourhoods across Johannesburg, a non-experimental research design was necessary for our study. Although not as powerful as an experimental research design in establishing a causal relationship, non-experimental research offers an alternative when the manipulation of explanatory variables or random assignment is not feasible or desirable (Belli, 2009). In addition, true experimental research designs are often impractical and difficult to implement in violence studies in global South contexts given the lack of resources. Further, true experimental research requires

experimental and control groups, presenting obvious ethical implications for the study of violence and the already problematic nature of South Africans having unequal access to resources. Most importantly, though, the element of control and the clinical nature of true experimental research often undermine the ability of the research output to capture the complex nature of the social structure (Lum & Yang, 2005) – one of the key interests of this particular case study. As such, we constructed neighbourhood variables for a non-experimental analysis by using secondary data from the National Injury Mortality Surveillance System (NIMSS) and Statistics South Africa's most recent national Census. We then estimated a multivariate regression model that adjusted for spatial autocorrelation to determine the relationship between neighbourhood sociostructural characteristics and male homicide.

Dependent variable: Male homicide counts

The dependent variable for the analysis was the number of homicides among male victims aged 15 years and older that occurred in Johannesburg between 2001 and 2005. The number of homicides was pooled across a five-year period to add stability to the estimates and to ensure adequate homicide counts to allow us to perform a multivariate analysis at the neighbourhood level. Male homicide data were obtained from the NIMSS, which captures epidemiological information on injury-related deaths based on medico-forensic investigative procedures at state medico-legal laboratories (Donson, 2008). The NIMSS began collecting injury data in 1999 at selected sites across the country as part of a collaboration between the South African Medical Research Council (SAMRC), the Centre for Scientific and Industrial Research, the University of South Africa (Unisa), the national Department of Health and the South African Police Service that housed the forensic laboratories at the time. Currently, the NIMSS is coordinated by the SAMRC–Unisa Violence, Injury and Peace Research Unit (VIPRU) and is part of a collaboration with the national and two provincial (Gauteng and Mpumalanga) departments of health. The inclusion of national governing bodies in the coordination of this project ensures continued ethical practice. It also emphasises the importance of homicide research in the context of South Africa so that homicide research becomes an ethical enterprise in and of itself.

During data collection, the medical practitioner and forensic officers at the participating laboratories complete a form for every death, which records information on victim demographics; time, scene and place of injury; and external cause and apparent manner of death (homicide, suicide, accidental, undetermined) (Donson, 2008). The form is completely anonymous and allows no identifying information concerning the deceased subject to be captured, thus presenting very few ethical implications. The data are then captured into a computerised database that is sent to the SAMRC–Unisa VIPRU at the end of each year, where all of the databases from the participating laboratories are cleaned and merged. Although the NIMSS has had full coverage of all injury-related deaths for the city of Johannesburg since its inception, for this study we focused on male homicides between 2001 and 2005 to coincide with Census 2001, the most recent available Census data at the time. The data obtained from the NIMSS

included victim demographics (sex and race), weapon or method used, scene, and geographical location (suburb) where the homicide occurred. The use of secondary data of this type is advantageous given that it is cost-effective, resolves issues relating to ethics and provides a large data set that is likely to be representative and is less likely to be biased due to issues relating to response styles and other data-gathering issues (Sørensen, Sabroe & Olsen, 1996).

Between 2001 and 2005, the NIMSS registered a total of 6 445 male (≥ 15 years) homicides for Johannesburg. Of these homicides, 1 173 (18.2%) were excluded from the analysis because of incomplete information on the suburb or residential neighbourhood where the homicide occurred. Similar to patterns reported in other South African research (e.g. Kramer & Ratele, 2012; Ratele, Swart & Seedat, 2009), of the 5 272 male homicide cases analysed in this study, most victims were black (*n* = 4 691, 89.0%), aged 15 to 29 years (*n* = 2 408, 45.7%) and 30 to 44 years (*n* = 2 152, 40.8%), and most were killed by firearms (*n* = 3 708, 70.3%).

Spatial distribution of male homicide in Johannesburg's neighbourhoods

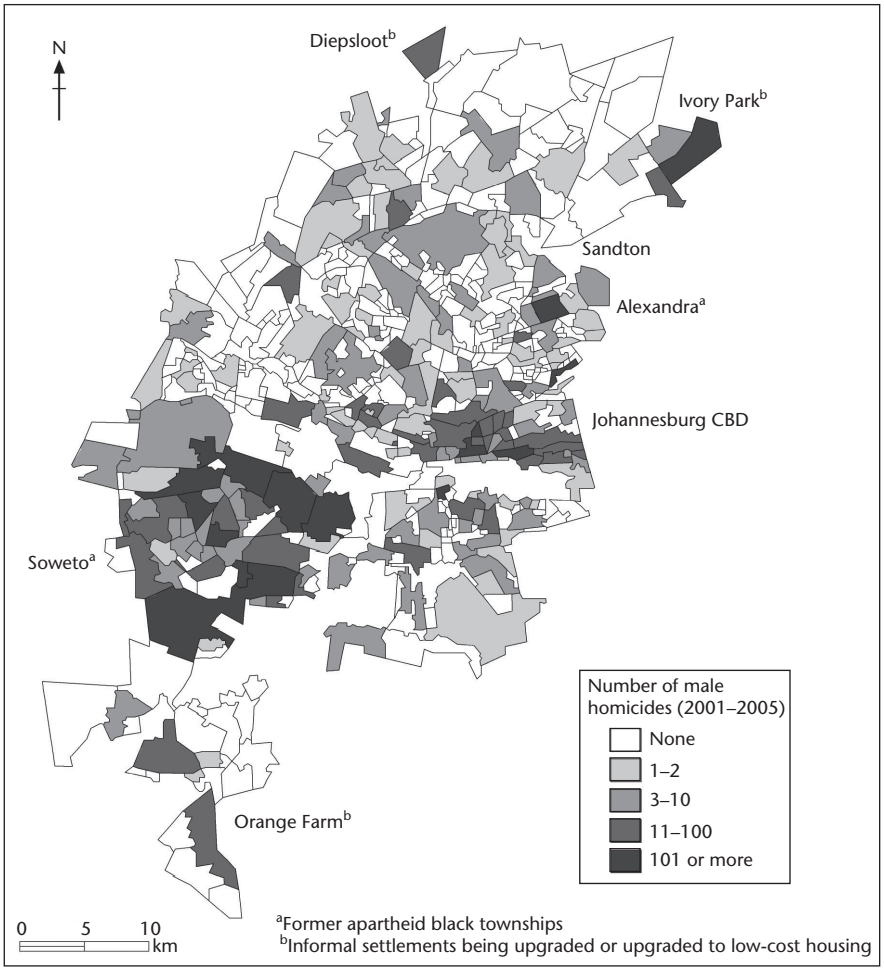
Each of the 5 272 male homicides was matched to a residential neighbourhood (*n* = 508) and geocoded to a base map shape file.[1] The residential neighbourhoods were based on subplace names provided by Statistics South Africa's Population Census 2001. Of the 684 neighbourhoods provided by Census 2001, 84 were excluded as they consisted of nature reserves, industrial areas, parks, hospitals, universities, recreational areas and areas with residential populations of less than 200. Another 132 Census subplaces were combined to comprise 40 residential areas because the homicide data lacked sufficient detail on neighbourhood extension and zone numbers. For example, Diepkloof Zones 1 to 6 were combined into one subplace. The final number of residential neighbourhoods included in the study was 508.

Figure 2.1 shows the spatial distribution of male homicides across Johannesburg neighbourhoods from 2001 to 2005. The majority (*n* = 283, 55.7%) of the 508 neighbourhoods had no male homicides over the study period. Eighty-four (16.5%) of the neighbourhoods had one or two male homicides, 79 (15.5%) had between three and ten male homicides, 47 (9.4%) had between 11 and 100 male homicides, and 15 (2.9%) had between 101 and 532 male homicides. Therefore, a disproportionate number of male homicides were concentrated in relatively few neighbourhoods, particularly the areas in former apartheid black townships, informal settlements on the outskirts of the city and the inner city of Johannesburg.

Explanatory variables: Neighbourhood characteristics

Eleven variables were constructed from Statistics South Africa's Census 2001 community profiles (Statistics South Africa, 2003) to reflect neighbourhood differences in socioeconomic disadvantage, housing and density, demographic composition (race, citizenship, age), family disruption and residential mobility. The list of explanatory variables was informed by social disorganisation theory and the type of data available from Census 2001. Following the way previous

Figure 2.1 Number of male homicide victims per neighbourhood, Johannesburg (2001–2005)



Source: Authors, redrawn by Janet Alexander

studies have constructed socioeconomic disadvantage (e.g. Breetzke, 2010b; Kubrin, 2003; Land, McCall & Cohen, 1990; Strom & MacDonald, 2007; Wang & Arnold, 2008), poverty (the percentage of households earning less than R9 600 annually), unemployment (the percentage of persons unemployed in the 15–64-year age group) and low educational attainment (the percentage of residents who have not completed high school) were included in the measures of socioeconomic disadvantage. In addition, the percentage of households living in informal dwellings and household density (number of residents per number of household rooms, excluding kitchen and bathroom) were included in the study as measures of inadequate and overcrowded housing conditions.

For the other explanatory variables, the percentage of black residents was used as a measure of racial composition, the percentage of non-citizens was used to capture ethnic composition, and the percentage of persons aged between 15

and 29[2] years was used to measure the youth population. Two measures were selected to represent family disruption, namely the percentage of female-headed households and the percentage of persons divorced aged 15 and older. Although previous studies tend to use the percentage of single-parent households, this information is not provided by the South African Census data and therefore we used the percentage of female-headed households. Finally, population turnover (the percentage of persons aged five and above who changed residences in the past five years) was used to measure residential mobility.

Table 2.1 provides the descriptive statistics for the 11 neighbourhood variables. The sociostructural variables varied considerably across the neighbourhoods in our study. For example, in the 508 neighbourhoods, the percentage of those living in poverty ranged from 0% to a maximum of 88%; the percentage of unemployed from 0% to 58.3%; the percentage of households in informal dwellings from 0% to 97.8%; and the percentage of black residents ranged from a low of 1.5% to a high of 100%.

Table 2.1 Descriptions of the 11 explanatory variables used in the factor analysis together with mean values and ranges for the 508 residential areas of Johannesburg

Indicator	Description	Mean	Min.	Max.
Socioeconomic disadvantage				
1. Poverty	Percentage of households earning less than R9 600 annually	22.21	0.00	88.00
2. Unemployment	Percentage of persons unemployed in age group 15–64 years	13.57	0.00	58.30
3. Low educational attainment	Percentage of persons with less than Grade 12 aged 25 years and older	49.13	11.50	94.12
Housing and density				
4. Informal dwelling	Percentage of households living in informal dwellings	9.50	0.00	97.79
5. Household density	The number of residents per the number of household rooms (excluding kitchens and bathrooms)	.79	.32	3.81
Demographic composition				
6. Race	Percentage of black residents	45.90	1.49	100.00
7. Non-citizenship	Percentage of non-South African citizens	4.66	0.00	31.13
8. Youth population	Percentage of persons aged between 15 and 29 years	27.63	4.58	68.86

continued

Indicator	Description	Mean	Min.	Max.
Family disruption				
9. Female-headed household	Percentage of female-headed households	37.12	0.00	71.43
10. Divorced	Percentage of persons divorced aged 15 and older	5.14	0.00	14.96
Residential mobility				
11. Residential mobility	Percentage of persons aged five and over who have changed residences in the past five years	29.79	1.20	82.17

Source: Authors

As is typical in this type of research design, measures of socioeconomic structural conditions tend to be highly correlated, posing the risk of multicollinearity in the multivariate modelling process. Accordingly, we examined the bivariate correlations between the dependent and explanatory variables, presented in Table 2.2. The interpretation of the analytic output reveals that the three measures of socioeconomic disadvantage were significantly correlated with male homicide in the expected direction (positive), indicating that in Johannesburg poor neighbourhoods had more male homicides. Of the housing measures, informal dwellings were not significantly associated with male homicide, while household overcrowding was significantly positively associated with male homicide. These measures of socioeconomic disadvantage and inadequate housing were also all highly correlated with each other. Of the demographic measures, both the percentage of black and the percentage of youth were significantly positively associated with male homicide, while the percentage of non-citizens was not significantly related to male homicide. Accordingly, in the city of Johannesburg, neighbourhoods with a high concentration of black residents and neighbourhoods with larger proportions of youth (15 to 29 years) had more homicides. Furthermore, both the percentage of black and the percentage of youth were significantly positively correlated with each other and with all of the measures of socioeconomic disadvantage and inadequate housing.

In contrast to expectations concerning the two measures of family disruption, the percentage of female-headed households was not significantly associated with male homicide, while the percentage of divorced residents was significantly negatively correlated with male homicide. Therefore, Johannesburg neighbourhoods with higher proportions of divorced residents had less male homicide. Table 2.2 also shows that neighbourhoods in Johannesburg with higher concentrations of divorced residents had higher concentrations of female-headed households, higher levels of educational attainment and lower levels of socioeconomic disadvantage (low household income and unemployment), which may account for the negative correlation between divorce and male homicide.

Table 2.2 Correlations for male homicide and neighbourhood characteristics in Johannesburg (2001–2005)

	1	2	3	4	5	6	7	8	9	10	11	12
1. Male homicides	1	.170**	.256**	.166**	.070	.205**	.262**	–.021	.300**	.002	–.187**	–.153**
2. Low household income		1	.846**	.807**	.721**	.746**	.664**	–.263**	.471**	.026	–.494**	–.318**
3. Unemployment			1	.805**	.677**	.710**	.782**	–.382**	.574**	–.065	–.512**	–.363**
4. Low educational attainment				1	.614**	.765**	.643**	–.318**	.439**	–.101*	–.516**	–.409**
5. Informal dwellings					1	.549**	.570**	–.179**	.289**	–.089*	–.408**	–.172**
6. Household overcrowding						1	.651**	–.238**	.565**	–.120**	–.496**	–.204**
7. Black							1	–.177**	.596**	–.150**	–.630**	–.172**
8. Non-citizenship								1	–.139**	–.004	–.104*	.396**
9. Youth (15 to 29 years)									1	–.215**	–.437**	.035
10. Female-headed household										1	.355**	–.091*
11. Divorced											1	.238**
12. Population turnover												1

Source: Authors

Notes: * $p < .05$ ** $p < .01$

The measure of residential mobility, namely the percentage of residents that had moved in the past five years, was also significantly negatively correlated to male homicide. This variable was also strongly negatively correlated with all of the socioeconomic measures, indicating that neighbourhoods in Johannesburg with high levels of residential turnover were more socioeconomically resourced.

As the sociostructural measures were highly correlated with each other, following Land and colleagues' (1990) recommendations, an exploratory factor analysis (principal component) using orthogonal rotation (varimax with Kaiser Normalisation) was conducted across the 11 contextual indicators to decrease instances of multicollinearity and to ensure that statistical inferences were not affected by high correlations between the explanatory variables. A three-factor model was derived that explained 73% of the cumulative variance (Table 2.3).

Table 2.3 Pattern matrix from the factor analysis with factor loadings for each contextual indicator

	Factor 1	Factor 2	Factor 3
Household income less than R9 600	**.900**	–.223	.072
Unemployed aged 15–64 years	**.881**	–.306	–.068
Household density	**.834**	–.122	–.128
Black	**.828**	–.047	–.246
Low education aged 25+ years	**.817**	–.354	–.078
Informal dwelling	**.763**	–.103	.029
15–29-year-olds	**.650**	.150	–.354
Live in dwelling for less than five years	–.147	**.847**	–.049
Non-citizen	–.139	**.772**	.052
Female-headed household	.011	–.029	**.918**
Divorced aged 15+ years	–.558	.141	**.566**

Source: Authors

Note: Numbers in bold represent the highest loading of each variable on one factor.

Factor 1 accounted for 50.4% of the variance among the three factors and consisted of the percentage of households with an income less than R9 600 per annum, the percentage of unemployed residents, household density, the percentage of black residents, the percentage of residents with a low education, the percentage of residents living in informal dwellings and the percentage of 15- to 29-year-olds. Given that this factor primarily consisted of poor economic and housing conditions, it was labelled 'concentrated disadvantage'. Unlike patterns demonstrated by previous studies (Land et al., 1990; Strom & MacDonald, 2007; Wang & Arnold, 2008), the variable 'female-headed households' did not load on this factor. Instead, the percentage of residents aged 15 to 29 years loaded on this factor, indicating that in areas with high levels of socioeconomic disadvantage, there were also high concentrations of youth.

Factor 2 accounted for 13.2% of the variance among the factors and consisted of the percentage of residents living in a dwelling for less than five years and the percentage of non-South African citizens, and accordingly was labelled

'residential mobility'. Factor 3, labelled 'female-headed households', accounted for 9.3% of the variance, and consisted of the percentage of female-headed households and the percentage of divorced residents. These three neighbourhood factors comprised the explanatory variables in the non-experimental multivariate analysis that follows.

Neighbourhood characteristics and male homicide: Multivariate analysis adjusting for spatial autocorrelation

Given that most neighbourhoods had zero or low homicide counts, and our design was non-experimental by nature, we used a negative binomial regression model to examine the relationship between the three neighbourhood sociostructural characteristics and male homicide. When analysing spatial data, it is also important to take into consideration that the units of analysis are interrelated (Bernasco & Elffers, 2010). In other words, neighbourhoods are spatially dependent, so the level of homicide in a neighbourhood is likely to influence the levels of homicide in adjacent neighbourhoods (Morenoff, Sampson & Raudenbush, 2001). If the spatial processes operate and are ignored, regression analysis may lead to false indications of significance (Messner et al., 1999). Accordingly, a base map shape file for all of the neighbourhoods and a data table of the number of homicides for each neighbourhood were joined in GeoDa™* to test for spatial autocorrelation. Following the procedures outlined by Anselin (2005), a spatial weights matrix was constructed based on rook contiguity (neighbours were defined as sharing a common border), followed by the computation of a spatially lagged variable based on the predicted values of the dependent variable (male homicide counts). A significant spatial pattern was observed for the dependent variable (Moran's $I = 0.1370$; $p < .01$) and therefore we added the spatial lag variable to the regression model to control for spatial autocorrelation.

Because the analysis used homicide count data, we added the natural logarithm of the population at risk as an offset variable with a fixed coefficient to the regression model to control for the variation in the size of the population at risk across neighbourhoods. This procedure converts the counts of homicide into the equivalent of a rate for each neighbourhood, and serves to standardise the regression model (Osgood, 2000). Thus, the final regression model consisted of the three neighbourhood factors, the spatial control and the natural logarithm of the population at risk (i.e. males aged 15 years and older) as an offset.

Table 2.4 presents the standardised coefficients and the standard errors for the negative binomial regression model explaining male homicides in 508 Johannesburg neighbourhoods. As shown in the first column of Table 2.4, all three of the neighbourhood factors – concentrated disadvantage, residential mobility and family disruption – were significantly related to male homicide. Concentrated disadvantage, in particular, had a profound positive impact ($\beta = .717$, $p < .001$), with one unit of concentrated disadvantage, holding all other variables constant, corresponding to a 105% increase in the overall rate of male homicide (percentage change = $100 \times [\exp(.717) - 1]$). Residential mobility also had a positive impact ($\beta = .192$, $p < .001$), with one unit change in residential mobility leading to a 21% increase in overall male homicides. Family disruption,

in contrast, was significantly negatively related to male homicides (β = –.303, p < .001), with a unit increase in this factor being associated with a 26% decrease in overall male homicides. Table 2.4 also reveals that spatial autocorrelation was significantly associated with male homicide distributions across neighbourhoods. However, the coefficient for spatial autocorrelation was negative, indicating a spatial clustering pattern where high-homicide neighbourhoods bordered low-homicide neighbourhoods.

Table 2.4 Negative binomial regression results for neighbourhood characteristics on male homicide, Johannesburg (2001–2005)[a]

Variable	Male homicide
Concentrated disadvantage	.717***
	.0726
Residential mobility	.192***
	.0510
Family disruption	–.303***
	.0645
Spatial lag	–.007***
	.0019
Intercept (constant)	–5.595***
	.0636
Likelihood ratio Chi-square	170.521***

Source: Authors

Notes: [a] Entries are unstandardised coefficients (β) followed by standard errors.

*** $p < 0.001$

Discussion and conclusion

This chapter presents a case study using secondary data to demonstrate the utility of non-experimental methods in South African research by modelling the effects of the neighbourhood sociostructural context – specifically concentrated disadvantage, residential mobility and family disruption on male homicide in the city of Johannesburg. Research that targets neighbourhood-level covariates of male homicide through the use of non-experimental techniques such as the advanced regression models demonstrated in this chapter is unique in that it offers an alternative approach to data collection, ethical considerations and analysis. Analytically, the inclusion of a natural logarithm in the regression model allowed us to draw on count data. This has massive implications for how we can manage standard ethical requirements. Homicide counts were population-based, anonymous and collected blindly. Thus, beyond ethical clearance from governing bodies, this type of research allows for administrative- and resource-'light' studies that are able to span entire decades and populations with little need

to engage in the often substantial costs and resources that good ethical practice requires. This has obvious implications in the context of a developing and resource-competitive landscape such as South Africa's.

The use of our non-experimental model and design had several other implications. In terms of the actual case study, although all three explanatory measures were significant, only two were in the expected direction, and therefore the study provides partial support for social disorganisation theory. The loading of the percentage of black residents on the factor of concentrated disadvantage also points to the persistent racial socioeconomic inequalities and residential segregation that contribute to levels of violence and homicide among men in urbanised South African contexts. However, contrary to social disorganisation theory, the results also revealed that Johannesburg neighbourhoods with greater concentrations of family disruption have lower levels of male homicides. It is important to note that while divorce together with female-headed households was significantly negatively correlated with male homicide in the regression model, the correlation between female-headed households and homicide was non-significant at the bivariate level. As alluded to by Breetzke (2010a), in the South African context a female-headed household does not necessarily imply a single-headed household and may comprise a variety of family structures, including extended family households (Amoateng et al., 2004). At this point it is important to note that the application of non-experimental methodologies that target neighbourhood-level covariates of male homicide in the South African context is likely to present with fundamentally different results from countries characterised by less diversity, violence and socioeconomic strain. It is thus important to apply methodologies in a contextually sound and appropriate manner that takes cognisance of specific South African characteristics (such as non-nuclear family structures) that will likely impede on the way the analysis is treated during both the analytic process and output stages.

One of the main limitations of the above case study is missing or incomplete information on the neighbourhood where the homicide occurred, which also resulted in a considerable number (n = 1 173, 18.2%) of male homicides being excluded from the analysis. This clearly points to the need to improve the quality and detail of information on the geographical location of homicides and other injury events that is currently collected by the NIMSS. This speaks to broader issues related to research practice in South Africa and other global South contexts. Whilst non-experimental designs and multivariate regression models such as the ones drawn upon in this chapter are generally robust and able to account for count data, rare events (such as homicides), spatial influences and missing data, the lack of research-related resources and quality information in our secondary databases still impedes our ability to make definitive claims. This also means that our analyses and outputs are unlikely to be as 'clean' and as easily explicable as they might be in more developed contexts in the global North.

Another limitation of the study is its cross-sectional design. Using longitudinal designs in non-experimental research often provides richer data and thus overcomes some of the non-experimental limitations such as restrictions concerning research claims (Blundell & Costa Dias, 2000). Additionally, correlational

designs cannot take into account the changes in neighbourhood structure over time. The city of Johannesburg has experienced significant growth due to factors such as urbanisation, natural population growth and migration, and longitudinal studies are required to capture the changes in neighbourhood sociostructure and their influence on homicide levels.

Finally, non-experimental methods are generally unable to make causal claims (Shadish et al., 2002) and thus conclusions cannot be made as to whether the neighbourhood characteristics are linked to male homicide in any causal way. Using homicide data effectively means that it is neither ethical nor possible to randomise, manipulate variables and exert control through experimentation (Sousa et al., 2007). Neighbourhood predictors are pre-existing variables and attempting to manipulate these (e.g. an impoverished versus non-impoverished condition) is an ethical and practical impossibility. Despite the limitations, the use of complex and robust analytic regression models can alleviate some of these design-related challenges. In the example presented in this chapter, the results are able to make a case for interventions that target neighbourhood-level covariates of male homicide such as concentrated disadvantage and residential mobility, and which strengthen the mediating influences of social cohesion, community ties and equitable relations.

Non-experimental research is particularly useful in studying the social ecology or neighbourhood context as sociostructural conditions are examined as they exist, without control and/or manipulation, and the design thus offers alternative approaches to data collection, ethical considerations and analysis. The fine-tuning of the advanced regression models and increased quality control of both secondary neighbourhood and victim data will go a long way in supporting this research design and the analytic requirements that these types of non-experimental studies necessitate. It is our hope that the case study provided in this chapter will stimulate future methodological work that is able to enhance our understanding of 'hard to study' variables, such as the spatial distribution of violence and homicide in South Africa.

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Notes

1 Based on the Municipal Demarcation Board City of Johannesburg Metropolitan Municipality map, June 2009.

2 Although the South African National Youth Policy defines youth as between the ages of 14 and 35 years, the term 'youth' is a broad concept that encompasses young people at different stages of development, and the specific age group that defines 'youth' varies across cultures and countries. The United Nations defines 'youth' as between the ages of 15 and 24 years, while the World Health Organization's *World Report on Violence and Health* defines youth as between the ages of ten and 29 years (Mercy, Butchart,

Farrington & Cerdá, 2002). As the focus of our study was on male homicide, we chose to define 'youth' as between the ages of 15 and 29 years since this age band was more aligned with the *World Report* definition of youth, and because the highest homicide rates in South Africa are typically reported for this age group (Matzopoulos et al., 2015; Norman et al., 2007).

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