

Building neighbourhood-level resilience to crime:

The case of Khayelitsha, South Africa

Lauren K. Pijper¹, Gregory D. Breetzke^{1,*} & Ian Edelstein^{2,3}

¹Department of Geography, Geoinformatics and Meteorology, University of Pretoria, South Africa

²Human Sciences Research Council

³Safety and Violence Initiative, University of Cape Town, Cape Town, South Africa

*Correspondence to: greg.breetzke@up.ac.za

Abstract

South Africa is crippled with high rates of crime. Examining factors that may build neighbourhood-level resilience to crime is central to reducing the poverty gap and lowering inequality particularly in impoverished communities. By drawing on theories from environmental criminology in this study we quantify and spatially locate resilient neighbourhoods in the township of Khayelitsha located on the urban periphery of Cape Town in South Africa. We then examine the extent to which access to various built environment factors in the township is stratified based on neighbourhood-level resiliency. Contrary to expectations we found that the most resilient neighbourhoods in Khayelitsha most often experience a decrease in access to a range of built environment factors. Explanations for these findings are provided in the context of a uniquely South African township setting.

Keywords: crime; resilience; township; South Africa, Khayelitsha

Introduction

There are a number of different meanings associated with the term resilience. This can be largely attributed to the multi-dimensional nature of the term which has been classified by Rogers (2013) into three main types: organisational, technological, and community resilience. Organisational resilience refers to the ability of an organisation to anticipate, prepare for, react and adjust to any incremental change or sudden disturbance in order to survive and flourish. Technological resilience is defined as the ability of a physical system to be able to perform at an acceptable and desired level when subject to various external forces or internal failures. Finally, community resilience is defined as the ability of a community to cope and adapt to challenges and adversity in a way that will promote the successful achievement of the desired result. Accordingly, a resilient community is a community that can utilise the resources available to them in order to respond to, and recover from, an adverse situation in a positive manner. A community that is resilient is able to overcome adverse circumstances in a way that not only reacts to but also proactively reduces the effects of an adverse event and/or circumstance. Importantly, in this study we refer to community as individuals living within a specific geographic area and with intimate knowledge of their particular locality.

Most prior scientific research has explored the concept of community resilience in the context of natural disasters or hazards (see Adger, 2003; Crittenden, 2001; Morrow, 2008) with very little research undertaken in the spatial crime literature examining what makes communities resilient to crime in the face of disadvantageous settings. In the limited criminological literature that does exist, researchers have most often focused their studies at the individual level, as opposed to the community. These studies have, for example, examined the resilience of individuals that have experienced sexual assault

(Bonanno, 2013), child abuse (DuMont, Spatz-Widom, & Czaja, 2007), or been a witness to family violence (Ward, Martin, Theron, & Distiller, 2007), with very little cognizance given to determining what drives resilience at the community-level. The main aim of this research is to identify factors in the built environment which may drive resilience to crime in a township setting in South Africa. Specifically, we aim to identify which built neighbourhood-level factors make communities in the crime-plagued township of Khayelitsha (located in the Western Cape province of the country) more resilient to crime despite their theoretically disadvantageous socio-economic settings. We do this by first developing a neighbourhood-level crime resilience index using regression techniques and then examine the relationship between the resilience index and various built neighbourhood factors.

Crime, place, and resilience

Criminological theories aim to explain criminal behavior; its causes and consequences. These theories are most often abstract in nature and form part of broader social science studies that attempt to explain human behavior and society more generally (Akers, 2013). Environmental criminology is a criminological school of thought that aims to gain an improved understanding of crime by focusing on the locations, spaces, and objects that have either facilitated or prevented criminal behavior. The theory considers the causes of crime in a neighbourhood to be related to its environmental characteristics or its environmental backcloth, broadly speaking. The environmental backcloth refers to the 'elements that surround and are part of an individual and that may be influenced by or influence his or her criminal behavior' (Brantingham & Brantingham, 1993, p. 6) including various physical characteristics in neighbourhoods such as shopping centers, churches, and public transportation stops, among many others. A number of theories housed within the school of environmental criminology have been used to better

understand the role of neighbourhoods in affecting crime. Chief among these is the social disorganisation theory of Shaw and McKay (1942) which posits that neighbourhoods that are socially disorganised will have increased risk of crime and delinquency. Accordingly, neighbourhoods with higher levels of economic deprivation, racial heterogeneity, residential mobility, and family disruption, are more likely to be socially disorganised and thus prone to higher rates of crime. The social disorganisation theory was later expanded by Sampson, Raudenbush, and Earls (1997) to include the concept of collective efficacy which refers to the ability of neighbours to share a common objective. Environmental criminological theories such as the social disorganisation theory are well suited to examine the effects of neighbourhood-level factors on the community resilience to crime because they shift the focus from the criminal offender to the place-based or spatial factors of the environment in which the crime is occurring.

The central tenets of the social disorganisation theory have been tested in various contexts both internationally and locally (see Allen & Cancino, 2012; Andresen, 2010; Breetzke, 2010; Kennedy, Silverman, & Forde, 1991; Porter & Purser, 2010; Thompson & Gartner, 2014) and across multiple spatial scales from street segments (see Weisburd, Morris, & Groff, 2009) to census blocks (see McCord & Ratcliffe, 2007) to whole cities and regions (see Allen & Cancino, 2012; Breetzke, 2010), with varying results.

Although the theory of social disorganisation has been supported by research in most instances, a number of data and methodological issues have been identified (see Braga & Clarke, 2014; Breetzke, 2010). While theories such as the social disorganisation theory provide vital insight into the spatial risks associated with criminal offending, they focus predominantly on what factors cause a neighbourhood to be at an increased risk for crime, rather than focus on what factors enable a neighbourhood to over-achieve

or exhibit ‘resilience’ in the face of these adverse risk factors. As Breetzke & Pearson (2015, p. 445) note:

...theorizing on what is ‘bad’ or socially disorganised about a neighbourhood (or community) can lead to a social problems mind-set which limits the opportunities crime researchers have for building capacity and resilience in disadvantaged neighbourhoods. It is just as important, if not more so to determine what features of an environment can explain the *lack* of crime in a location.

Resilience in this context can be viewed as a developmental process that involves an initial exposure to adversity and hardship followed by positive adaptation leading to a good outcome. Most scientific literature has explored the concept of community resilience in the context of natural disasters or hazards (see Adger, 2003; Crittenden, 2001; Morrow, 2008), or focused on the factors that impact the resilience of an individual (see Bonanno, 2013; DuMont et al., 2007; Smith, Park, Ireland, Elwyn, & Thornberry, 2013) with few studies having been undertaken focussing on community-level resilience to crime, specifically. Neighbourhood resilience in other contexts, such as health, have been investigated and include Tunstall, Mitchell, Gibbs, Platt, and Dorling (2007) who investigated age-specific mortality rates in Britain and found that similarly economically disadvantaged areas had varying mortality rates and ascribed this to the higher levels of social cohesion, stemming from the shared experience of economic adversity, ethnic or religious identity or shared former industry of occupation, in more ‘resilient’ communities. Similarly, Van Hooijonk, Droomers, van Loon, van der Lucht, and Kunst (2007) examined the health resilience of areas within the Netherlands and found that urbanisation and residential segregation based on age, ethnicity and marital status may have a significant impact on the resilience of these

areas. Pearson, Pearce, and Kingham (2013) examined the paradox of low mortality rates despite high social deprivation in neighbourhoods of New Zealand and found that resilient neighbourhoods had poorer access to gambling and alcohol outlets, better access to safe drinking water, and overall lower levels of environmental deprivation. Their study was one of the first to emphasise the importance of ‘place-specific’ resilience factors that can reduce the mortality rates experienced in some neighbourhoods.

We are aware of only a handful of studies that have specifically focused on the resilience of neighbourhoods to crime. They include Platts-Fowler and Robinson (2013) who examined the key neighbourhood features that promote community resilience in Sheffield in the United Kingdom. The researchers compared a number of key stressors (deprivation, income, and rate of unemployment) against a number of neighbourhood outcome measures (including the rate of crime and anti-social behaviour) in each of Sheffield's 100 neighbourhoods. Various aspects of the social and physical context and features of the local community were recognised as being important in developing neighbourhood resilience to the identified stressors (the physical environment, access to facilities and amenities, sufficient service provision, active citizenship, media and communication, and adequate housing, among others). In Toronto, Thompson and Gartner (2014) identified a small number of - what they termed – ‘resilient neighbourhoods’ in the city, although this was not the explicit aim of their research. These neighbourhoods had higher than average levels of poverty, families headed by lone parents, Black residents, residents who were recent immigrants, and residents aged 15 to 24. Importantly, these factors were shown to be associated with higher crime rates in neighbourhoods yet the homicide rates in these neighbourhoods were below—and in some cases, well below—the citywide average. The authors suggested that this

resilience could be due to certain social interactional mechanisms present in these neighbourhoods such as social cohesion or collective efficacy, although this was not empirically tested. Finally, a study by Breetzke and Pearson (2015) identified the neighbourhood-level characteristics that aid in the promotion of crime resilience in New Zealand neighbourhoods. The researchers found resilient neighbourhoods had decreased access to a range of healthcare, education, and living infrastructures. Very little difference was found in the social environment of high resilient and low resilient neighbourhoods in the country.

The study site

The study was undertaken in the township of Khayelitsha located on the outskirts of Cape Town. In South Africa, the term township describes urban or residential areas that are underdeveloped and were commonly reserved for non-whites under the Apartheid system (Pernegger & Godehart, 2007). Townships such as Khayelitsha were most often built on the urban periphery and were, and most often continue to be, synonymous with extreme poverty and socio-economic deprivation (Kynoch, 2005). Khayelitsha, the Xhosa word for ‘Our New Home’, is a partially informal township located approximately 30 km from the central business district of Cape Town. The township is located on the so-called ‘Cape Flats’ – a low-lying, flat area of land situated to the south-east of the Cape Town central business district. The township has a current recorded population of roughly 400,000 people (Statistics South Africa [[SSA], 2011) but figures of up to 1.2 million residents have been speculated (Cronje, 2014), of which almost 99% are Black African. The township is uniformly poor. The World Economic Forum [WEFORUM] (2016) lists Khayelitsha as one of the world’s five biggest slums with an estimated 32% to 46% of households in the township living in severe poverty. More than half the residents live in informal dwellings with almost three quarters of

households surviving on less than R3,200 per month (US\$160) (SSA, 2011). Only 62% of the eligible labour force of Khayelitsha is employed, with only 36% of individuals 20 years or older having completed Grade 12 or higher.

Khayelitsha is also one of the most crime-ridden locations in South Africa and most often ranks among the top ten policing areas in the country for violent crime (South African Police Services (SAPS), 2018). The lack of competent law enforcement in the township (as highlighted by O'Regan *et al*, 2014) over the past decade has resulted in a surge in 'mob justice' and violent vigilantism incidents (Super, 2016), exacerbated by a concomitant increase in gangsterism (Pinnock, 2016). The culmination of these events led to the formation in 2012 of a provincial commission of inquiry to investigate allegations of police inefficiency in Khayelitsha. Despite a number of recommendations being made in the Commission's report to increase safety and security in the township, few have been implemented successfully resulting in continued high levels of crime (see Gontsana, 2019).

Indeed, the township 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 (Artz, Burton, Ward, et al., 2016). Importantly, a number of initiatives have been undertaken in Khayelitsha in an attempt to reduce growing rates of crime. One notable example is the Violence Prevention through Urban Upgrading (VPUU) programme which is an area-based community development that aims to improve the quality of life for residents in townships using a comprehensive range of urban improvements and social interventions. A recent VPUU development to upgrade the infrastructure in the township was found to be a success in uplifting the community (see Turner, 2013), but questions remain about its ability to actually reduce crime in these communities.

It is within this broader context that the present study aims to make a contribution. In particular, we aim to provide answers to the following two related questions: First, are there neighbourhoods within Khayelitsha that ‘overachieve’ in terms of low crime rates, despite their theoretically disadvantageous environments? And second, if so, are there built neighbourhood-level factors that can explain this resilience? The inter-connected factors that might explain the interplay of the built environment and crime within this unique underlying urban township structure are also discussed.

Data and methods

Crime data

Crime data for this research study was obtained from the South African Police Services. There are three police precincts in the greater Khayelitsha policing area: Khayelitsha, Lingeletu-West, and Harare. Contact crime data was obtained for all three SAPS precincts for 2006 to 2016 and included information such as the incident code, the date and time at which the crime occurred, its location (x and y coordinate) and type of offense. A total of 65,408 crimes were recorded across the ten-year study period including, among others, assault, murder, rape, robbery and burglary. We used all crime in the analysis rather than disaggregating by type of crime. We are aware of the dangers of aggregating crime across various types (see Andresen & Linning, 2012), however, we were interested in identifying resiliency factors in neighbourhoods in relation to all crime and we were also keen to improve the statistical power of the regression model.

Census data

The 2011 census data collected by Statistics South Africa was used to generate the independent variables used in the first part of the analysis. All analysis was undertaken at the small area level (SAL) unit of aggregation. This is the smallest unit of analysis for

which Statistics South Africa disseminates spatial information. There are 583 SALs in Khayelitsha with each SAL containing roughly 630 people. In this study, a SAL approximates a neighbourhood. It is readily acknowledged that neighbourhoods are most often do not adhere to administratively defined boundaries (see Duncan, 1957), however, a spatial unit is required to perform place-based analysis and can further aid in the communication of findings in such analyses.

Built environment data

A total of sixteen neighbourhood-level characteristics of the built environment were compiled from a variety of data sources (see Table 1). In this study, the built environment includes all man-made or modified structures and facilities (Sarkis, Meade, Neeley, & Presley, 2009). In the criminological literature, built environment factors form an essential part of the underlying environmental backcloth of any community or region (see Brantingham & Brantingham, 1993) and are thought to play an important role in bolstering or limiting social capital in neighbourhoods (see Breetzke & Pearson, 2015; Pearson et al., 2013). They can also include measures related to access to various healthcare and education facilities, as well as access to various living infrastructures. These factors were calculated by measuring straight-line distances from the geometric centroid of the SAL to the nearest facility. Importantly, the nearest facility did not necessarily have to fall within the immediate boundaries of Khayelitsha to be included in the analysis. Road network distances were considered in the calculation of distances but, after a closer examination of the road infrastructure in the township, this was deemed problematic. Indeed, much of the road network in Khayelitsha is informal often consisting of footpaths, particularly in the poorer regions of the township. Calculation of proximity measures using only the formal road network would, therefore, exclude these important informal areas and pathways.

Table 1. Built neighbourhood characteristics, data sources and years.

Built environment factors		Data source	Year
Healthcare	Clinics	City of Cape Town Open Data Portal	2016
	Hospitals	Western Cape Department of Health	2012
Living infrastructure	Community centres	City of Cape Town Open Data Portal	2016
	Libraries	City of Cape Town Open Data Portal	2016
	Places of worship	City of Cape Town Open Data Portal	2016
	Sports grounds	City of Cape Town Open Data Portal	2016
	Recreational hubs	City of Cape Town Open Data Portal	2016
Services	Fire stations	City of Cape Town Open Data Portal	2016
	Police stations	South African Police Services	2017
Green and blue space	Waterbodies	City of Cape Town Open Data Portal	2016
	Community parks	City of Cape Town Open Data Portal	2016
	Greenbelts	City of Cape Town Open Data Portal	2016
	Public open spaces	City of Cape Town Open Data Portal	2016
Education	Primary schools	Department of Basic Education	2016
	Secondary schools	Department of Basic Education	2016
Vices	Alcohol outlets	Western Cape Liquor Authority	2017

Analysis

The analysis employed for this study was divided into two parts. The first involved the development of a crime resilience index at the neighbourhood-level for Khayelitsha. In order to develop the index, we identified SALs that had unexpectedly low crime, given high levels of socio-economic deprivation, residential mobility, family disruption, ethnic heterogeneity, and percentage of young males (aged 15–24). This index was developed by first fitting a regression model and identifying areas of model over- and under-prediction, as detailed below. In order to select the most appropriate regression model, the mean and variance of the dependent variable (crime rate per 1000 population per SAL) were examined. The variance from the mean was used to determine the appropriateness of the selected regression model. The variance was found to be over 400 times the mean, motivating the use of a negative binomial regression model. In order to rule out any spatially correlated errors, Moran's I was calculated (Moran's I statistic = 0.047) which displayed no evidence of spatial dependence; hence the use of a spatial model was deemed unnecessary. The final model assumed a negative binomial distribution with the crime rate per 1,000 population as the dependent variable. The independent variables were selected using the social disorganisation theory as a theoretical framework. Accordingly, *socio-economic deprivation* was measured using (1) the percentage of population unemployed, (2) the percentage of individuals with the highest education level achieved being less than Grade 12 (the final year of schooling in South Africa), and (3) the percentage of the population earning less than R12,800 (£700) per month per SAL. Economic deprivation is considered a key component of the social disorganisation theory and has been generally found to be positively associated with increased crime rates in neighbourhoods (see Livingston, Kearns, & Bannister, 2014; Martinez, Stowell, & Lee, 2010). Finding a measure of *ethnic heterogeneity* in Khayelitsha is complicated by the fact that the township is remarkably homogenous.

Indeed, almost 99% of residents are Black African; almost 91% speak the same language, Xhosa; and almost 80% have the same religious affiliation, namely Christian (SSA, 2011). Eventually, we settled on using the percentage of the population born outside the Western Cape as a measure of ethnic heterogeneity.

Residential mobility has been traditionally associated with a lack of cohesion and collective efficacy in neighbourhoods (see Bernasco & Nieuwbeerta, 2005; Breetzke & Pearson 2015). This is largely due to the difficulty in forming bonds and integrating effectively in highly mobile communities. Two measures were used to represent residential mobility: (1) the percentage of Khayelitsha residents that have moved in the past five years, and; (2) the percentage of individuals renting. According to social disorganisation theory, a disrupted family is thought to increase the risk of crime in neighbourhoods (see Jobes, Barclay, Weinand, & Donnermeyer, 2004; Kwong Wong, 2011; Kwong Wong, 2012). To represent *family disruption* in Khayelitsha, the percentage of individuals divorced or separated, along with the percentage of female-led households, were utilised. Finally, the *percentage of males aged between 15 and 34 years* was also included. Young males are a subpopulation that have been identified in previous literature as associated with an increase in crime in neighbourhoods (see Gruenewald & Remer, 2006; Hirschi & Gottfredson, 1983; Phillips, 2006).

In truth, any crime theory housed within the school of environmental criminology could have been used as a guide to select this list of independent variables. We were weary, however, of detracting from the original aim of this study which is to identify factors which contribute to resilience to crime in neighbourhoods, and not to empirically test international spatial crime theories in a South African context. We ultimately felt

that this list of variables, loosely based on social disorganisation theory, best provided an overall picture of adversity and crime risk in neighbourhoods throughout the country.

To determine the under- (low resilience) and over-prediction (high resilience) of neighbourhoods, the deviance residuals from the final regression model were generated for each neighbourhood. The generated residuals were then ranked and grouped into quintiles of high (5) or low (1) resilience to create the resilience index. A map showing the resilience of neighbourhoods in Khayelitsha is shown in Figure 1 below.

The second part of the analysis was to determine the impact that certain built environment factors play on building neighbourhood-level resilience to crime in Khayelitsha. For each of the 16 factors characterizing the built environment, we calculated average values by crime resilience index quintile, ratios, and Spearman's rank correlation coefficients and p -values (between resilience quintiles and the built environmental characteristics).

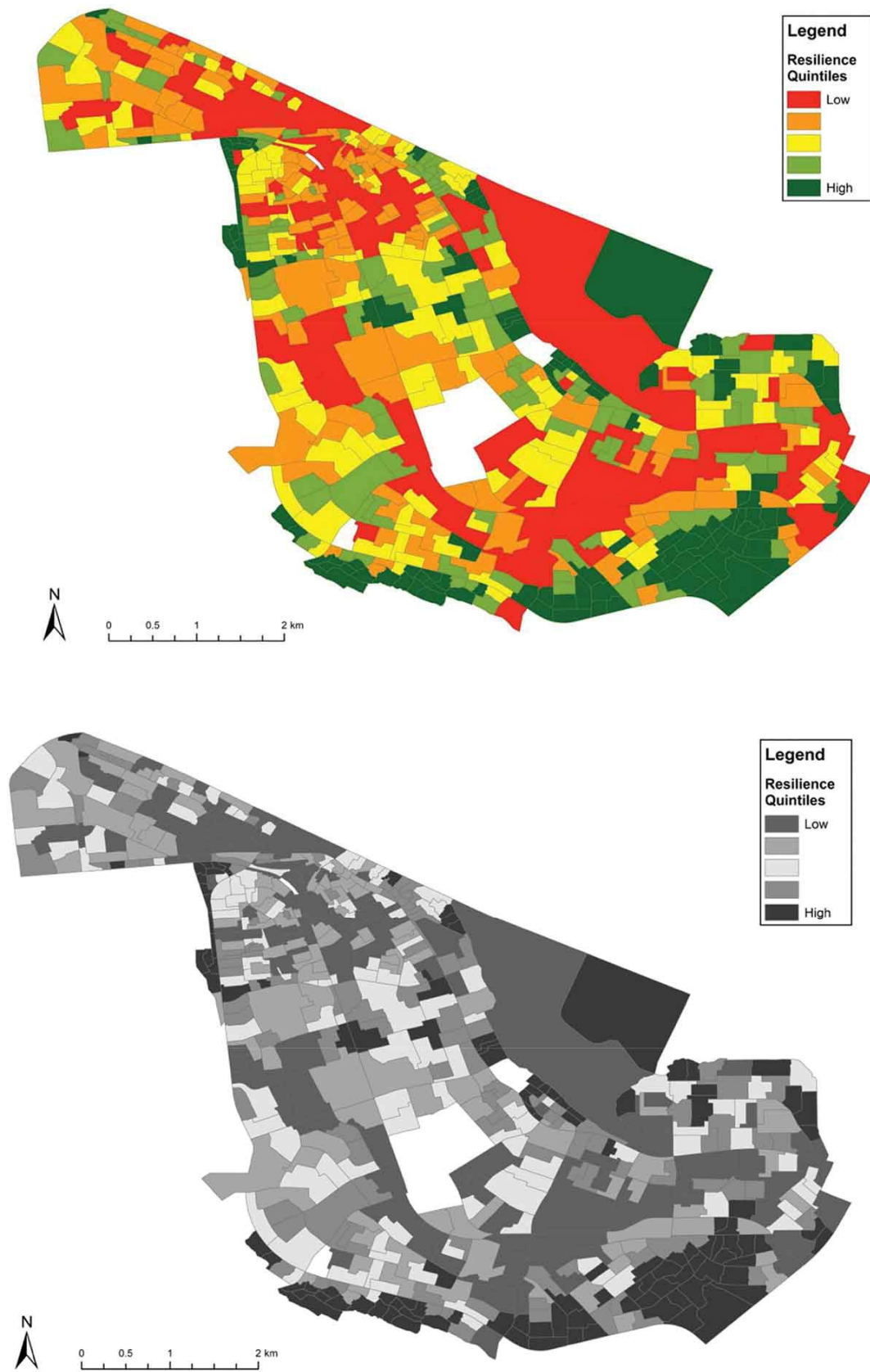


Figure 1. Resilience map of Khayelitsha ($n = 583$)

Results

The results of the regression model are shown in Table 2 below. All the covariates were found to be both positively and statistically significantly associated with neighbourhood crime in Khayelitsha. The largest significant independent effect was found for the percentage of young males, followed by the percentage of female-headed households and percentage renting.

The relationship between the suite of built environment factors and the resilience quintiles are shown in Table 3. Spearman's rank correlation coefficients were found to be significant for both built healthcare factors, although in opposing directions.

Resilient neighbourhoods were found to have greater access to hospitals than less resilient neighbourhoods however, rather paradoxically, resilient neighbourhoods were found to have decreased access to clinics than less resilient neighbourhoods. A subtle but noticeable resiliency gradient is evident in the living infrastructure factors. That is, access to these factors generally decreases across neighbourhoods stratified by resiliency. The size of this relationship varies marginally across factors as the ratios of the distances in quintile five (high resilience) compared with quintile one (low resilience) ranged from 1.28 (for sports ground distance) to 1.55 (for library distance). Interestingly, these values suggest that distances to various living infrastructure factors are up to 1.55 times *greater* among resilient neighbourhoods than less resilient neighbourhoods.

Both service built factors were found to be significant but not in the direction expected. More resilient neighbourhoods were found to have decreased access to police and fire stations than less resilient neighbourhoods. Only one of the 'natural' factors was found to be significant with more resilient neighbourhoods having decreased access to water bodies. In terms of education, similar to the trends observed above, more

Table 2. Results of negative binomial regression used to create the resilience index.

Independent variables		IRR	p-value	95% CI
Social deprivation	% with < Grade 12 education	0.98	0.00***	0.977-0.979
	% unemployed	1.00	0.00***	0.995-0.996
	% earning < R12,800 per month	1.00	0.00***	0.998-0.999
Ethnic heterogeneity	% born outside the Western Cape	0.99	0.00***	0.999-0.999
Residential mobility	% renting	1.05	0.00***	1.046-1.049
	% moved in the last five years	1.03	0.00***	1.027-1.038
Family disruption	% female-headed households	1.06	0.00***	1.060-1.065
	% divorced/separated	0.94	0.00***	0.932-0.945
Young males	% males aged between 15 - 34	1.07	0.00***	1.063-1.069

Table 3. Neighbourhood-level built environment factors organised by the resilience index.

		Low				High			
Built environment factors		R1	R2	R3	R4	R5	R5:R1	r ²	p-value
Healthcare	Clinics	0.65	0.72	0.73	0.77	0.84	1.29	0.18	<0.01
	Hospitals	2.78	2.66	2.56	2.43	2.42	0.87	-0.16	<0.01
Living	Community centres	0.59	0.58	0.59	0.69	0.82	1.38	0.25	<0.01
infrastructure	Libraries	0.75	0.82	0.81	0.96	1.17	1.55	0.31	<0.01
	Places of worship	0.60	0.57	0.57	0.57	0.81	1.36	0.15	<0.01
	Sportsgrounds	1.00	1.00	1.05	1.05	1.29	1.28	0.18	<0.01
	Recreational hubs	1.38	1.30	1.30	1.44	1.99	1.45	0.27	<0.01
Services	Fire stations	1.38	1.42	1.48	1.60	1.85	1.34	0.25	<0.01
	Police stations	1.62	1.48	1.55	1.65	2.17	1.34	0.22	<0.01
Green and blue	Waterbodies	0.24	0.29	0.27	0.30	0.41	1.68	0.19	<0.01
space	Community parks	0.46	0.41	0.37	0.39	0.46	1.02	0.01	ns
	Greenbelts	1.17	0.94	0.97	0.87	1.00	0.86	-0.08	ns
	Public open spaces	0.41	0.47	0.41	0.39	0.47	1.15	0.03	ns
Education	Primary schools	0.37	0.36	0.39	0.40	0.56	1.53	0.25	<0.01
	Secondary schools	0.56	0.50	0.52	0.52	0.74	1.33	0.21	<0.01
Vices	Alcohol outlets	0.42	0.35	0.35	0.39	0.44	1.04	0.04	ns

resilient neighbourhoods in Khayelitsha were also found to have decreased access to educational facilities. Indeed, access to both primary and secondary schools decreased linearly across resilience quintiles, although primary schools (1.53) exhibited a greater proportional difference in terms of access than secondary schools (1.33). Finally, in terms of access to vices, the results indicate that more resilient neighbourhoods have decreased access to validly licensed liquor outlets, although this association was not found to be significant.

Discussion

It is important to unpack the concept of resilience particularly in impoverished urban communities which are most often at an increased risk of criminal victimisation.

Determining which characteristics of the built environment can promote resilience in these types of communities is important for planners, policymakers, law enforcement agencies, and other key role-players tasked with preventing crime and protecting these communities. In this study, we attempted to add to the limited research examining neighbourhood-level resilience to crime. Contrary to expectations, we found that resilient neighbourhoods most often had decreased access to a range of built environment factors. There is some support for these findings as Breetzke and Pearson (2015) also found that access to a range of built factors thought to increase the liveability of neighbourhoods (i.e. distance to clinics, distance to schools) was least among more resilient neighbourhoods in New Zealand. The authors suggested that, in terms of building neighbourhood-level resilience, the benefits of residing at a greater distance from 'negative' characteristics, such as gambling facilities, could outweigh the drawbacks of being farther from other built environment features such as hospitals and schools. The results of this research similarly suggest that, in terms of building neighbourhood-level resilience to crime, it is not necessarily beneficial to have

increased access to various built environment factors (schools, clinics, community centres) as previously thought. This unexpected result suggests that the social and cultural environment could perhaps play a larger role in engendering neighbourhood-level resilience. Indeed, it could be that related social disorganisation concepts such as social cohesion and collective efficacy are important in building resilience to crime particularly in impoverished communities. Globally, there is increasing evidence globally that political and cultural infrastructures, as well as social capital, values and shared life orientation build community-level resilience (Aldrich & Meyer, 2015; Flora & Flora, 2004; Harris et al., 2000; Wyche et al., 2011). Locally, researchers have found that family resilience in low-income communities is driven by having a determination to survive and establishing social networks within and outside the community (Raniga & Mthembu, 2017). It could be that, in Khayelitsha, these and other community-level factors play a greater role in building resilience to crime than having increased access to a range of built environment factors.

Two other findings are particularly noteworthy. First, we found no significant association between resilience and access to alcohol outlets. Of course, the relationship between the access and availability of alcohol outlets and crime is well-established both locally and internationally (see Day, Breetzke, Kingham, & Campbell, 2012; Pridemore & Grubestic, 2013), while other research has also found that resilience to crime may also depend on access to alcohol (see Breetzke & Pearson, 2015). However, in this study, we found no such association. We strongly suspect that the results of our study were influenced by the fact that we only examined the association between access to licensed alcohol outlets ($n = 63$) and resilience and did not take informal and/or illegal alcohol outlets into account. The number of licensed outlets that we obtained from the Western Cape Liquor Authority we suspect greatly underestimates the actual number of outlets

selling alcohol. Indeed, the exact number of illegal alcohol outlets (known as shebeens in South Africa) in Khayelitsha is difficult to ascertain with a study by the Western Cape Department of Community Safety (2016) suggesting that the number may be in the thousands. Future resilience-based research could aim to incorporate this information spatially into analyses and include other vices such as access to gambling outlets. Second, we found that resilient neighbourhoods had the least access to police stations. This finding is, however, not surprising. Trust in the police in Khayelitsha is low (see O'Regan, Pikoli, Bawa, Sidaki & Dissel, 2014) and has resulted in a surge in 'mob justice' and violent vigilantism incidents over the past decade (Super, 2016), exacerbated by a concomitant increase in gangsterism (Pinnock, 2016). According to Gillespie (2013), an informal justice system exists in Khayelitsha headed by local taxi associations and local street patrols and committees. This informal system has deep historical roots in the township and is borne out of desperation and frustration of the community who see the SAPS as corrupt and incompetent. The fact that more resilient neighbourhoods have the least access to existing police services in the township suggests the extent to which police in this community are not seen as effective in preventing and reducing crime.

Of course, a study of this nature is not without limitations. First is the reliance on police-recorded contact crime data as the sole indicator of crime. We are aware of the gross under-reporting of crime, particularly in the South African context (see Bruce, 2010; Burger, 2018; Overall, Singh, & Gcina, 2008). This under-reporting is often exacerbated in poorer township settings such as Khayelitsha where confidence and trust in the SAPS is sorely lacking (Lancaster, 2017). According to O'Regan et al (2014) the main causes of under-reporting particularly in Khayelitsha include gangsterism and the poor treatment of victims of crime. Related to the issue of under-reporting is the spatial

accuracy of crime incident locations that are recorded. A recent report by Edelstein and Arnott (2019) highlights the inaccuracies that are often present when the SAPS capture crime incident locations, particularly in informal areas (where nearby intersections or landmarks, including built environment features, may be substituted for more precise crime locations). However, this is less of an issue in our study since we aggregated the crime data to the neighbourhood level. We acknowledge that both the underreporting and imprecise spatial recording of crime may have an influence on the output of the regression model used to quantify and spatially locate resilient neighbourhoods. While unfortunate, these data limitations are simply a reality in a number of less developed contexts. Future crime data in particular could potentially be collected utilising a more efficient system of geocoding, such as through the use of online applications such as ‘what3words’. However for the moment, 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. Second, resilience is a complex and multi-faceted concept and making use of only a selection of certain built environment factors to examine what drives resilience at the neighbourhood-level is a simplification of this concept. Indeed, we defined resilience as a ‘lower than expected crime rate’, while adversity was demonstrated through a plethora of socio-economic hardship variables. In fact resilience could be related to a number of other individual and/or neighbourhood-level factors or circumstances, as outlined by previous researchers (see Breetzke & Pearson, 2015; Elliott et al., 2006; Hipp, 2013). We acknowledge that using ‘only’ built environment factors is limiting and that there could be an array of more applicable social, economic, cultural and other variables to study this concept. Finally, a neighbourhood with a disproportionately lower than expected crime rate could simply be described as somehow being relatively immune, or less vulnerable or susceptible to crime, but not

necessarily resilient to crime. However, this is one of the first empirical attempts to examine neighbourhood level resilience to crime and we believe that, despite these limitations, we have demonstrated an important linkage between neighbourhood-level risk and resilience and have paved the way for future research of this nature. Finally, this study did not consider resilience with respect to time. Nor did the study take into account any lag time between exposure to the various neighbourhood-level factors and the occurrence of crime which may have proven to be a better test of neighbourhood resilience to crime. Neighbourhoods and their built environments are fluid and may well change over time, making any longitudinal study of resiliency difficult to accomplish given the data requirements.

The main aim of this research was to further our understanding of the resilience of places. That is, to understand how or why neighbourhoods experience low crime despite a high number of risk factors. We were specifically interested in whether the built environment plays a role. By drawing on theories from environmental criminology, we were able to quantify and spatially locate the resiliency of neighbourhoods in Khayelitsha and subsequently examined the extent to which access to various built environment factors was stratified in neighbourhoods ranked from most to least resilient. Contrary to expectations, we found that the most resilient neighbourhoods in Khayelitsha experience decreased access to a range of built environment factors. Explanations for these findings were provided in the context of a uniquely South African township setting. We believe that the results generated make an important contribution to the current explanation of neighbourhood crime both in South Africa and globally, as they examine, for the first time, neighbourhood-level built resiliency factors within a uniformly impoverished community.

Disclosure statement

No potential conflict of interest was reported by the authors

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