HOMICIDAL STRANGULATION IN AN URBAN SOUTH AFRICAN CONTEXT

by

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DECLARATION

Student number: 4729-341-1

I declare that **Homicidal strangulation in an urban South African context** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

23 March 2015

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Shahnaaz Suffla   **Date**

DEDICATION

To those about whom I have composed this account.

Represented here in counts, but remembered not as such.

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SUMMARY

As an external cause of death, strangulation represents an extreme and particularly pernicious form of violence. Following the evidence gap in the extant literature, the current research examined the incidence, distributions, individual and situational predictors, and structural determinants of homicidal strangulation in the City of Johannesburg for the period 2001-2010. The thesis is structured around four discrete but interrelated studies, which collectively offer an initial contribution to the body of scholarship on homicide generally, and on the characteristics and patterns of strangulation homicide specifically. The research drew on data from the National Injury Mortality Surveillance System and the South African National Census. Study I is a descriptive study that quantifies the extent of homicidal strangulation in the City of Johannesburg and describes its distribution by characteristics of person, time, place and alcohol consumption. The remaining studies are analytical in focus, and are aimed at explaining homicidal strangulation in the City of Johannesburg in terms of its determinants. These studies are differentiated by their focus on individual-level and neighbourhood-level risks. Study II assesses overall homicide strangulation risk in relation to all the other leading causes of homicide. Study III undertakes further disaggregation to investigate homicidal strangulation risk by gender specifically. Study IV considers the socio-structural correlates and geographic distributions of fatal strangulation. The study engages select micro-level and macro-level theories that focus on the intersection between vulnerability and routine activities, gender and neighbourhood derivatives of violence to explain the social ecology of lethal strangulation. The research findings demonstrate that homicidal strangulation in the City of Johannesburg is a unique phenomenon that is distinct from overall homicide. As the fourth leading cause of homicide in the City of Johannesburg, fatal strangulation exhibits a marked female preponderance in victimisation and distinctive socio-demographic, spatio-temporal, sex-specific and neighbourhood-level variation in risk. The study is aligned with the increasing trend towards disaggregating overall homicide into more defined and conceptually meaningful categories of homicide. The study may represent one of the first empirical investigations that also attempts to offer theoretically-derived explanations of homicidal strangulation in South Africa. Fatal strangulation is a multi-faceted

phenomenon that requires multi-dimensional and multi-level interventions directed at several points of its social ecology.

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INTRODUCTION

Violence is a universal challenge and a foremost cause of death and disability globally. The magnitude of fatal violence presents as an intractable public, psycho-social and social policy concern. Homicide results in innumerable health, social and economic costs, reverberating across every level of society, and eroding the ideals of justice, freedom and security. The global average homicide rate is 6.9 per 100 000, with Africa's estimated rate of 17.4 per 100 000 the highest among the regions (United Nations Office on Drugs and Crime, 2011). In South Africa, violence is commonly recognised for its derivations in decades-long colonial and apartheid rule, and its attendant repressions, deprivations, displacements, social fractures and traumas. Violence in South Africa contributes significantly to the country's burden of mortality, and physical, psychological and social morbidity. After HIV/AIDS, violence and unintentional injuries combined represent the second foremost cause of death and disability-adjusted life years (DALYs) in the country (Seedat, Van Niekerk, Jewkes, Suffla, & Ratele, 2009). South Africa's overall injury death rate of 157.8 per 100 000 is driven by interpersonal violence, reported to be four and a half times the global proportion (Matzopoulos, Norman, & Bradshaw, 2004). Burden of disease estimates for South Africa (64.8 per 100 000) reveal markedly elevated homicide rates relative to other regions of the world (Norman, Matzopoulos, Groenewald, & Bradshaw, 2007). Additional comparisons, based on data collated for the 2011 Global Study on Homicide, ascribe the highest female homicide rate to the African region (United Nations Office on Drugs and Crime, 2011). According to the latest official crime statistics, 17 068 homicides were reported in 2013/2014 (South African Police Service, 2014). Within this context, there is growing concern about the mortality of both South African men and women from homicidal violence.

EPIDEMIOLOGICAL PROFILES AND PATTERNS OF HOMICIDE

Notwithstanding the strengthening of its democratic institutions and traditions to promote gender equality and a culture of safety, and an increasing focus on gender justice in public and policy discourses, South Africa is estimated to have the highest rate of female homicide not only in the region, but in the world (Abrahams et al., 2009; Mathews, 2010) when compared to countries that produce such data (see United Nations Office on Drugs and Crime, 2011). Although the total female homicide rate declined from 24.7 per 100 000 in 1999 to 12.9 per 100 000 in 2009 (Abrahams, Mathews, Jewkes, Martin, & Lombard, 2013), the current figure remains considerably higher than the estimated global rate of 4.0 per 100 000 female

population (Dahlberg & Krug, 2002), and underlines the persisting and inordinate problem of violence against women (also see Mayosi et al., 2012). Of these female homicides, almost half are estimated to result from intimate partner violence, with 5.6 per 100 000 women age 14 years and older murdered by an intimate partner in 2009 (Abrahams et al., 2013). These results are consistent with the conclusions of a South African study on the disease burden attributable to exposure to interpersonal violence, which indicate that intimate partner violence accounts for 50% of the overall violence-attributable burden in females (Norman, et al., 2010).

Equally striking is the research evidence that points to the disproportionate representation of males as victims of lethal violence (Kramer & Ratele, 2012; Ratele, Smith, van Niekerk, & Seedat, 2011; Seedat et al., 2009). Findings demonstrate that homicide is a significant contributor to years of life lost for South African males (Bradshaw et al., 2003) and among the top five causes of male mortality in the country (Pillay-Van Wyk et al., 2013). Estimates suggest that the male to female homicide ratio is 7:1, with this ratio increasing for deaths during the evening (see Seedat et al., 2009). Epidemiological descriptions of male homicide in urban South Africa identify black men, and men in their twenties and thirties to be most at risk (Ratele et al., 2011). The homicide rate of 184 per 100 000 in this socio-demographic group is considered to be nine times greater than the global rate, and to signify three times the burden than estimated in females (Norman et al., 2007). Firearm discharge as a result of the criminal use of guns is the external cause of death in the majority of male fatalities, followed by deaths from sharp objects and blunt objects respectively (Ratele et al., 2011). Homicide studies in South Africa have consistently revealed that these factors characterise a high risk cluster that is explained by hegemonic, antagonistic and risk-taking constructions of masculinity that accentuate the gendered form and peculiarities of the homicide phenomenon.

Research on homicide reveals identifiable and predictable patterns to homicide victimisation as they relate to situational and structural aspects of social life. South African research findings indicate these to be largely comparable to the homicide risks identified in other parts of the world. Studies on the situational predictors of homicide have focused on homicide characteristics such as cause of death, gender, race, age group and the victim-offender relationship (e.g., Abrahams et al., 2013; Campbell et al., 2003; DeJong, Pizarro, & McGarrell, 2011; Kramer & Ratele, 2012; Gonzalez-Guarda & Luke, 2009; Leyland & Dundas, 2010; Matzopoulos, Thompson, & Myers, 2014; Piquero & Brame, 2008; Ratele et al., 2011; Swart,

2014). Both national and international studies have indicated black adults to be at increased risk of homicide victimisation compared to other race groups, and demonstrated this risk to be higher in urban contexts and among young men than in other contexts or among other age-gender groups (e.g., DeJong et al., 2011; Kramer & Ratele, 2012; O'Flaherty & Sethi, 2010). Males are also more likely to be murdered by strangers or acquaintances unlike females who are at greater risk of intimate partner homicide (e.g., Cao, Hou, & Huang, 2008; Gallup-Black, 2005). Spatio-temporal risks indicate that homicide events tend to occur more often in public places when the victim is male (e.g., Pizarro, 2008), whereas females are more likely to be murdered in private places (e.g., Swart, 2014; United Nations Office on Drugs and Crime, 2011). In general, the risk for homicide victimisation is higher during the periods associated with leisure activities, alcohol use and increased social interaction, notable during the evening, weekends and the warmer months of the year (e.g., Kramer & Ratele, 2012; Pizarro, 2008; Sisti, Rocchi, Macciò, & Preti, 2012).

Studies on the socio-structural correlates of homicide have focused on the influence of neighbourhood characteristics on fatal violence (e.g., McCall, Land, & Parker, 2010; Pridemore, 2002). Although some variance has been observed across studies, factors such as economic disadvantage, racial and ethnic heterogeneity, mobility and community change, housing and population density, and family structure have been identified as key explanations of neighbourhood-level homicide risk (e.g., Avakame, 1998; Dobrin, Lee, & Price, 2005; Frye et al., 2008; Kubrin & Herting, 2003; Madkour, Martin, Halpern, & Schoenbach, 2010; Sampson & Lauritsen, 1994; Steffensmeier & Haynie, 2000). The extant literature on homicide and contextual disadvantage is dominated by studies from North America; the ecological study of homicide in South Africa is very clearly in a nascent stage. Nonetheless, emerging investigations on the area-level attributes of fatal interpersonal violence in South Africa have yielded interesting, albeit somewhat mixed, results. Overall, research findings on the homicide-area disadvantage nexus have highlighted the persisting influences of South Africa's apartheid and colonial history, which have contributed to endemic poverty, inequality and social exclusion. In corroboration, Seedat and his colleagues (2009) argue that poverty and inequality are central drivers of South Africa's burden of violent injury, and suggest that these factors interact with other key influences, such as dominant notions of masculinity, the inter-generational cycling of violence, alcohol misuse and the proliferation of firearms (also see Coovadia, Jewkes, Barron, Sanders, & McIntyre, 2009). According to the Global Study on

Homicide (United Nations Office on Drugs and Crime, 2011), countries that report low levels of human development and countries that show high levels of income inequality exhibit homicide rates approximately four times higher than those of more equal societies.

Collectively, the research reported here has made an important contribution towards the development of a homicide record for a range of countries, including South Africa. However, systematic analyses that disaggregate homicide victimisation to examine the epidemiologic characteristics and risk profiles of specific manners of death, including strangulation, remain incomplete. The section below provides a brief overview of research on strangulation homicide.

HOMICIDAL STRANGULATION

Research on strangulation describes this form of physical aggression as an extreme and particularly pernicious form of violence that contains a multiplicity of unique psychological, social and gendered meanings (Glass et al., 2008; Häkkänen, 2007; Joshi, Thomas, & Sorenson, 2012). Strangulation, alongside firearm, sharp and blunt object violence, is among the leading external causes of homicide in South Africa. In particular, the predominance of women as victims of homicidal strangulation has come to be bracketed with notions of power and control, the lethality of violent expression against women, the demonstration of sexual and sadistic brutality against women, and the manifestation of hegemonic masculinities (e.g., Thomas, Joshi, & Sorenson, 2013; Suffla, Van Niekerk, & Arendse, 2008).

As a manual method of homicide, strangulation is defined as a form of mechanical asphyxia (Saukko & Knight, 2004). Several mechanisms of death are implicated in strangulation; these include occlusion of the airway, resulting in hypoxia; occlusion of the neck vessels or compression of the carotid arteries, leading to cerebral ischemia; and carotid sinus reflex, leading to cardiac arrest (Saukko & Knight, 2004). Strangulation involves the application of external pressure to the neck (Saukko & Knight, 2004), with almost all attempted or completed homicides by strangulation involving either ligature strangulation (strangulation with a cord-like object) or manual strangulation (with the hands or forearms, or standing or kneeling on the victim's throat) (Maryland Network Against Domestic Violence, 2002). Ligature strangulation is recorded as the more common method of asphyxial homicide (Abder-Rahman & Abu-Alrageb, 1999; Hata et al., 2001; Maxeiner & Bockholdt, 2003; Verma, 2007; Verma & Lal,

2006).

RATIONALE AND JUSTIFICATION

The disaggregation of homicide data is a growing tradition in research on the social production of lethal violence. The disaggregation of overall homicide data recognises the heterogeneous character of the homicide phenomenon as it relates to social actors, circumstances and victim-perpetrator relationships and, therefore, that the demographic, situational and structural correlates of fatal violence vary by mechanism of death. It is argued to provide useful and, at times, unexpected insights into the nature, causes and occurrence probabilities of different mechanisms of fatal injury, advance theoretical understandings of this crime, and bear differential implications for prevention and future research (Pizarro, 2008). The literature on homicide is replete with illustrations of empirical inquiry and theory testing that support the utility of and case for disaggregating homicide data (e.g., Haynie & Armstrong, 2006; Ratele et al., 2011; Steffensmeier & Haynie, 2000; Swart, 2014; Vieraitis & Williams, 2002; Williams & Flewelling, 1988).

However, where disaggregation of data is by mechanism of death, the body of scholarship on homicide demonstrates a conspicuous gap on research that specifically focuses on homicidal strangulation; the substantive focus has been on firearm homicide (United Nations Office on Drugs and Crime, 2011). The lower frequency of strangulation deaths in comparison to deaths by firearm discharge, and sharp and blunt objects has likely deprivileged the research focus on homicidal strangulation. Yet, regardless of the manner in which individuals are murdered, the imperatives for studying homicide remain equal in significance both for those who seek to understand and prevent it, as well as those whose lives have, in one way or another, been marked by strangulation violence. It could be argued that these considerations are particularly important for a phenomenon that, in some instances, is common but invisible in the precursory cycle of violence that terminates in fatal strangulation (e.g., Glass et al., 2008; Thomas et al., 2013; Wilbur et al., 2001); is not especially amenable to the kinds of regulatory interventions that are directed at the prevention of other types of homicide, such as firearms control, or those that are overly universal in focus; and is not merely a matter of superior physical strength, to which it is sometimes speciously reduced. The current research attempts to address the afore-mentioned concerns and, ultimately, to contribute to knowledge on how to prevent homicidal strangulation specifically.

As indicated above, homicidal strangulation remains an under-investigated area in South Africa and elsewhere in the world. While studies on homicide are increasingly evident in the literature on violence, research in South Africa that disaggregates fatal violence to provide insights into victimisation along such signifiers as homicide cause, gender, race and age has markedly trailed in range and depth. Consequently, little is known about the incidence and risks of fatal strangulation relative to other causes of homicide. A search of the literature on homicidal strangulation revealed forensic and epidemiological descriptions about victim demographics and selected circumstances of occurrence (e.g. Demirci, Dogan, Erkol, & Gunaydin, 2009; Hawley, McClane, & Strack, 2001; Maxeiner & Bockholdt, 2003; Mohanty, Panigrahi, Mohanty, & Das, 2004; Verma, 2007), but a near absence of published evidence on the individual, situational and neighbourhood-level patterns that characterise risk for lethal strangulation, and coherent theoretical explanations for the occurrence of the phenomenon. Across contexts, research on homicidal strangulation has focused almost exclusively on descriptive accounts of occurrence, with studies of an analytic nature devoted to either homicide in the aggregate or other leading causes of fatal injury. Yet, in many contexts, including South Africa, strangulation presents as a leading external cause of homicide, representing a significant proportion of lethal interpersonal violence (Häkkänen, 2007; Suffla et al., 2008). In the precursor study to the current research, Suffla and her colleagues (2008) established that across four major metropolitan centres of South Africa, for the period January 2001 to December 2005, strangulation ranked fourth among all homicide deaths, and resulted in more female than male deaths.

The aims and objectives of the current research are thus informed by the aforementioned gaps in scholarship on homicidal strangulation. Specifically, the four studies that comprise this research empirically and theoretically address the call by researchers to disaggregate homicide data in investigations of the effects of individual, situational and structural factors (e.g., Kubrin, 2003; Pridemore, 2002). This recommendation is made on the basis that the disaggregated effect is different from the overall effect (e.g., Pizarro, 2008); that homicide is not a homogenous phenomenon in that it varies in typological characteristics that relate to the victim, perpetrator, circumstances and motive (e.g., Swart, 2014); and that the aetiology of different causes of homicide is potentially distinctive when compared to the broad-ranging influences of aggregated homicide (DeJong et al., 2011). The research is also responsive to the observation that information on variation in homicide rates across geographical locations and time periods

is primarily available for Europe and North America (Eisner, 2012), with records from low- and middle-income contexts relatively meagre. Finally, the research expands the conceptual foundation for understanding the social ecology of strangulation homicide by employing micro-level and macro-level theories to explain its occurrence; these are described in the next section.

The current research represents the first systematic attempt in South Africa, and perhaps elsewhere too, to investigate homicidal strangulation along several conceptually important dimensions. The systematic investigation of female and male homicidal strangulation in South Africa is critical not only to address the evidence gap in the extant literature, but also to make visible the utilisation of strangulation as a method to commit fatal violence. Reliable and accurate records of the phenomenon and explanations of its occurrence extend the compass of national and international research on the subject, enabling context-specific interpretations, within-country and cross-national comparisons, and the tracing of longitudinal trends. Although lack of precision in homicide prediction cannot be avoided, it clearly still is possible to systematically formulate hypotheses about its occurrence using established statistical methods and analytical tools. Given the staggering levels of both fatal and non-fatal violence in South African, the current study has the potential to contribute to efforts to disaggregate overall mortality data into more defined and conceptually meaningful categories of homicide, represent a valuable source of knowledge for the development of interventions aimed at reducing the burden of mortality from strangulation, as well as to attempts to secure essential resources required to mitigate and prevent lethal strangulation.

THEORETICAL FRAMEWORK

Theoretical constructions of interpersonal violence, including homicidal violence, are wide ranging (e.g., Barak, 2006). The trend in contemporary research on violence is increasingly towards multi-dimensional conceptual frames that are at once reflective of the complexities that underlie its manifestation, and that also articulate with paradigms of empirical inquiry. In this vein, the current research is located within a multi-theory perspective that accommodates the multiple aims and multi-level nature of the study. Specifically, the research draws from routine activities theory, theories of femininities and masculinities, and structural theory. Read together, the theoretical perspectives that have informed this research represent a constellation of micro- and macro-level explanations that are considered to be conceptually edifying in

explaining homicidal strangulation in the City of Johannesburg. Collectively, the theories employed in this study locate the phenomenon of homicidal strangulation within the context of the individual, interpersonal, social, psychological, economic, political and ideological milieu. The thesis by publication format that is presented here does not allow for a detailed explication of the theoretical background from which this research draws; relevant theoretical constructs are summarised below, and further explained and critiqued in each of the studies that comprise this body of work.

Initial iterations of routine activity theory focused on property crime (Cohen & Felson, 1979). Mustaine and Tewksbury (2000) attribute this to the fact that in its early development, routine activities theory related the notion of victimisation to static conditions and objects rather than to social actors. This conceptualisation has since been revised, with evidence of its utility in research on violence now well documented in the literature (e.g., Freisthler, Midanik, & Gruenewald, 2004; Messner, Lu, Zhang, & Liu, 2007; Spano, Freilich, & Bolland, 2008), and widely accepted in criminological work that seeks to explain and predict criminal victimisation risks. From a predictive modelling perspective, this approach appears to be primarily used as a conceptual guide to the development of hypotheses and selection of independent variables, and to provide an explanatory framework for victimisation risk (Groff & La Vigne, 2002). In homicide research, routine activities theory is presented in the literature as one of the most systematically devised models of ecological variation in individual-level victimisation risk (e.g., Cohen & Felson, 1979; Wooldredge, Cullen, & Latessa, 1992), and is employed as a guiding conceptual framework to explain demographic and situational patterns of homicide at the individual level. As a means of understanding how, to whom, when, where and why victimisation occurs, routine activities theory is increasingly referenced in homicide research to explain risk within sub-groups of the population and the situational spheres in which victimisation occurs (Mustaine & Tewksbury, 1999).

Routine activity theory implicates three core factors in victimisation: an offender motivated to commit a crime, a suitable target (person or property), and the absence of guardians capable of preventing the violation (Cohen & Felson 1979), thereby emphasising the intersections between these factors. According to routine activity theory, when each of these three constituents converge in time and space, the risk of victimisation is greatly enhanced. The routine activities perspective further suggests that this conjunction is influenced by the

structure of everyday activities (Kennedy & Silverman, 1990; Messner & Blau, 1987). Accordingly, routine activities theory allows for the exploration and explanation of criminality with a focus on both the domains and sub-populations within which victimisation occurs.

The research draws from two interlocking approaches to theorising about gender, theories of femininities and masculinities, to further explain patterns of strangulation homicide at the individual level. Increasingly, homicide research considers gender as a central theoretical issue in explanations of lethal violence. In particular, gender has received attention in social analyses on the over-representation of men in homicide victimisation and perpetration, and intimate partner homicide (e.g., Brookman, 2005; Mathews, 2010; Ratele, 2010). Many of these inquiries explain violence as a function of gender formations and a way of doing gender within specific social, cultural and economic contexts. By focusing on gender inequality, gender status, gender hierarchy and gender power, and patriarchy as a source of violence, these theoretical perspectives also accord emphasis to vulnerable populations and situations of risk, and explicitly underline action to promote gender justice (e.g., Hearn & Whitehead, 2006; McCarry, 2007; Ratele, 2010; Stanistreet, Bambra, & Scott-Samuel, 2005).

Macro-level explanations of fatal strangulation are informed by structural theory. Specifically, strain theory, which focuses on deprivation and structural inequalities as a key contributor to urban violence, and control theory, which considers the disruption of social bonds as a predisposing influence in homicide events (see Land, McCall, & Cohen, 1990; Pridemore, 2002; Sampson & Lauritsen, 1994), serve as the theoretical basis of the current study.

Strain is conceptualised and operationalised as either absolute or relative deprivation, and is referenced against low income, high unemployment, low educational attainment and the Gini coefficient. In general, research has observed both forms of deprivation to be highly correlated (Pridemore, 2002); however, theoretical explanations of the significance and relationship of each to homicide tend to vary. Where one school of thought posits that the social and psychological strain produced by absolute deprivation contributes to higher homicide rates, the other argues that cognisance of inequality and the resultant competition for limited resources may provoke strong psychological responses, which in turn may lead to fatal violence (e.g., McCall & Nieuwbeerta, 2007; Pridemore, 2002; Williams & Flewelling, 1988). Theoretical debates on the role of economic deprivation in homicide tend to lean towards the argument that

relative deprivation represents the more influential mechanism that leads to strain and higher homicide rates (see Pridemore, 2002). It is reasoned that relative deprivation engenders conditions wherein the injustice of socio-economic inequities are made particularly stark.

Social disorganisation theory, which originates from the scholarship of Wirth (1938), and Shaw and McKay (1942), represents a formative theoretical basis for contemporary studies on the ecology of violence. Social disorganisation theory focuses on the effects of different types of neighbourhoods in creating conditions that are either favourable or unfavourable to crime (Kubrin & Weitzer, 2003). The theory therefore directly links homicide rates to neighbourhood ecological characteristics. From the perspective of social disorganisation theory, the disruption of social bonds through structural impediments weakens the ability of communities to exercise control and to realise common goals, thereby predisposing its members to commit crime (Land et al., 1990; Pridemore, 2002). According to the theory, indicators such as economic hardship, residential mobility, population structure, ethnic and racial heterogeneity, and family disruption weaken the local community social organisation, and hence increase the likelihood of crime (e.g., Land et al., 1990; McCall et al., 2010; McCall & Nieuwbeerta, 2007; Pridemore, 2002; Sampson & Lauritsen, 1994; Sampson, Raudenbush & Earls, 1997).

While the theoretical framework described above is utilised to understand and explain the risk factors implicated in homicidal strangulation in the City of Johannesburg, the empirical logic of the research is informed by the public health approach and related ecological perspective to studying violence. Public health research on violence is underpinned by the notion that interpersonal violence is preventable, and is concerned with: (1) defining the problem; (2) investigating why violence occurs; (3) designing, implementing, monitoring and evaluating interventions; and (4) implementing interventions, disseminating information and determining the cost-effectiveness of programmes (Mercy, Rosenberg, Powell, Broome, & Roper, 1993; Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002). Public health research that draws on the ecological perspective underlines the idea that the individual, relationship, community and societal levels of a system are interconnected, and influence and are influenced by other parts of the system, with these interactions occurring in a cyclic or recursive fashion (Krug et al., 2002; Ratele, Suffla, Lazarus, & Van Niekerk, 2010). Notwithstanding concerns about the limitations of the ecological approach in sufficiently deconstructing the mesh and complexity of risk factors implicated in violence (e.g., Jewkes, Levin, & Penn-Kekana, 2002), it is argued

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that this stance, at the very least, serves to enhance collaboration across disciplinary, methodological and theoretical boundaries in the attempt to better understand the complex causal pathways and multiple constructed meanings of violence (Stevens, Seedat, & Van Niekerk, 2003). Of the four-step public health model, the current study focuses on establishing the magnitude of homicidal strangulation in the City of Johannesburg, and identifying its risk factors. The research aims and objectives are detailed below.

RESEARCH AIMS AND OBJECTIVES

The overarching aim of this thesis is to identify the incidence, distributions, individual-level predictors and structural determinants of homicidal strangulation in South Africa's largest metropolitan centre, the City of Johannesburg, for the period 2001-2010. The thesis is structured around four discrete but interrelated studies, which collectively address an under-researched area in homicide studies, and offer an initial contribution to the body of scholarship on homicide generally, and on the characteristics and patterns of strangulation homicide specifically.

Study I is a descriptive study that quantifies the extent of homicidal strangulation in the City of Johannesburg for the period 2001-2010. This study describes the distribution of lethal strangulation in the City of Johannesburg by characteristics of person (age, race and sex), time (time of day, day of week and month of year), place (geographic location of fatality) and one other victim attribute, blood alcohol concentration (BAC). The remaining three studies are analytical in focus, and are aimed at explaining homicidal strangulation in the City of Johannesburg in terms of its determinants. These studies are differentiated by their focus on individual-level and neighbourhood-level risks. Through disaggregated analyses, Study II assesses overall homicide strangulation risk in relation to all the other leading causes of homicide, both combined and disaggregated. Study III undertakes further disaggregation to investigate homicidal strangulation risk by gender specifically. Complementing the studies on individual-level attributes and variables, Study IV shifts the analytic focus to consider the socio-structural correlates and geographic distributions of fatal strangulation.

The four studies address the following specific objectives:

Study 1

- To describe the incidence of female and male homicidal strangulation relative to the other leading causes of homicide in the City of Johannesburg

- To describe the cause-specific rates for female and male homicidal strangulation relative to the cause-specific rates for the other leading causes of homicide in in the City of Johannesburg

- To describe the age-specific and race[1]-specific rates for female and male homicidal strangulation in the City of Johannesburg

- To describe the characteristics of female and male homicidal strangulation, by person, time, place and blood alcohol concentration, in the City of Johannesburg

Study II

- To identify the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from all other homicides in the City of Johannesburg

- To identify the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from firearm homicides in the City of Johannesburg

- To identify the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from sharp object homicides in the City of Johannesburg

- To identify the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from blunt object homicides in the City of Johannesburg

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[1] The author subscribes to the view that race is not biologically determined, but is socially and politically constructed through social institutions and practices. In South Africa, the terms Indian, black, coloured (referring to mixed heritage) and white refer to various population groups, and are an artifact of the apartheid era. Their use is contentious and does not imply acceptance of the racist assumptions on which these labels are founded. It is recognised that these categories are a social construction that has served particular political purposes. The terms are used to reflect the differential manner in which the earlier South African policies of racial segregation, or *apartheid*, had impacted on the lives of various groups of South Africans, and still do. Nonetheless, the use of these terms remains troubling, and highlights the risk of perpetuating racial identities in post-apartheid South Africa. For this reason, scholars, practitioners and policy-makers continue to seek alternatives to the current use of racial classifiers as a means of monitoring change in democratic terms. A leading scholar on the subject, Neville Alexander, argues for the use of class or income group categorisation instead, given the intersection between race and class in South Africa (see Alexander, 2007). At the same time, some scholars warn against the total rejection of racial categories, suggesting that doing so may undermine efforts to redress pervasive racial inequality in South Africa and inadvertently preserve its legacy of racial hierarchy (see Milazzo, 2015). This position argues that race-based policies that require race classification are necessary to address the discrimination of the past and to evaluate changes in the populace (see Mare, 2001). These debates are reflective of the complexities and enduring effects of apartheid's racial classification (see Posel, 2001).

Study III

- To identify the individual-level risk factors that differentiate female homicidal strangulation from all other female homicides in the City of Johannesburg
- To identify the individual-level risk factors that differentiate male homicidal strangulation from all other male homicides in the City of Johannesburg

Study IV

- To determine the clusters of socio-structural area attributes that are descriptive of the living situations of the residents of the City of Johannesburg
- To assess the impact of these clusters of disadvantage on homicidal strangulation in the City of Johannesburg
- To identify the differential influence of neighbourhood disadvantage on homicidal strangulation risk for females, males, adults and blacks in the City of Johannesburg

METHOD

Research Context

The City of Johannesburg was chosen for the current study since it accounts for the greatest proportion of the South African urban population (Statistics South Africa, 2012b), among the highest relative number of overall homicides (Altbeker, 2008; South African Institute of Race Relations, 2012), and the availability of systematically collected data on homicidal strangulation (MRC-UNISA Safety & Peace Promotion Research Unit[2], 2013). The City of Johannesburg[3] (see Figure 1) is the provincial capital of Gauteng, and one of eight metropolitan municipalities in South Africa (see Figure 2). Violence is the leading cause of non-natural death in Gauteng, represented by an overall rate of 34.3 deaths per 100 000 population (MRC-UNISA Safety & Peace Promotion Research Unit, 2013). According to the 2011 South African National Census, the City of Johannesburg is estimated to have a total population of 4.4 million, of which 76.4% are black, 12.3% white, 5.6% coloured and 4.9% Indian, and a population density of 2696 persons per km^2 (Statistics South Africa, 2012b). The City has an estimated sex ratio of 100.70 (males per 100 females) (Statistics South Africa, 2012b). Approximately 73% of the City's population is concentrated in the 15 to 64 years age range (Statistics South

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[2] Now named the MRC-UNISA Violence, Peace and Research Unit.
[3] The description provided here is applicable to the research setting in all four studies. For publication purposes, this detail will be included in all the study-related manuscripts.

Africa, 2012a). Although it is located in South Africa's wealthiest province and is considered to be the economic hub of the country, the City of Johannesburg continues to face significant challenges in terms of urban poverty and under-development, with elevated levels of unemployment (25% of the economically active population) identified to be a key factor contributing to high inequality levels. In women, the highest unemployment rate is among blacks, followed by coloured, Indian and white women respectively (City of Johannesburg, 2012a). The majority of the City's youthful population only has a matric certificate and struggles to access the labour market (City of Johannesburg, 2011). Johannesburg continues to attract both national and cross-border migrants, with the resultant changes in demographics having resulted in sporadic xenophobic attacks across the city in recent times (City of Johannesburg, 2011).

The legacy of apartheid continues to have an impact on the City of Johannesburg. Historical social, geographical and economic inequities, together with current social and economic challenges have reportedly manifested in high levels of crime, violence and other forms of harm (City of Johannesburg, 2011). To address challenges related to safety, security, crime and violence, the City of Johannesburg has developed an integrated and multi-disciplinary safety strategy, the *Joburg City Safety Strategy*, which is primarily aimed at the reduction of crime and the improvement of perceptions of safety (City of Johannesburg, 2012b).

Figure 1. Map of the City of Johannesburg

Figure 2. Map of South Africa

Data Sources

The research draws from two distinct sets of material. These include: (1) the National Injury Mortality Surveillance System (NIMSS), from which the 2001-2010 homicide dataset was compiled; and (2) South African National Census data for 2001. The NIMSS dataset included records for all strangulation, firearm, sharp object and blunt object homicides registered by the surveillance system for the City of Johannesburg, and was used for all four studies. Census data were used in Study I for its description of the 2001 population estimates, as well as a base for city denominator interpolations for the period of 2002 to 2010. The denominator data were employed to calculate homicide rates (see Study I for detail). Data on the socio-structural characteristics of neighbourhoods in the City of Johannesburg were also drawn from Census 2001 (see Study IV). Census 2001 was the most recent and comprehensive database available for the City of Johannesburg at the time that the data analyses for Study IV were undertaken. The two data sources are described below.

NIMSS

The NIMSS was developed to provide epidemiological data on injury mortality in South Africa and is currently the most detailed source of information on the "who, what, when and where" of fatal injuries in South Africa. It provides valuable data for monitoring the effectiveness of prevention initiatives, injury trends, as well as the accuracy of other data sources. The NIMSS is coordinated by the Violence, Injury and Peace Research Unit (VIPRU), which is co-directed by the Medical Research Council (MRC) and the University of South Africa (UNISA), and is supported by the South African Department of Health (DoH). Specifically, the NIMSS is a mortuary surveillance system that uses findings from medico-forensic investigative procedures at state medico-legal laboratories and forensic chemistry laboratories to collate information on injury deaths (Donson, 2008). The NIMSS commenced in 1999 at 10 mortuaries across the country. Between 2001 and 2005, the system recorded full coverage of injury deaths in four major metropolitan cities in South Africa, namely Cape Town, eThekwini (Durban), Johannesburg and Tshwane (Pretoria). With the transfer of Forensic Pathology Services (FPS) from the South African Police Service to the provincial Departments of Health in 2006, several mortuaries withdrew from participation in the system. Since 2008, the NIMSS collects fatal injury information from all 30 mortuaries in the provinces of Gauteng and Mpumalanga, providing urban and rural representivity respectively (MRC-UNISA Safety & Peace Promotion Research Unit, 2013). Of these, 5 mortuaries contribute to the data collected for the City of

Johannesburg. At the end of each year, data from the participating medico-legal and forensic chemistry laboratories are sent to VIPRU where the information is collated for reporting purposes. The NIMSS has comprehensive coverage of injury mortality for Johannesburg for the period January 2001 to December 2010. The System collates and disseminates descriptive epidemiological information on deaths due to non-natural causes that, in terms of South African legislation, are subject to medico-legal post-mortem investigation (Inquests Act, 1959). Information for this system is collected by the police and forensic pathologists at each participating mortuary, and captured onsite into a computerised database by designated staff. The NIMSS records 21 items of information on the cause and mechanism of death, victim demographics, and the more immediate context and circumstances of fatal injury occurrence. It details, where available, the deceased person's age, sex, population group or race, province, town and suburb of injury, scene of injury, apparent manner and circumstances (or external cause) of death (Matzopoulos, Van Niekerk, Marais, & Donson, 2002). The external cause of death refers to the mechanism or circumstance that preceded the death; for homicide, the external cause refers to the method or weapon used to commit the homicide. The NIMSS also reports on the blood alcohol concentration (BAC) levels of the deceased through information obtained from forensic chemistry laboratory reports. It classifies the external cause of death using the International Classification of Disease version 9 (ICD 9) and assigns a probable manner of death code to each case, which is finalised on the basis of court findings. In the case of homicide, the external cause refers to the method or weapon used to commit the murder. As a national surveillance system, the NIMSS is regulated by and maintains the ethical standards prescribed by the MRC, UNISA and DoH.

Data and sources of data are of critical value in efforts to measure violence in South Africa, and respond to its epidemiological patterns and trends. The NIMSS, as the only systematic source of homicidal data for the City of Johannesburg, represents one of a limited number of injury surveillance systems in South Africa and on the African continent (Bowman, Seedat, Duncan, & Kobusingye, 2006; Donson & Van Niekerk, 2012). The NIMSS is considered to be a valuable resource in documenting and monitoring violence victimisation in urban South Africa, and thereby in informing city-level violence prevention and resource allocation decisions. Notwithstanding its usefulness, and characteristic of public health information systems in other resource-low countries (Mphatswe et al., 2012), the problem of incomplete documentation of key information items remains a challenge for the NIMSS. Some of the rates

and proportions reported in this study are therefore likely to be an under-estimate of the extent of occurrence. Despite the challenge noted here, the NIMSS remains the only injury surveillance system that provides baseline data for descriptions of injury epidemiology, and the monitoring of prevention interventions in the City of Johannesburg.

South African National Census

The South African National Census is undertaken by Statistics South Africa. Censuses are the primary means through which population and housing statistics on every individual within defined geographical areas in a country are collected, processed and published (Statistics South Africa, 2012b). Conducted every 10 years, the Census includes population and housing data such as gender, age, education level, ethnic composition, employment, recent migration, household structure and constituents, and dwelling types and services (Statistics South Africa, 2001a). Census data are widely used by both policy-makers and researchers alike. While the Census is generally considered to be the foremost statistical publication by government, and to have the potential to influence policy, concerns have been raised about the accuracy and validity of some of the data as they relate to errors in counts, boundary demarcations, geo-coding and coverage (e.g., Berkowitz, 2012). Notwithstanding its limitations, for the purposes of this research, the Census represents the most detailed information source on the population at the city and neighbourhood level.

Data Analysis

The four studies employed a range of descriptive and analytic approaches to analyse the data[4]. In Study I, cause-specific mortality rates were calculated for the four leading external causes of homicide, strangulation, firearm discharge, sharp object injury and blunt object injury, for the City of Johannesburg for the period 2001-2010, and specified by sex to depict the gendered profile of homicidal strangulation within the City's overall homicide profile. Age- and race-

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[4] The Bonferroni correction was not applied for the following reasons: a) the correction is necessary only when running several tests *simultaneously*; in the current research, the analysis varied by hypotheses and sub-sample; b) the Bonferroni correction suppresses Type II errors (false positives) but artificially inflates Type I errors (false negatives), that is, discounting results which are significant because they fail to meet the Bonferroni requirement; this problem is that much more pronounced when the sample size is small, as is the case in the current research; c) the Bonferroni correction is entirely dependent on the number of tests run in the family of analysis, which means that a given specific test result may or may not be significant simply based upon how many other tests were run in that analysis, which presents as a somewhat arbitrary standard; and d) there is no clarity on which tests should be included in the Bonferroni correction, that is, whether it should be all tests ever run on the data or only those to be reported in the writing; this therefore raises the question as to how one *apriori* counts the tests to calculate the Bonferroni correction.

specific mortality rates were computed for fatal strangulation specifically. Bivariate frequency distributions and three-variable cross tabulations were computed to examine relevant proportions of both female and male homicidal strangulation events occurring over the 10 year period of the study. In Study II, a series of logistic regressions were performed to measure the independent associations between socio-demographic and spatio-temporal predictor variables and the risk of strangulation, relative to other homicide mechanisms. The logistic models thus allow for analytic descriptions of the variables that distinguish homicidal strangulation from the other leading causes of homicide in the City of Johannesburg. Logistic regressions models were also applied to analyse the data for Study III. However, in this study, the logistic regressions were conducted to specifically examine the independent associations between each of the predictor variables and homicidal strangulation in females and in males in relation to all other female and male homicides respectively. The analyses yield analytic descriptions of the variables that distinguish female and male homicidal strangulation from the other leading causes of homicide in the City of Johannesburg, and also allow for a description of the differences in the risks for female and male fatal strangulation. In the final study, an analysis of select area-level correlates of homicidal strangulation was undertaken to establish whether neighbourhood socio-structural characteristics were associated with homicidal strangulation in the City of Johannesburg for the period 2001-2010. After delineating the unit of analysis and extracting data on strangulation fatalities from the NIMSS, and on area-level descriptions for the City of Johannesburg from the South African National Census, a principal components analysis was conducted and binomial regression models were subsequently fitted to examine the relationships between neighbourhood characteristics and the fatal strangulation of females, males, adults and blacks.

See Figure 3 below for a summary of the research focus and method.
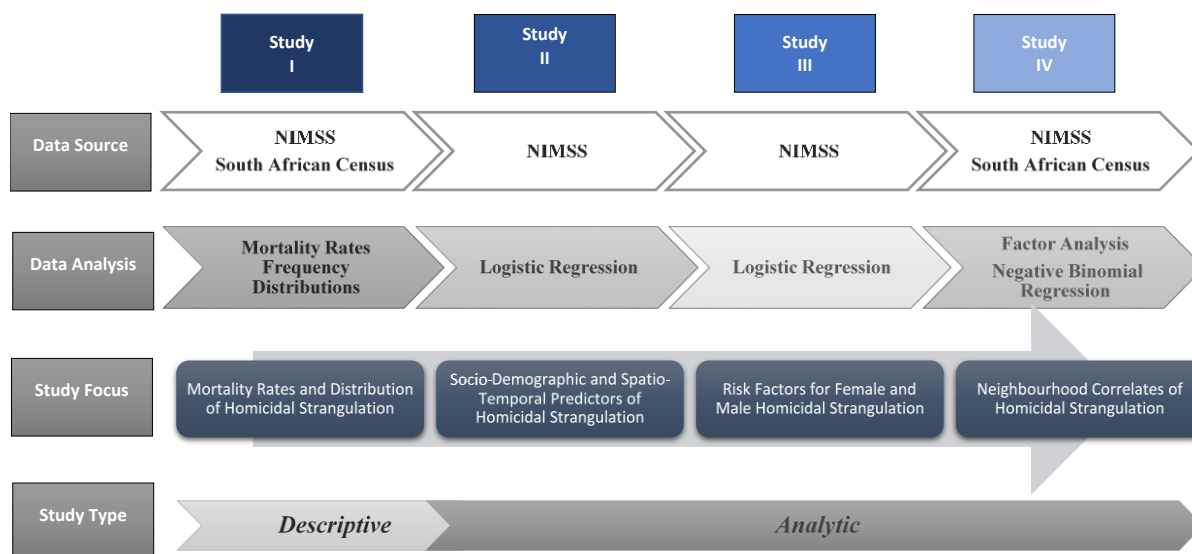
Figure 3. Summary of research focus and method

Ethics Approval

Ethical clearance for the study was obtained from the Ethics Committee of the Department of Psychology, located in the College of Human Sciences at the University of South Africa (see Appendix 1 for ethics approval letter). Access to the NIMSS database from which the homicide records were drawn was granted by the VIPRU.

STRUCTURE AND ORGANISATION OF THE THESIS

Following the Introduction outlined here, the thesis is organised around Studies I, II, III, IV, and closes with the Conclusion section. To reiterate, the first study, *The epidemiology of homicidal strangulation in the City of Johannesburg, South Africa*, provides a descriptive platform for the three analytic studies that follow. Specifically, Study I describes the extent and distribution of homicidal strangulation. The second study, *Socio-demographic and spatio-temporal predictors of homicidal strangulation in the City of Johannesburg, South Africa*, extends the descriptive investigation undertaken in Study I by identifying the individual-level and situational risk factors associated with strangulation. Specifically, the analysis examines select socio-demographic and spatio-temporal factors to determine their effects on the probability of death by strangulation in the City of Johannesburg. In Study III, *Risk factors for female and male homicidal strangulation in the City of Johannesburg, South Africa*, the focus on individual-level and situational risk factors for homicidal strangulation is tapered further through a gendered examination of the predictors of homicidal strangulation. The fourth study,

Neighbourhood correlates of homicidal strangulation in the City of Johannesburg, South Africa, is an area-based analysis that assesses the socio-structural risk factors associated with homicidal strangulation. Finally, the Conclusion summarises the main results of the four studies. This section also assesses the implications of the research findings for practice and policy, the research limitations and directions for future research[5], which are considered in an integrated discussion on the compendium of studies presented here.

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[5] In the interest of brevity, study implications for practice, policy and future research are outlined in the Conclusion section of the thesis for all four studies. These will be distilled and inserted into each study-related manuscript that is to be prepared for publication.

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STUDY I

THE EPIDEMIOLOGY OF HOMICIDAL STRANGULATION IN THE CITY OF JOHANNESBURG, SOUTH AFRICA

Abstract

Studies that provide accurate descriptions of the occurrence of fatal strangulation events are limited, both in South Africa and elsewhere in the world. The current study describes the extent and distribution of female and male homicidal strangulation in the City of Johannesburg for the period 2001-2010. The study is a register-based cross sectional study of homicidal strangulation that draws on data recorded by the National Injury Mortality Surveillance System. Crude, unadjusted strangulation rates, and proportions of strangulation across specific circumstances of occurrence were computed for each year and aggregated in some instances. Results indicated fatal strangulation to be the fourth leading cause of homicide in the City of Johannesburg. A total of 334 strangulation homicides were recorded, representing an average annual strangulation homicide rate of 0.90 per 100 000 population. Gender disproportionality in victimisation was reflected in the average annual rate of 1.03 per 100 000 population for females and 0.74 per 100 000 population for males. The highest rates were recorded among the elderly, and amongst coloured females and white males. Temporal and spatial descriptions indicated that victims were strangled primarily during the day, over the weekday period, and in private locations. When the scene of death was considered by race and age group, results indicated the victimisation of white females and males in private places, and the elderly in private settings. The majority of strangulation victims tested negative for alcohol. The results highlight the need for multi-level prevention strategies that target specific risk groups and situations.

Keywords: homicide; strangulation; epidemiology; mortality rates; distributions; South Africa

Research on homicidal strangulation has largely been undertaken from a legal and forensic medicine perspective, with a smaller number of studies located within victimology studies. Within this corpus of literature, studies have focused on post-mortem examinations of victims of strangulation fatalities (e.g. Demirci, Dogan, Erkol, & Gunaydin, 2009; Hawley, McClane, & Strack, 2001; Maxeiner & Bockholdt, 2003; Schmidt & Madea, 1995) and epidemiological profiles of strangulation deaths (e.g., Mohanty, Panigrahi, Mohanty, & Das, 2004; Verma, 2007; Verma & Lal, 2006). Others have provided reviews of attempted strangulation, particularly in the context of intimate partner violence (e.g., Glass et al., 2008; Joshi, Thomas, & Sorenson, 2012; McClane, Strack, & Hawley, 2001; Plattner, Bollinger, & Zollinger, 2005; Shields, Corey, Weakley-Jones, & Stewart, 2010; Smith, Mills, & Taliaferro, 2001; Strack, McClane, & Hawley, 2001; Thomas, Joshi, & Sorenson, 2013; Wilbur et al., 2001). Some research has focused on recommendations for the screening of risk, improved medical, social and legal interventions to mitigate risk, and the prevention of fatal and non-fatal strangulation (e.g. Glass et al., 2008; McClane et al., 2001; Mohanty et al., 2004; Shields et al., 2010; Smith et al., 2001; Strack et al., 2001; Wilbur et al., 2001).

The available, albeit vastly limited, research evidence on homicidal strangulation suggests that although a rare occurrence in the context of mortality, strangulation in fact presents as a relatively common mechanism of intentional fatal injury. Based on a review of research from Japan, Canada, Scandinavia and Scotland, Häkkänen (2007) concluded that fatal strangulation accounts for an estimated 10-20% of all homicide deaths in a range of countries, thereby constituting a significant proportion of violent deaths. Epidemiological descriptions of homicidal strangulation are available for both high-income contexts, such as Finland, Norway, Denmark and the United Kingdom (e.g., Häkkänen, 2005, 2007; Henderson, Morgan, Patel, & Tiplady, 2005; Rodge, Hougen, & Poulsen, 2001), as well as low- to middle-income settings, such as India, Jordan, Turkey and South Africa (e.g., Abder-Rahman & Abu-Alrageb, 1999; Ambade, Godbole, & Kukde, 2007; Demirci et al., 2009; Mohanty et al., 2004; Suffla, Van Niekerk, & Arendse, 2008; Verma & Lal, 2006). Research shows marked variation in homicidal asphyxia patterns between females and males, with selected studies on fatal strangulation reporting a higher female to male ratio (e.g., Glass et al., 2008; Hunt et al., 2010; Maryland Network Against Domestic Violence, 2002; Nordrum, Eide, & Jørgensen, 1998; Rodge et al., 2001; Sanford et al., 2006; Suffla et al., 2008; Verma, 2007), and others establishing a significant male representation among strangulation victims (e.g. Häkkänen,

2005; Maxeiner & Bockholdt, 2003; Verma & Lal, 2006). Distinct age differences characterise the trends in fatal strangulation victimisation. Peaks in age-related homicidal strangulation rates have been recorded for victims aged 20-30 year old, 30-40 year olds, victims over 60 year old, as well as 5-18 year olds in the case of the paediatric and adolescent victim sub-group (e.g. Häkkänen, 2005; Mathews et al., 2010; Mathews, Abrahams, Jewkes, Martin, & Lombard, 2012; Rodge et al., 2001; Suffla, et al., 2008; Verma, 2007; Verma & Lal, 2006). The victim's domestic context has been more consistently identified as the primary crime scene (e.g., Häkkänen, 2005; Henderson et al., 2005; Mohanty et al., 2004; Rodge et al., 2001; Suffla, et al., 2008). In the context of female homicidal strangulation, this finding has been cited in support of available records and hypotheses that label the victim-perpetrator relationship as primarily intimate (Aldridge & Browne, 2003; Häkkänen, 2005; Henderson et al., 2005; Hunt et al., 2010; Rodge et al., 2001; Sanford et al., 2006). In contrast, the findings of a South African study on injury patterns in female homicide victims indicated that in 1999 strangulation deaths among women 14 years and older were linked to non-intimate partners (Mathews et al., 2009b).

The preceding literature review suggests that investigations on the epidemiology of fatal strangulation have been primarily small-scale in nature. Existing studies are largely limited to initial descriptions of incidence and circumstances, thereby limiting explanations of the phenomenon and conclusions that may be derived. This near absence of research and theory on the subject, against the backdrop of findings emerging from city-level data exposing the elevated female homicidal strangulation rates in the country (Suffla et al., 2008), clearly calls for further inquiry into homicidal strangulation in South Africa. The current investigation seeks to build on the preliminary analysis by Suffla and her colleagues (2008) through the focus on a single urban centre over a more extended period of time, that is, a 10-year period. The initial descriptions emerging from this study are considered in relation to notions of vulnerability as they concern characteristics of person, time, place and alcohol consumption. Thus, this study also creates a platform for examination of the patterns of homicidal strangulation (see Study II, Study III and Study IV).

The current study investigated the extent and distribution of female and male homicidal strangulation in the City of Johannesburg for the period 2001-2010. The study addressed the following four questions:

1. What is the incidence of female and male homicidal strangulation relative to the other leading causes of homicide in the City of Johannesburg?

2. What are the cause-specific rates for female and male homicidal strangulation relative to the cause-specific rates for the other leading causes of homicide in in the City of Johannesburg?

3. What are the age-specific and race-specific rates for female and male homicidal strangulation in the City of Johannesburg?

4. What are the characteristics of female and male homicidal strangulation, by person, time, place and blood alcohol concentration (BAC), in the City of Johannesburg?

METHOD

The study is a register-based cross sectional study of homicidal strangulation that draws on data recorded by the National Injury Mortality Surveillance System (NIMSS) for the City of Johannesburg over the period 2001-2010.

Data Source

All fatal strangulation cases were extracted from the NIMSS (see Introduction to the thesis for a detailed description), together with firearm, sharp object and blunt object homicide cases among both females and males for the period 2001-2010. These mechanisms of death represent the four leading causes of homicide in the City of Johannesburg and in South Africa. The data included information on the: 1) external cause of death; 2) victims' age and race; 3) time, day and month of death; 4) scene of death; and 5) BAC levels detected in the victims at the time of death. Using descriptive univariate statistics, each variable in the dataset was separately checked and cleaned.

A Missing Values Analysis was undertaken on the dataset to assess the pattern of missing data. Of the 342 strangulation cases that were recorded by the NIMSS, 8 cases were found to have a high proportion of missing values across all variables and therefore excluded from the analysis. As noted in the Introduction, the incomplete documentation of key data items remains a challenge for the NIMSS. Some of the rates and proportions reported in this study are therefore likely to be an under-estimate of the extent of occurrence. Nonetheless, for the City of Johannesburg, the NIMSS represents the only injury surveillance system that provides baseline

data for descriptions of injury epidemiology, as well as for monitoring the effectiveness of prevention interventions.

Data Analysis

Cause-specific mortality rates were calculated for the four leading external causes of homicide, namely strangulation, firearm discharge, sharp object injury and blunt object injury, for the City of Johannesburg for the period 2001-2010, and specified by sex to illuminate the sex-specific profile of homicidal strangulation within the City's overall homicide profile. For the cause-sex rates computations, the numerator was the number of fatal events attributed to each of the specified causes for females and males for each year of the study period, and the denominator the estimated size of the female and male populations for the City of Johannesburg for each respective year. A combined mortality rate was also calculated for strangulation homicide for each year and aggregated for the period of the study. Female-male rate ratios, as a relative difference measure, were calculated for all four homicide categories to compare homicidal strangulation rates across sex, as well as to present this incidence profile in relation to homicide by firearm discharge, sharp object injury and blunt object injury.

Age-specific mortality rates for both female and male homicidal strangulation were calculated for age, grouped as 0-4, 5-14, 15-29, 30-44, 45-59 and 60+ years of age, and aggregated for the ten year period to examine the distribution of fatal strangulation across age categories and by sex. For these rates calculations, the numerator was the number of female and male deaths in each of the specified age categories, and the denominator the total female and male populations for the City for each of the indicated age groups.

Race-specific rates were computed for race group, classified as Indian, black, coloured and white, and aggregated for the study period. These rates were calculated for both females and males. As with the afore-mentioned, the rates calculations took into account the number of female and male strangulation cases in each of the race groups, and the total population of females and males in the respective race groups. All the rates are expressed per 100 000.

The 2001 South African National Census population estimates for the City of Johannesburg were used for 2001 rates computations (Statistics South Africa, 2003). For the remaining years of the study period, base population estimates were derived by linear interpolation of the 2001

and 2011 age group, population group and sex specific population distribution of the City of Johannesburg (Statistics South Africa, 2003; Statistics South Africa, 2012). In linear interpolation, inter-censal population counts represent an intermediate value calculated linearly between data points. Linear interpolation is a commonly used method to estimate inter-censal population counts when working with human population series, and is considered to be a valid methodology for estimating population size when the interval between data points is 10 years (Coulson & Joyce, 2003). To estimate the population of the City of Johannesburg for the years 2002 to 2010, the average annual percentage change between the 2001 and 2011 censal data points was calculated and then applied to the baseline value to estimate age, race and sex specific population denominators for the intervening years, 2002 to 2010.

To adjust for the addition of the "Other" category in the 2011 Census, which is now included to accommodate for South Africans who decline to classify themselves in terms of race, and assuming that individuals across the four racial categories were equally likely to choose "Other", the number of people in the Indian, black, coloured and white population groupings were adjusted upwards in the 2011 Census population estimates. Specifically, the population in the "Other" category was distributed across the four race classifications used in the 2001 Census data, and also in this study, based on the relative size of the four groups for each age-sex category. The adjusted estimates were used as the 2011 data point for the linear interpolation undertaken.

Bivariate frequency distributions and three-variable cross tabulations were computed to examine the proportions of both female and male homicidal strangulation occurring over the 10 year period for time of day (4 categories); day of week (2 categories); month of death (12 categories); scene of injury (2 categories); and BAC (2 categories). Proportions were compared using the Pearson's chi-square test (χ^2), with $p < .05$ used to indicate statistical significance. The Statistical Package for the Social Sciences (SPSS Version 22), a standard and comprehensive statistical software package for the social sciences, was utilised to analyse the data.

RESULTS

Following the study questions, the results below report on the incidence, rates and circumstances of fatal strangulation occurrence.

Incidence of Homicide and Strangulation

For the period 2001-2010, a total of 20 736 cases were recorded for homicide by firearm discharge, sharp object trauma, blunt object trauma and strangulation combined for the City of Johannesburg. Of the 20 595 (99.3%) cases valid for the examination of cause of death across sex, males accounted for 18 164 (88.2%) of these fatal events. In relation to the other external causes of death for both females and males, strangulation ranked fourth (1.6%), preceded by firearm discharge (59.4%), sharp object (23.2%) and blunt object (15.9%) homicides (see Figure 1). When differentiated by gender, a significant overall difference was observed in the cause of death between males and females χ^2 (3, $N = 20\ 595$) = 735.12, $p = .000$. Of the 334 strangulation fatalities analysed, a significantly higher proportion occurred in females (58.1%, $n = 194$) than in males (41.9%, $n = 140$) relative to the sex-specific profile of the other external causes of death.

	Firearm Discharge	Sharp Object	Blunt Object	Strangulation
■ Male	60.6%	23.1%	15.6%	0.8%
■ Female	50.2%	23.8%	18.1%	8.0%
■ Total	59.4%	23.2%	15.9%	1.6%
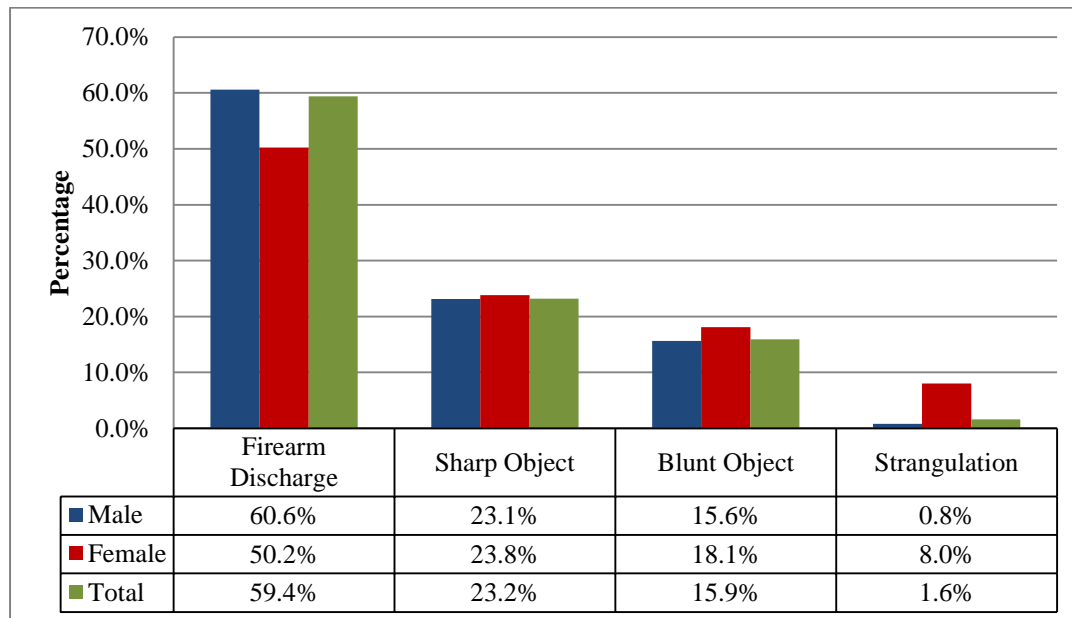
Figure 1. Distribution of homicide by sex and external cause of death, City of Johannesburg, 2001-2010

Cause-specific mortality rates

The cause-specific mortality rates for the four leading causes of death for the City of Johannesburg for the period 2001-2010 (see Table 1) signified a degree of fluctuation for female and male strangulation across the period of analysis. Notwithstanding, the computations showed the rate of female strangulation to be consistently higher than that for males (see Figure 2). In comparison, the rates computations revealed a declining trend for both female and male deaths from firearm discharge. The overall pattern for male homicide by sharp and blunt objects indicated an increase in deaths in more recent years, while the tendency appeared to be more variable for females.
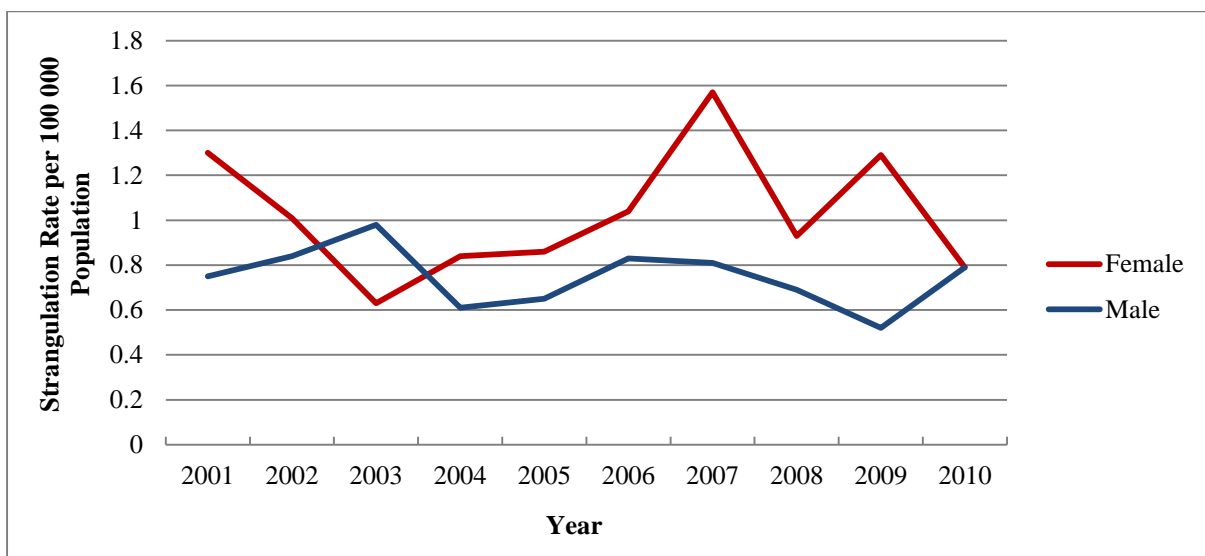
Figure 2. Rates for homicidal strangulation by sex, City of Johannesburg, 2001-2010

Table 1. **Cause-specific rates for homicide by sex and external cause of death, City of Johannesburg, 2001-2010 (N = 20 595)**

		2001		2002		2003		2004		2005		2006		2007		2008		2009		2010	
Year																						
City of Johannesburg Population		3 226 055		3 346 932		3 467 809		3 588 686		3 709 563		3 830 440		3 951 318		4 072 195		4 193 072		4 313 949	
		Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.	Total deaths	Rate / 100 000 pop.
Firearm Homicides	**Female (N=1 220)**	180	11.12	194	11.56	180	10.36	153	8.52	97	5.23	109	5.69	90	4.56	89	4.38	69	3.30	59	2.74
	Male (N=11 006)	1826	113.61	1877	112.46	1521	87.88	1250	69.73	846	45.62	909	47.44	823	41.61	776	38.04	614	29.22	564	26.07
Sharp Objects Homicides	**Female (N=578)**	61	3.77	71	4.23	54	3.11	71	3.95	40	2.16	67	3.50	48	2.43	61	3.00	53	2.53	52	2.42
	Male (N=4 190)	395	24.58	447	26.78	357	20.63	369	20.58	366	19.74	436	22.75	438	22.14	498	24.41	444	21.13	440	20.34
Blunt Objects Homicides	**Female (N=439)**	46	2.84	49	2.92	44	2.53	32	1.78	28	1.51	28	1.46	58	2.94	69	3.39	39	1.86	46	2.14
	Male (N=2 828)	237	14.75	271	16.24	221	12.77	270	15.06	180	9.71	202	10.54	344	17.39	411	20.15	357	16.99	335	15.49
Strangulation Homicides	**Female (N=194)**	21	1.30	17	1.01	11	0.63	15	0.84	16	0.86	20	1.04	31	1.57	19	0.93	27	1.29	17	0.79
	Male (N=140)	12	0.75	14	0.84	17	0.98	11	0.61	12	0.65	16	0.83	16	0.81	14	0.69	11	0.52	17	0.79

The average annual overall strangulation homicide rate was 0.90 per 100 000 population, and 1.03 per 100 000 population for females and 0.74 per 100 000 population for males. Female strangulation rates were higher in 2001, 2007 and 2009 (1.3, 1.57 and 1.29 deaths per 100 000 population respectively), peaking in 2007 at 1.57 deaths per 100 000 population, and declining towards convergence with the elevated rate for males in 2010 (0.79 deaths per 100 000 population for both females and males). The overall female-male rate ratio for homicidal strangulation for the period under study (1.39:1) revealed that almost one-and-a-half as many females than males were victims, representing a distinctly disproportionate epidemiological profile of female fatalities relative to the female-male rate ratios for firearm discharge (0.11:1), sharp object (0.14:1) and blunt object (0.16:1) homicide (see Table 2). The mortality rate for female homicidal strangulation for the City of Johannesburg is therefore consistent with the proportional description of homicidal strangulation reported above.

Table 2. Female-male rate ratios for homicide by external cause of death, City of Johannesburg, 2001-2010

Homicide Category	*n*	Female Rate	*n*	Male Rate	Female-Male Rate Ratio
Firearm Discharge	1220	6.47	11 006	58.38	0.11
Sharp Object	578	3.07	4190	22.22	0.14
Blunt Object	439	2.33	2828	15.00	0.16
Strangulation	194	1.03	140	0.74	1.39

Age-specific and race-specific mortality rates for homicidal strangulation

The age of the victims was known in 291 (87.1%) of the recorded strangulation deaths. The age-specific rates for female and male homicidal strangulation, aggregated for the 10 year period of the study for each age category, are reported in Table 3. The highest rates for both females and males were recorded in the 60+ age group, with more female (2.56) than male (1.77) deaths per 100 000 in this age category.

Table 3. Age-specific rates for homicidal strangulation by sex, City of Johannesburg, 2001-2010 (N = 291)

Age Group	Female Rate (*n*)	Male Rate (*n*)
0-4	0.70 (12)	0.82 (14)
5-14	0.23 (6)	0.19 (5)
15-29	0.98 (60)	0.53 (31)
30-44	0.85 (43)	0.74 (35)
45-59	0.78 (18)	0.63 (16)
60+	2.56 (26)	1.77 (25)

Race classification was recorded for all (*n* = 334) homicidal strangulation cases. Table 4 describes race-specific rates for female and male homicidal strangulation, aggregated for the 10 year period of the study. The rates of occurrence across all the race groups were higher for females than males. The highest rates for females were recorded for coloured victims (1.19 deaths per 100 000 population), marginally higher than that for white females (1.17 deaths per 100 000 population). Relatively elevated rates were also observed for black female victims (1.00 death per 100 000 population). For males, the highest rates were computed for white strangulation victims, at 1.05 deaths per 100 000 population.

Table 4. Race-specific rates for homicidal strangulation by sex, City of Johannesburg, 2001-2010 (N = 334)

Population Group	Female Rate (*n*)	Male Rate (*n*)
Indian	0.81 (7)	0.70 (6)
Black	1.00 (141)	0.70 (101)
Coloured	1.19 (14)	0.55 (6)
White	1.17 (32)	1.05 (27)

Circumstances of Strangulation Occurrence

Circumstances of fatal strangulation occurrence are described in relation to time, place and BAC.

Homicidal strangulation by time

Time of death was recorded for 295 (88.3%) cases. The distribution of female and male strangulation deaths across time zones, aggregated for the ten year period of the analysis, indicated an almost identical pattern (see Figure 3). The majority of strangulation fatalities occurred during the day, with the highest percentages of occurrence across time categories recorded for the periods 09h00-16h59 (37.2%, $n = 64$ and 37.4%, $n = 46$ respectively), and 05h00-08h59 (28.5%, $n = 49$ and 26%, $n = 32$ respectively).
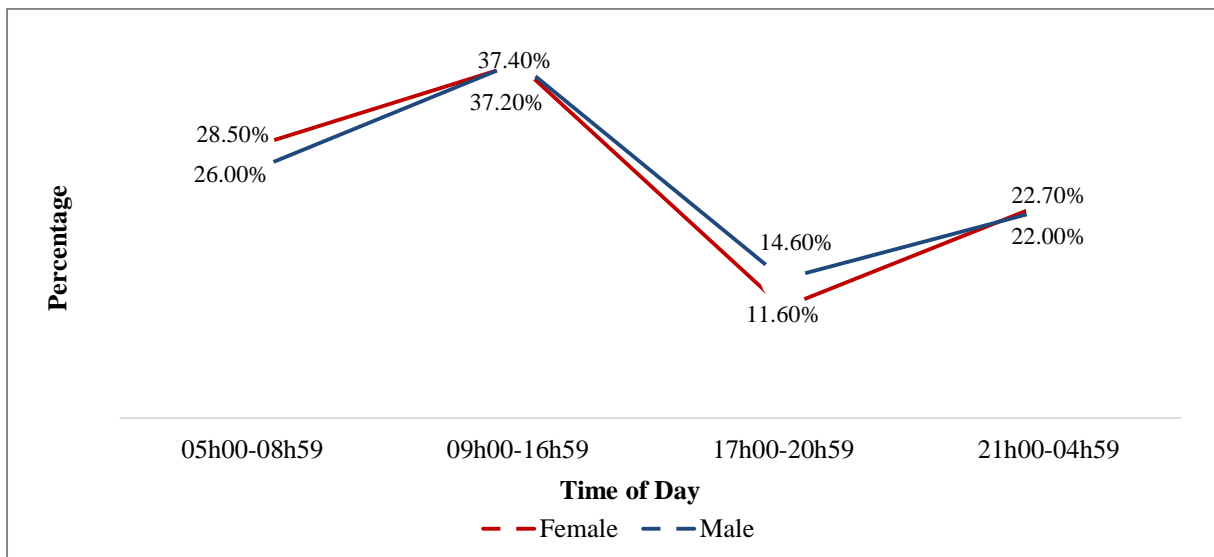
Figure 3. Distribution of homicidal strangulation by sex and time of day, City of Johannesburg, 2001-2010

Day of death by weekday and weekend was registered for 98.8% ($n = 330$) strangulation fatalities. The distribution of strangulation by weekdays and weekend, with the latter commencing on Friday at 16h00, aggregated for the decade under study, indicated no noteworthy difference between the proportion of female and male strangulation fatalities across these two temporal categories. Almost two-thirds more females were strangled over weekdays (63.5%, $n = 122$) than during the weekend period (36.5%, $n = 70$), not altogether unlike the occurrence of male deaths (68.8%, $n = 95$ and 31.2%, $n = 43$ respectively). There were, thus, slightly more female than male strangulations over the weekend interval.

Day of death by each day of the week was specified for 330 (98.8%) strangulation fatalities. Disaggregated by day, there appears to be a relatively even spread of occurrences across the days of the week, with deaths peaking somewhat on Fridays for females (18.2%, $n = 35$), and

on Mondays for males (20.3%, $n = 28$), and dropping to their lowest frequency midweek for females (9.9%, $n = 19$) and on Sundays for males (9.4%, $n = 13$) (see Figure 4).
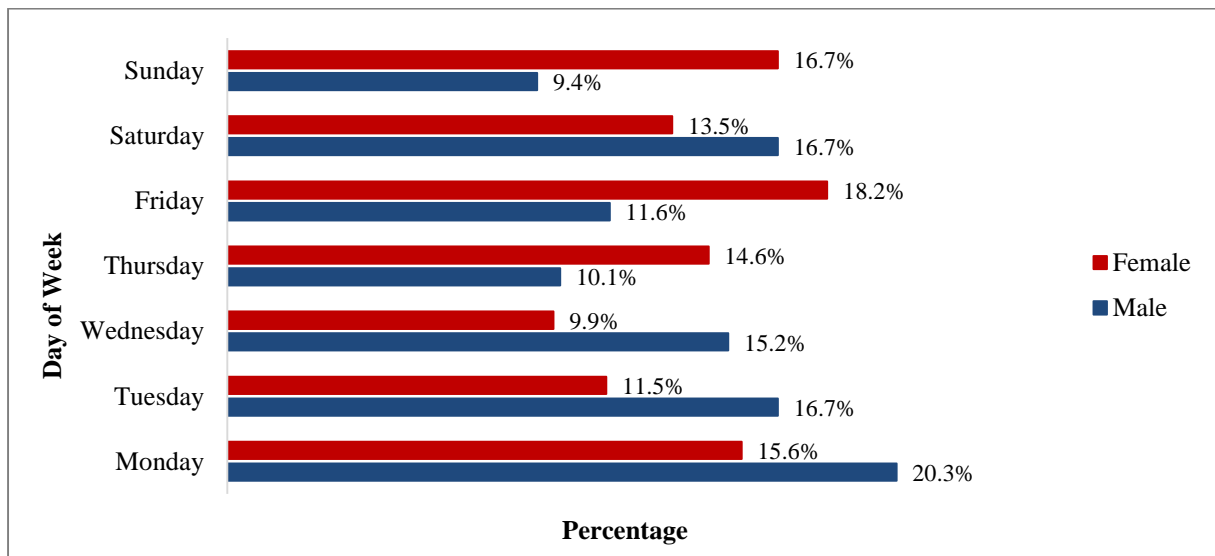
Figure 4. Distribution of homicidal strangulation by sex and day of week, City of Johannesburg, 2001-2010

Month of death was recorded for 330 (98.8%) cases. Figure 5 reveals that the occurrence of female and male strangulation by month of death, for all years combined, is somewhat similar in trend. The highest occurrence of both female and male deaths was in August (15.1%, $n = 29$ and 13%, $n = 18$ respectively), with no apparent pattern differentiating the homicidal strangulation profile across the seasons of the year.
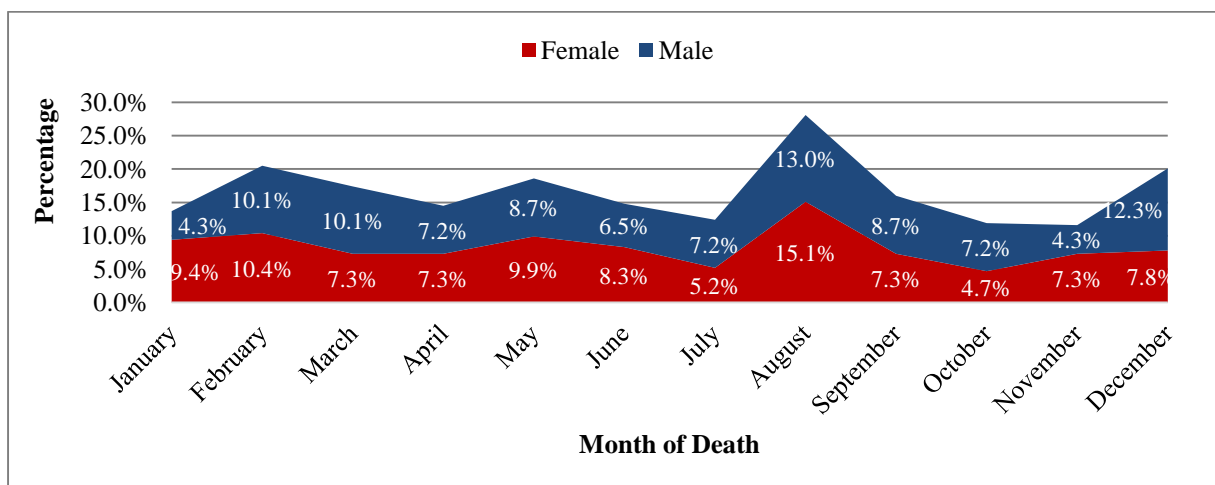
Figure 5. Distribution of homicidal strangulation by sex and month of year, City of Johannesburg, 2001-2010

Homicidal strangulation by place

The crime scene was recorded for 98.5% ($n = 329$) of all strangulation cases; of these, 23 female deaths and 29 male deaths were registered as unknown. For the purposes of the current study, the known scene of fatal injury was categorised into private (residential) and public places. Overall, a significantly higher proportion of victims were strangled in private spaces compared to public locations χ^2 (2, $N = 329$) = 6.17, $p = .046$. The occurrence of death in private places was recorded at 53.1% ($n = 102$) for females and 52.6% ($n = 72$) for males (see Figure 6). More females (34.9%, $n = 67$) than males (26.3%, $n = 36$) were strangled in public places. The proportion of deaths for which the crime scene was unknown was higher for males (21.3%, $n = 29$) than for females (12%, $n = 23$).
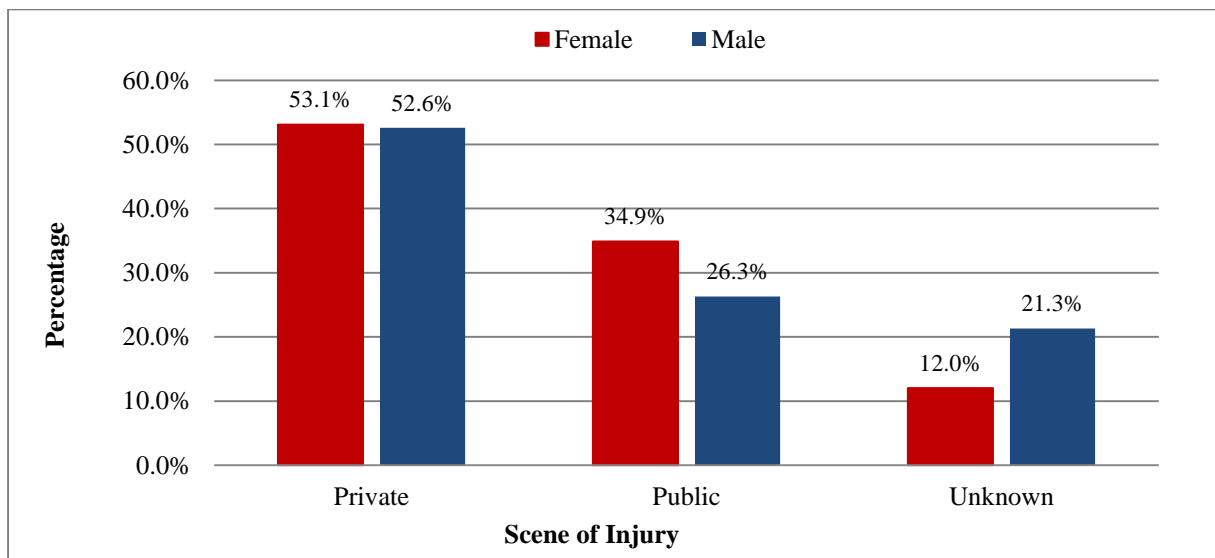
Figure 6. Distribution of homicidal strangulation by sex and scene of injury, City of Johannesburg, 2001-2010

When differentiated by race, and the distribution of female strangulation fatalities examined across the scene of death (99%, $n = 192$), the results approached significance ($p = .061$). On the whole, approximately one-and-a-half-times more females were strangled in private spaces (53.1%, $n = 102$) than in public contexts (34.9%, $n = 67$). The proportion of fatalities was highest for white females compared to the other race groups, with 78.1% ($n = 25$) fatally victimised in private settings and 18.8% ($n = 6$) in public places (see Table 5). Similarly, many more Indian females were killed in residential locations (71.4%, n = 5) than in public ones (28.6%, $n = 2$). The higher number of homicidal strangulations occurring in public spaces were hence among black (38.8%, $n = 54$) and coloured females (35.7%, $n = 5$). This pattern was

repeated for the unknown category of scene of death, with the place of death undetermined for 14.4% ($n = 20$) of black victims and 14.3% ($n = 2$) of coloured females.

For this same computation for males (97.9%, $n = 137$), the results indicated a significant relationship between race and scene of injury χ^2 (6, $N = 137$) = 12.87, $p = .045$. Similar to the overall spatial profile for females, twice as many males were strangled in residential places (52.6%, $n = 72$) than in public spaces (26.3%, $n = 36$). Here too, the occurrence of fatal strangulation events in private places was shown to be elevated for white victims, with five times more male strangulations recorded to have taken place in private spaces (76.9%, $n = 20$) than in public locations (15.4%, $n = 4$) (see Table 5). Of all the race groups, and unlike the female victimisation profile, the highest number of homicidal strangulations in public spaces occurred among Indian males.

When differentiated by age category (84%, $n = 163$), and the distribution of female strangulation fatalities was considered across the scene of death, the results revealed a significant relationship between age group and scene of injury χ^2 (8, $N = 163$) = 16.77, $p = .033$. The scene of injury for females in the 60+ and 45-59 age categories was overwhelmingly the private context (80.8%, $n = 21$ and 76.5%, $n = 13$ respectively) compared to the remaining age groups, which were on average less disproportionately distributed across these two locations (see Table 6). In the 60+ age category, females were strangled in residential localities at seven times the frequency than that recorded for public places (11.5%, $n = 3$). The inverse of this pattern was evident in the higher proportion of female fatalities in the 15-29 age group having occurred in public places (47.5%, $n = 28$) than in private settings. Here again, the profile for unknown scene of death appeared to correspond with that of the public place category, with the highest proportion of deaths occurring in this same 15-29 age group (13.6%, $n = 8$).

The distribution of male homicidal strangulation by age group and scene of injury also indicated significant differences χ^2 (8, $N = 123$) = 16.81, $p = .032$. As with females, the highest proportion was recorded for the 60+ age category, with males in this category strangled ten times more in private spaces (83.3%, $n = 20$) than in public settings (8.3%, $n = 2$) (see Table 6). Similarly, the proportion of occurrence for the 15-29 age group (33.3%, $n = 10$) indicated the scene of death to be predominantly the private context.

Table 5. Homicidal strangulation by race, sex and scene of injury, City of Johannesburg, 2001-2010 (N = 192)

Race	Indian		Black		Coloured		White	
	Female	Male	Female	Male	Female	Male	Female	Male
	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)
Private	71.4% (5)	16.7% (1)	46.8% (65)	48.5% (48)	50% (7)	50% (3)	78.1% (25)	76.9% (20)
Public	28.6% (2)	66.7% (4)	38.8% (54)	26.3% (26)	35.7% (5)	33.3% (2)	18.8% (6)	15.4% (4)
Unknown	0% (0)	16.7 (1)	14.4% (20)	25.3% (25)	14.3% (2)	16.7% (1)	3.1% (1)	7.7% (2)

Table 6. Homicidal strangulation by age group, sex and scene of injury, City of Johannesburg, 2001-2010 (N = 163)

Age Group	0-4		5-14		15-29		30-44		45-59		60+	
	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male
	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)	% (*n*)
Private	58.3% (7)	71.4% (10)	50% (3)	60% (3)	39% (23)	43.3% (13)	55.8% (24)	37.1% (13)	76.5% (13)	53.3% (8)	80.8% (21)	83.3% (20)
Public	41.7% (5)	21.4% (3)	16.7% (1)	20% (1)	47.5% (28)	33.3% (10)	32.6% (14)	28.6% (10)	17.6% (3)	20% (3)	11.5% (3)	8.3% (2)
Unknown	0% (0)	7.1% (1)	33.3% (2)	20% (1)	13.6% (8)	23.3% (7)	11.6% (5)	34.3% (12)	5.9% (1)	26.7% (4)	7.7% (2)	8.3% (2)

Blood alcohol concentration levels

BAC levels were available for only 126 (37.7%) of the recorded homicidal strangulation cases. Of these, the majority of both female (75.4%, $n = 49$) and male (60.7%, $n = 37$) fatalities tested negative for alcohol (see Table 7). Using the South African threshold of 0.05g/100 ml for legal intoxication, less females (18.5%, $n = 12$) than males (32.8%, $n = 20$) tested above the legal BAC limit.

Table 7. BAC levels for female and male homicidal strangulation cases, City of Johannesburg, 2001-2010 (N = 126)

	Female	Male
BAC level (g/100ml)	**% (*n*)**	**% (*n*)**
Zero	75.4 (49)	60.7 (37)
Legal limit (< 0.05g/100ml)	6.2 (4)	6.6 (4)
Illegal limit (≥ 0.05g/100ml)	18.5 (12)	32.8 (20)

DISCUSSION

This study examined the epidemiology of homicidal strangulation in the City of Johannesburg for the period 2001-2010. The fluctuating trend in occurrence over the 10 year period of the study, together with the relatively small number of homicidal strangulation events registered for this time, do not lend themselves to any definitive interpretation about occurrence patterns. Nonetheless, the average annual overall strangulation homicide rate of 0.90 per 100 000 population, and the average annual rate of 1.03 per 100 000 population for females and 0.74 per 100 000 population for males are comparable to those reported in a previous urban-based South African study on fatal strangulation, albeit on female deaths only (Suffla et al., 2008). Strangulation rates have been reported in only a few other studies; a dated Jordanian study estimated the combined overall rate (for females and males) to be 0.17 per 100 000 (Abder-Rahman & Abu-Alrageb, 1999), considerably lower than the rates reported in the current study, while a North American study approximated a combined overall rate of 1.1 per 100 000 (Federal Bureau of Investigation, 2004), analogous to the rates computed here.

More meaningful, however, is the gender difference in victimisation, supported by the higher female strangulation rate, female-male rate ratio and proportion of female deaths observed in this study. While South Africa is reported to have the highest rate of female homicide in the world (Abrahams et al., 2009; Mathews, 2010), it is South African males who are disproportionately represented as victims of lethal violence (Kramer & Ratele, 2012; Ratele, Smith, van Niekerk, & Seedat, 2011; Seedat, Van Niekerk, Jewkes, Suffla, & Ratele, 2009). Thus, the marked female preponderance in strangulation fatality, also observed in an earlier study by Suffla and her colleagues (2008), appears to be a phenomenon that is inimitable to asphyxial homicide. However, the evidence from previous studies appears to be mixed. Thus, the findings of this study correspond with previous research that documents strangulation as a particularly gendered form of violence (e.g., Joshi et al., 2012; Thomas et al., 2013), especially where analyses have established a higher occurrence in females (Mohanty et al., 2004; Sanford et al., 2006; Verma, 2007), but contradict earlier reports of a higher incidence of male strangulation, for example in selected settings in Germany and India (e.g., Häkkänen, 2005; Maxeiner & Bockholdt, 2003; Verma & Lal, 2006).

Building on existing descriptions, as reflected in the literature review, the results of the current study are likely explained by both the opportunistic and relational dimensions of homicidal strangulation. An obvious explanation for the higher female occurrence found here is that strangulation is chosen as a method of murder by perpetrators who are physically stronger than their victims, who are therefore more likely to succumb to the assault. The literature on woman abuse and non-fatal strangulation, in particular, constructs strangulation violence as a method of establishing fear and coercive control, and exerting control, with escalating levels of this form of violence resulting in death; this is a pattern that is typically detected within the context of intimate partner violence (e.g., Glass et al., 2008; Thomas et al., 2013; Wilbur et al. 2001). Although the absence of offender data in the current study does not allow for the relationship status between victims and their perpetrators to be characterised, the existing South African research evidence on femicide (Abrahams, Mathews, Jewkes, Martin, & Lombard, 2012; Mathews, 2010) supports the supposition offered here that the higher occurrence of female strangulation homicides may also be explained by relationship violence perpetrated by intimates.

The age pattern for fatal strangulation appears to be distinct (also see Mathews et al., 2009). This study reported the highest rates of strangulation deaths amongst elderly women and men. In South Africa, females are less likely to become victims of homicide with increasing age (Mathews et al., 2010), while urban men in their twenties and thirties are most at risk for homicide (Ratele et al., 2011). The findings of this study highlight the physical vulnerability of elderly victims, and their relative inability to resist violent attack. Age-related limitations restrict mobility among the elderly and diminish their ability to escape or protect themselves in the context of interpersonal violence. The higher strangulation rate for older women reported in this study is consistent with previous findings that indicate elderly women, in relative terms, to be inherently more vulnerable to victimisation than their male counterparts, and younger women (e.g., Safarik, Jarvis, & Nussbaum, 2000). Vulnerability in elderly women is ascribed to physical size and strength (Nelson & Huff-Corzine, 1998) and also, in some contexts, to the increased risk of widowhood and longer life expectancy (Safarik et al., 2000). The profile of older persons in South Africa highlights the feminisation of ageing in the country (Statistics South Africa, 2014). Elderly South African women, when compared with elderly men, are reported to experience lengthier periods of widowhood and higher life expectancy at older ages (Statistics South Africa, 2014). It may be speculated, then, the clustering of these factors increases strangulation risk among the elderly in general, and among elderly women in particular.

The highest rates of strangulation occurrence were reported among coloured females, and white males. The former finding is consistent with the conclusions drawn in the Suffla et al. (2008) study, and is also consistent with the elevated intimate femicide rate among coloured females, documented in previous South African research on female homicide (Mathews et al. 2004). The race-specific rates also draw attention to occurrence among white and black females. The finding related to males is inconsistent with existing epidemiological descriptions of overall male homicide in urban South Africa, which identify blacks to be most at risk (Ratele et al., 2011). These distinctive, but also dispersed results suggest that the risk of strangulation may be present across, and possibly irrespective of, race groups (also see Suffla et al., 2008). Accordingly, the well-documented explanations in the national and international literature that account for race-related disproportionality in overall homicide, such as those that link race-related risk to socio-structural conditions (e.g., Jones-Webb & Wall, 2008; McCall & Niewbeerta, 2007; Sampson &

Lauritsen, 1994; also see Study IV), bear little resemblance to the current findings, at least in the absence of further investigations. The current study offers only an initial socio-demographic profile of strangulation deaths in the City of Johannesburg; the closer analysis hereof, to better understand racialised vulnerability to strangulation, is undertaken in the studies to follow.

In the current study, the temporal and spatial descriptions of female and male homicidal strangulation were largely identical. Victims were strangled primarily during the day, over the weekday period, and in private locations. When the scene of death was specified by race and age group, the emerging pattern highlights the victimisation of white females and males in private places, and the elderly in private settings. The circumstances of greatest vulnerability for strangulation appear to be those periods when individuals are home-bound during the day, when the majority of people are at work or at school, and therefore the times when protection and safety may not be optimal (also see Suffla et al., 2008). This cluster of factors appear to suggest that the occurrence of strangulation is opportunistic. Given the data on which this study is based, it is not possible to determine whether perpetration in the private context was by an intimate partner; however, it is plausible that at least some proportion of adult females were strangled by intimates. This hypothesis is supported by previous findings that have demonstrated the victim-perpetrator relationship in strangulation violence to be primarily intimate in nature (e.g., Aldridge & Browne, 2003; Häkkänen, 2005; Henderson et al., 2005; Sanford et al., 2006), but warrants further investigation given the contradictory finding of an earlier South African study on female homicide (Mathews et al., 2010). As with the findings on race-specific rates, the victimisation of white individuals in private places requires additional examination. Clearer, though, is the association between age and scene of death, that is, the possibility that risk of strangulation death in private contexts increases with age. According to Safarik et al. (2000), older victims of interpersonal violence are at greater risk of being attacked in their own homes. The elderly are either more likely to live alone, or to be unaccompanied in their private settings during high-risk time periods. In South Africa, there is reportedly an upward trend of the elderly living alone (Statistics South Africa, 2014). Regional variations indicate that the growth of single-member households among the elderly is especially evident in the urbanised provinces of the country, including Gauteng.

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Alcohol consumption has been causally linked to interpersonal violence worldwide (e.g., World Health Organization, 2006), as well nationally (e.g., Seedat, et al., 2009). South Africa's alcohol consumption levels and patterns reveal a total alcohol per capita consumption of 32.8 litres and 16 litres of pure alcohol consumed per male and female aged 15 years or older respectively (World Health Organization, 2014), amongst the highest in the world. However, in this study, proportionally fewer female and male strangulation victims were found to have tested positive for alcohol. This result corresponds with the findings of a recent South African study on adolescent homicide victimisation in the City of Johannesburg (Swart, Seedat, & Nel, 2015), which observed that victims of strangulation were significantly less likely to have consumed alcohol. A South African study on the link between alcohol and femicide established that fatal strangulation victims were either sober or very intoxicated (Mathews et al., 2009a). In contrast, this finding differs from previous South African descriptions of the involvement of alcohol in female and male homicides (e.g., Ratele, Swart, & Seedat, 2009), as well as to international findings on alcohol inebriation and strangulation risk specifically (Häkkänen, 2005; Rodge et al., 2001). The finding that more males than females were legally intoxicated at the time of death is consistent with existing research evidence that indicates binge drinking to be particularly prevalent among urban males (Shaw & Gastrow, 2001). Notwithstanding, the number of cases with BAC records was very small, thereby limiting the interpretations that may be made on the basis of these results. Interpretation of these findings is furthermore limited by the reported pitfalls in forensic toxicology. According to the forensic pathology literature (e.g., O'Neal & Poklis, 1996; Richardson, 2000), the interpretation of ethanol results in cadavers is frequently confounded by the fact that decomposing bodies produce a range of alcohol by-products as they undergo putrefaction. BAC findings are also influenced by such factors as storage temperature and the time interval between death and autopsy.

The above findings are based on a well-established injury mortality surveillance system that provided reliable forensic data for the City of Johannesburg. However, the number of strangulation events studied is relatively small, which is not uncommon in homicide research that seeks to disaggregate data in order to analyse the specificities of different mechanisms of death. Furthermore, the dataset was characterised by missing values for several variables. The problem of small numerators, for example, implies that a minor change in frequency can potentially result in a significant change in the fatality rate from one year to the next, thereby creating instability in

rates. While these limitations restrict the conclusiveness of findings, this study provides useful epidemiological descriptions of a rare event that has earned only very partial scrutiny in international and national research. This study does not aim to quantify causation, but does raise important hypotheses for the further investigation of homicidal strangulation in the City of Johannesburg, as well as in South Africa. In this respect, the current investigation serves as a platform for the three analytic studies that follow, and for the formulation of evidence-based prevention and policy recommendations.

CONCLUSION

This study is one of a limited number of investigations in South Africa to specifically describe the epidemiology of homicidal strangulation in an urban context. The study results indicated fatal strangulation to be the fourth leading cause of homicide, and exhibited a perceptible gender disproportionality in victimisation relative to the other leading causes of death in the City of Johannesburg. The study also indicated the rate of homicidal strangulation occurrence to be highest among the elderly, and among coloured females and white males. With respect to temporal and spatial trends, evidence indicated that victims were strangled primarily during the day, over the weekday period, and in private locations. The socio-demographic and spatio-temporal profiles of occurrence reported here signify initial hypotheses about individual-level and situational homicidal strangulation risk profiles; these are further investigated in Study II and Study III.

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STUDY II

SOCIO-DEMOGRAPHIC AND SPATIO-TEMPORAL PREDICTORS OF HOMICIDAL STRANGULATION IN THE CITY OF JOHANNESBURG, SOUTH AFRICA

Abstract

The literature on the predictors of disaggregated homicide rates exposes a distinct void with respect to strangulation fatality. The current study therefore examines the effects of socio-demographic and spatio-temporal variables on the risk for homicidal strangulation relative to the other leading causes of homicide in the City of Johannesburg for the period 2001-2010. The study draws on routine activities theory to explain these predictors of homicidal strangulation. The data were derived from the National Injury Mortality Surveillance System. A series of logistic regressions were performed to assess the independent associations between each of the predictor variables and fatal strangulation relative to the other leading causes of homicide. The analysis revealed that there are several unique socio-demographic and spatio-temporal factors that differentiate homicidal strangulation risk from the risk for other causes of homicide. Sex was found to be the strongest predictor of homicidal strangulation, with the risk significantly higher for females. The elderly were found to be at marked risk of fatal strangulation, as were children between the ages of 0-14 years. The most noteworthy predictive effects for temporality were observed for time of day and day of the week, with daytime and weekdays representing the periods of higher risk. In the current analyses, scene of death did not emerge as a significant predictor of strangulation homicide. The study supports the contention that differentiated risk profiles for the different causes of homicide are important to recognise and delineate for the purposes of strangulation homicide prevention.

Keywords: homicide; strangulation; socio-demographic; spatio-temporal; predictors; routine activities theory; South Africa

There is a substantial body of research that explains the effects of micro- and macro-level social factors on homicide. Homicide studies, using analytic inquiries to test hypotheses and predictive models, report that there are statistically identifiable and predictable patterns to homicide victimisation, and that the predictors of homicide are complex. This analytic trajectory in homicide studies has tended to focus on the social-structural determinants of homicide (e.g., Pridemore, 2002; McCall, Land, & Parker, 2010), and to combine the different mechanisms of death to provide descriptions of overall incidents (see United Nations Office on Drugs and Crime, 2011). However, over the last several years, analyses have increasingly sought to disaggregate homicide to discern the occurrence probabilities of different homicide types. By and large, these recent studies have established that homicide is a heterogeneous phenomenon, and have thereby helped to uncover previously obscured predictors of disaggregated homicide rates. Research on the sharper distinctions between homicide types has thus allowed for more refined conceptual and empirical descriptions of the demographic and situational predictors of different mechanisms of fatal injury. Accordingly, international and South African studies on the situational predictors of homicide have focused attention on such homicide characteristics as mechanism of death, gender, race, age group and the victim-offender relationship (e.g., Abrahams, Mathews, Jewkes, Martin, & Lombard, 2012; Abrahams, Mathews, Martin, Lombard, & Jewkes, 2013; Campbell et al., 2003; Cao, Hou, & Huang, 2008; Dahlberg, Ikeda, & Kresnow, 2004; DeJong, Pizarro, & McGarrell, 2011; Echeburúa, Fernández-Montalvo, de Corral, & López-Goñi, 2008; Gonzalez-Guarda & Luke, 2009; Hemenway, Shinoda-Tagawa, & Miller, 2002; Kramer & Ratele, 2012; Leyland & Dundas, 2010; Mathews, Abrahams, Jewkes, Martin, & Lombard, 2012; Matzopoulos, Thompson, & Myers, 2014; Piquero & Brame, 2008; Ratele, Smith, Van Niekerk, & Seedat, 2011; Sampson, Morenoff, & Raudenbush, 2005; Swart, 2014; Swatt & He, 2006).

Although the value of more refined theoretical understandings of homicide through disaggregation is by now well established, the literature on the predictors of disaggregated homicide rates exposes a distinct void with respect to strangulation fatality. A search of the literature on strangulation homicide produced evidence on forensic and epidemiological profiles (see Study I), but a near absence of analytic research on the predictive patterns that characterise homicidal strangulation at the individual and situational level. In contrast, firearm homicide, as the leading external cause of death, has procured the most scrutiny across a range of contexts (e.g., Dahlberg et al., 2004; Fox

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& Zawitz, 2002; Hemenway et al., 2002; Kramer & Ratele, 2012; Matzopoulos et al., 2014; United Nations Office on Drugs and Crime, 2011; Wells & Chermak, 2011). The current study therefore extends the descriptive investigation undertaken in Study I to specifically examine, through data modelling, the hypothesis that the probability of being fatally strangled is a core function of demographics and circumstances. Specifically, the study employs multivariate analysis to determine the effects that socio-demographic and spatio-temporal variables exert on the risk for death by strangulation relative to the other leading causes of homicide in the City of Johannesburg for the period 2001-2010. To reiterate, the focus of the study is consistent with prevailing assumptions in the homicide literature that homicide varies by the composition of a population, and across time and space (Gartner, 1990).

Following previous research on homicide, this study draws on routine activities theory to explain the socio-demographic and spatio-temporal predictors of homicidal strangulation specifically. Based on patterns of routine activities, it is expected that the chosen theoretical framework will illuminate the unique patterns associated with lethal strangulation victimisation. Since its emergence in the literature, routine activities theory has been recognised for offering systematic and coherent explanations of criminality patterns that may otherwise have presented as contradictory and disjointed (e.g., Mustaine & Tewksbury, 1999). In fact, the theory was specifically developed as an approach to assembling and synthesising diverse and previously disparate analyses into a single substantive framework that seeks to explain victimisation risks by inferring from demographic and situational variables (Cohen & Felson, 1979; Mustaine & Tewksbury, 2000). These variables are used as proxies and broad indicators of interaction between social actors, living arrangements and normative lifestyle regimes. Routine activities theory was initially critiqued for this very reason; scholars suggested that the use of coarse proxies did not necessarily account for heterogeneity and lifestyle diversity among people (Mustaine & Tewksbury, 2000). However, more recent developments in routine activities theory have demonstrated the use of sophisticated and disaggregated measures of lifestyle activities (e.g., Finkelhor & Asdigian, 1996; Mustaine & Tewksbury, 2000; Pizarro, 2008). Notwithstanding, methodological challenges related to the operationalising of key concepts and acquiring appropriate levels of measurement have limited the rigorous testing of routine activities theory (Mustaine & Tewksbury, 1999, 2000). As indicated earlier, from a predictive modelling

perspective, the theory has therefore been primarily used as a theoretical guide to the development of hypotheses, and to provide an explanatory framework for victimisation risk. Theory-driven modelling allows for the identification of factors that predict homicide, and thus informs prevention efforts.

The study therefore seeks to extend routine activities theory in the context of homicide research in low- to middle-income countries, and relative to homicidal strangulation specifically. Given the limited number of variables and small dataset, the current analysis is ground in routine activities theory; it does not aim to assess it. Model testing in homicide research tends to be hampered by limited dataset size and choice of variables, a situation that is not peculiar to this study, but that is intrinsic to the study of homicide worldwide (Ouimet & Montmagny-Grenier, 2014).

Specifically, the current study addressed the following four questions:
1. What are the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from all other homicides in the City of Johannesburg?
2. What are the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from all firearm homicides in the City of Johannesburg?
3. What are the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from all sharp object homicides in the City of Johannesburg?
4. What are the socio-demographic and spatio-temporal factors that differentiate homicidal strangulation from all blunt object homicides in the City of Johannesburg?

The sections to follow situate the study within the relevant body of literature, describe the components and relevance of routine activities theory in more detail, outline the method, and present and discuss the study findings.

SOCIO-DEMOGRAPHIC AND SPATIO-TEMPORAL VARIATION IN HOMICIDE RISK: THE EVIDENCE

This review suffers from the fact that there is a dearth of published analytic studies on homicidal strangulation risk specifically. For this reason, the section will focus on evidence as related to homicide in the aggregate and, where available, on firearm homicide which has received the most attention in research on disaggregated homicide. In particular, the review will consider findings on age-, race- and sex-specific predictors of homicide, and the temporal and micro-spatial factors that are predictive of risk.

Research indicates that one of the most stable explanations for the disproportionate distributions of fatal violence risk across time and place is demographic variation, as applicable to age, race and gender (e.g., Cohen & Land, 1987; Fox & Piquero, 2003; Trussler, 2012). Demographic factors have thus become central to predictions of homicide. While demographics are not the only, or conceivably the strongest, predictor of homicide rates, and very likely interact with other risk factors, they are widely accepted as a strong predictor of homicide rates. Spatio-temporal factors call into focus the relationships between homicide and characteristics of the physical and social environments in which homicide concentrations occur (Groff & La Vigne, 2002), as well as temporal variations associated with lethal violence, which are commonly associated with changes in human activity patterns (e.g., Ceccato, 2005).

Socio-demographic Risks

According to Trussler (2012), the age-homicide link holds across studies, demonstrating a robust association. This relationship is largely supported by research undertaken in the North, such as in the United States, United Kingdom and Canada, where the young, and male, population has been found to be at highest risk for lethal violence (e.g., Schwartz, 2010; Trussler, 2012; also see Schneider, 2015). Specifically, vulnerability is reported to be elevated in the 15-29 year age group, followed by the 30-44 age category, and to decline steeply with age thereafter; again, this is for males and considerably pronounced relative to the estimated risk for females in the same age groups (e.g., Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002; United Nations Office on Drugs and Crime, 2011). When disaggregated, the established predictive patterns are strongly analogous to those determined for firearm homicide (e.g., Krug et al., 2002; Miller, Hemenway, & Azrael, 2006;

Wells & Chermak, 2011). A comparable pattern is evident in South Africa (see Kramer & Ratele, 2012; Seedat, Van Niekerk, Jewkes, Suffla, & Ratele, 2009; Thaler, 2011). At nine times the global rate (184 per 100 000), the highest homicide rates have been reported among males aged 15-29 years, (Norman, Matzopoulos, Groenewald, & Bradshaw, 2007; also see Norman, Schneider, Bradshaw, Jewkes, Abrahams, Matzopoulos, & Vos, 2010). The vulnerability of younger men to homicide has been ascribed to their more likely participation in violence related activities, such as criminal offenses in public places, gang membership, substance abuse and possession of weapons (United Nations Office on Drugs and Crime, 2011), typically influenced by dominant ideas of what it connotes to be a man (Ratele, 2008).

The racial homicide gap in risk is reportedly enduring and pervasive. There is consistent evidence in the international and national literature that black adults are at increased risk of homicide victimisation compared to other race groups, and that this risk is higher in urban settings and among young men than in other contexts or among other age-gender groups (e.g., Cubbin, LeClere, & Smith, 2000; DeJong et al., 2011; Kramer & Ratele, 2012; O'Flaherty & Sethi, 2010; Ratele, 2009; Schwartz, 2010). In North America, for example, African-American males are estimated to be approximately six times more at risk of being murdered than white American males (O'Flaherty & Sethi, 2010). Based on the finding that black females were more likely to be murdered than white males, O'Flaherty and Sethi (2010) observed that race is a more powerful risk factor than gender. This black-white homicide risk disparity has also been reported in South Africa (e.g., Kramer & Ratele, 2012; also see Shaw & Gastrow, 2001). Black South African males between the ages 20 and 40 are reported to be seventeen times more likely to be murdered compared to white males in the same age group (Ratele et al., 2011). Ratele (2010) explains that in extremely unequal societies, such as South Africa, human development opportunities for the population are vastly asymmetrical so that in the absence of employment and other optimal possibilities for young black males, violence comes to represent an alternative mechanism in some men's attempts to assert their masculinity. An alternative explanation, and perhaps complementary to Ratele's accent on masculinity, is offered by O'Flaherty and Sethi (2010), who maintain that the concentration of homicide risk among blacks cannot be sufficiently accounted for by individual characteristics. They argue that conceptualisations of risk must consider the notion of preemptive motive; that is, individuals sometimes kill purely to avoid being murdered themselves. They elaborate that in

environments perceived to be dangerous, disputes within particular dyadic interactions have the potential to escalate, resulting in violence, as well as notable racial disparities in rates and risk of homicide victimisation. While explanations for the racialised risk profile described here may differ, the empirical evidence appears to remain firm.

As the age-sex and race-sex interactions indicate, gender is an important risk factor in homicide victimisation. Males are at a substantially higher risk of being murdered compared to females, at a global rate of 11.9 per 100 000 compared to 2.6 per 100 000 for females (United Nations Office on Drugs and Crime, 2011). Males are also far more likely to be murdered by strangers or acquaintances whereas women bear the greater risk of intimate partner homicide (e.g., Cao et al., 2008; Gallup-Black, 2005). In fact, across country contexts, the female homicide rate appears to be driven by intimate partner homicide. As with overall female homicide, intimate femicide is commonly referenced as an extreme manifestation of gender inequality, discrimination, power disparities and structural inequalities between the sexes, and the subordinated status of women in society (United Nations Office on Drugs and Crime, 2011). At a rate of 5.6 per 100 000, intimate femicide represents the leading cause of female homicide in South Africa (Abrahams et al., 2012). As already noted, homicide is the leading cause of injury in males (Norman et al., 2007). The marked sex structure and risk differentials for female and male victims of homicide victims appears to have remained relatively stable over time.

Situational Risks

While the combination of, and intersection between age, race and gender demonstrably account for variances in homicide victimisation risk, situational homicide patterns are also considered as essential to deciphering homicide risk (Pizarro, 2008). From a micro-spatial perspective, the crime location is considered to be an important variable both in overall homicide, as well as disaggregated homicide (United Nations Office on Drugs and Crime, 2011). Homicide events have been found to occur more often in some geographic locations than in others (Pizarro, 2008). In this respect, lethal violence is indicated to occur more often in public places through which people navigate in the course of their daily routines (e.g., Pizarro, 2008; Tardiff, Marzuk, & Leon, 1995). In general, this same pattern is iterated for males, but is the converse for females who are reportedly more likely to be murdered in private places (e.g., Swart, 2014; United Nations Office on Drugs

and Crime, 2011). There is thus a discernibly gendered orientation to the relationship between sex and scene of homicide. Research also suggests that homicide in private spaces is more likely to involve a known perpetrator, unlike the pattern observed in fatalities in public spaces such as the street (e.g., United Nations Office on Drugs and Crime, 2011). In fact, in their study, Cao and his colleagues (2008) found that public locations reduced the probability of murder by a known person, but increased the risk of being murdered by a stranger. Thus, evidence suggests that place matters in homicide, both with respect to the type of fatality, as well as the victim-offender relationship.

Research on the temporal patterns in the distribution of homicide indicates that, in general, homicide events are reported to occur with higher frequency during the evening, weekends and the warmer months of the year (e.g., Kposowa & Breault, 1998; Pizarro, 2008; Sisti, Rocchi, Macciò, & Preti, 2012). These times are associated with recreational activities, the use of alcohol and other substances, and increased social interaction, which tend to interact to increase homicidal risk. The temporal patterns for South Africa, at least as they relate to urban homicide, are similar (e.g., Ratele, Swart, & Seedat, 2009; Swart, Seedat, & Nel, 2015; also see Shaw & Gastrow, 2001). However, when disaggregated, the temporal patterns for homicide show a degree of variation across age groups, locations and type of lethal violence (e.g., Carbone-Lopez & Lauritsen, 2013; Ceccato, 2005). In the main, these differences are attributed to the distinct routine activities of different groups of individual across time and space. For example, during the warmer months of the year, people will tend to spend more time and longer hours outdoors, thereby increasing the number of available victims in public places. Seasonal patterns have also been associated with weather patterns, but studies show mixed results on the correlation between weather conditions and lethal violence (e.g., Ceccato, 2005; Murataya & Gutiérrez, 2013). More recent explanations in homicide research focus not so much on the idea that high temperature leads to aggressive behaviour, but instead on the behavioural argument that social interactions in public places increase during the warmer months, thereby leading to greater risk for interpersonal conflict and, at its extreme, homicide (Carbone-Lopez & Lauritsen, 2013).

ROUTINE ACTIVITIES THEORY: EXPLAINING SOCIO-DEMOGRAPHIC AND SPATIO-TEMPORAL PREDICTORS

Socio-demographic and spatio-temporal variations in homicide risk at the individual level have to a large extent been conceptualised within the framework of routine activities theory. Routine activities theory has the conceptual capacity to account for a range of contrary findings, and has resultantly been employed as a guiding framework to understand the socio-demographic and situational patterns of homicide at the individual level (e.g., Carbone-Lopez & Lauritsen, 2013; Mustaine & Tewksbury, 1999; Pizarro, 2008). Thus, as a means of understanding how, to whom, when, where and why victimisation occurs, researchers have increasingly utilised routine activities theory to explain the risk of criminal events, including homicide, within sub-groups of the population and the situational domains in which victimisation occurs (Mustaine & Tewksbury, 1999).

Routine activities theory is posited as one of the most systematically formulated models of ecological variation in individual-level victimisation risk (e.g., Gartner, 1990; Wooldredge, Cullen, & Latessa, 1992). Advanced by Cohen and Felson (1979), routine activities theory argues that homicide is a function of opportunities for victimisation. They explain that for a crime to occur, there must be convergence in time and space of a) a motivated offender, b) a suitable target, and c) a lack of a capable guardian. From this perspective, the structure of regular, everyday activities of individuals potentially places them at risk for homicide victimisation since what individuals do on a daily basis typically facilitates (or inhibits) the conjunction of these three elements. Accordingly, activities that increase the draw towards targets, exposure to potential offenders and proximity to offenders, and decrease levels of guardianship over possible victims are likely to correspond with greater likelihoods of victimisation (Cohen & Felson, 1979).

Victims may know their assailants through contact with them in the course of daily life. It is very likely that the higher risk of homicide in public spaces is a consequence of motivated offenders having greater access to potential victims in these locations. Routine activities theory explains the risky nature of private spaces in relation to the limited presence of capable guardianship in such settings, which renders specific groups vulnerable, such as the elderly living alone. Similarly, the temporal distribution of homicide may be explained by the increase in the contact between targets

and motivated offenders. For example, younger individuals are likely to converge at taverns and bars, at night, and during summer months and weekends when people tend to engage in leisure activities.

METHOD

Data

All cases with valid data for the four leading mechanisms of homicide in the City of Johannesburg for the decade spanning 2001-2010 were derived from the National Injury Mortality Surveillance System (NIMSS). The NIMSS is a mortuary surveillance system that collects and disseminates information on deaths due to non-natural causes (see Introduction to the thesis for a full description of the NIMSS). The dataset included the homicide mechanism; age, race and sex of each homicide victim; time, day and month of the victim's death; scene of homicidal injury; and blood alcohol concentration (BAC) level of the victim. BAC was excluded from the analyses due to there being too few cases in this category (discussed below). The variable coding is based on the descriptive data in all the included cases.

Dependent Variable

The dependent variable for the analyses was homicidal strangulation, measured on a dichotomous scale where the two categories of the independent variable (described below) were considered in terms of the following discrete outcomes: 1) strangulation homicide and all other homicides; 2), strangulation homicide and firearm homicide; 3) strangulation homicide and sharp object homicide; and 4) strangulation homicide and blunt object homicide. As indicated in Table 1, homicidal strangulation accounted for the smallest proportion of all deaths (2.2%, $n = 218$), consistent with its epidemiological profile as the most rare of homicidal events in urban South Africa (see Study I). Of the remaining 97.8% ($n = 9702$), fatalities were caused predominantly by firearm discharge (60.5%, $n = 6005$), followed by sharp object injuries (25%, $n = 2478$) and blunt object injuries (12.3%, $n = 1219$). The strangulation dataset excluded 116 cases with missing data, representing 34.73% of the collection of data analysed in Study I. For the same reason, the combined dataset for the four leading causes of homicide represented 48.17% ($n = 9920$) of the data reported in Study I.

Table 1. Descriptive characteristics of the leading causes of homicide in the City of Johannesburg, 2001-2010 (N = 9920)

	Frequency (N)	Valid Percent (%)
Strangulation	218	2.2
All Other Homicides	9702	97.8
Firearm	6005	60.5
Sharp Objects	2478	25.0
Blunt Objects	1219	12.3

Independent Variables

The predictors selected for analyses included two primary groups of categorical variables: socio-demographic correlates and spatio-temporal correlates. These independent variables are captured in the NIMSS, and are also factors that have been reported to bear an empirical relationship with homicide risk, as reviewed in the preceding section. The independent variables employed in this study are also congruous with the tenets of routine activities theory. For example, within this theoretical formulation, reduced mobility in the elderly could potentially predispose them to homicide risk. The socio-demographic category comprised three independent variables: 1) age group: 0-14, 15-29, 30-44, 45-59 and 60+ years of age, with the latter coded as the reference category; 2) race: Indian, coloured, white and black, with the latter coded as the reference group; and 3) sex, with males coded as the reference category. Four spatio-temporal variables were included in the analyses: 1) time of day: day (05h00-18h59) and night (19h00-04h49), with night coded as the reference category; 2) day of the week: weekdays and weekend (commencing on Friday at 16h00), with the latter serving as the reference group; 3) month of fatal injury by seasonality, with spring coded as the reference category in this four-category variable; and 4) scene of death: private and public places, with the latter representing the reference group.

Missing cases were excluded from the analyses. BAC, which is also included in the NIMSS, was eliminated from the analyses on the basis that the smaller number of cases for which this data are available (40.9%) and the resultant diminished sample size would have led to a substantial loss of overall cases for the regression analyses. The Missing Values Analysis indicated that BAC was Missing Not at Random (MNAR) while all the other variables were Missing at Random (MAR).

These observations increase the degree of confidence that the results are representative of homicidal strangulation in the City of Johannesburg, and that the predictive capacity of the analyses are a result of the variables introduced rather than precision losses and instability in case counts from a lack of standardised inputs across the range of analyses.

Table 2 presents the frequency distribution of all the variables included in the analyses, aggregated for the four leading causes of homicide. The majority of victims were aged between 15 and 29 (41.6%, $n = 4128$) and 30 to 44 (40.7%, $n = 4040$). Blacks (87.4%, $n = 8670$) and males (86.5%, $n = 8580$) were markedly over-represented in the socio-demographic profile of victims. A slightly higher proportion of homicides were committed at night (55.2%, $n = 5475$) and during the weekend (50.5%, n = 5012). Fatalities were almost equally distributed across the season of the year. Private places were identified as the scene of injury for the majority of deaths (54.5%, $n = 5411$).

Table 2. Socio-demographic and spatio-temporal characteristics of homicide victims, City of Johannesburg, 2001-2010 (N = 9920)

	Frequency (N)	Valid Percent (%)
Socio-demographic Variables		
Age		
0-14	173	1.7
15-29	4128	41.6
30-44	4040	40.7
45-59	1198	12.1
60+	381	3.8
Race		
Indian	188	1.9
Coloured	365	3.7
White	697	7.0
Black	8670	87.4
Sex		
Female	1340	13.5
Male	8580	86.5
Spatio-temporal Variables		
Time of Day		
Day	4445	44.8
Night	5475	55.2
Day of Week		
Weekday	4908	49.5
Weekend	5012	50.5
Season of Year		
Summer	2402	24.2
Autumn	2326	23.4
Winter	2624	26.5
Spring	2568	25.9
Scene of Injury		
Private	5411	54.5
Public	4509	45.5

Logistic Regression Analyses

A series of logistic regressions were performed to assess the independent associations between each of the socio-demographic and spatio-temporal predictor variables and the risk for strangulation, relative to other homicide mechanisms. The logistic models thus allow for analytic descriptions of the variables that distinguish homicidal strangulation from the other leading causes of homicide in the City of Johannesburg. Logistic regression is the appropriate statistical prediction technique for a dichotomous, binary-coded dependent variable that represents the log of the odds

of having been strangled. It is also a technique that offers more flexibility than ordinary least squares regression or linear discriminant function analysis (Alderden & Lavery, 2007; Peng, Lee, & Ingersoll, 2002). The independent variables were all recorded as categorical-level variables, and preliminary analyses were undertaken to ensure that the assumptions of logistic regression were not violated. The analyses focused on a series of comparisons between two discrete outcome categories: strangulation and the remaining three leading causes of homicide combined, with the latter coded as the reference category; and strangulation relative to firearm homicide, sharp object homicide and blunt object homicide respectively, with each of the latter three homicide types serving as the reference category. Conceptually analogous explanatory variables were added sequentially to the analyses. Two logistic regression analyses were conducted for each of the comparisons, each one examining a different model, and with all of the predictors introduced simultaneously into each model. The first model examined socio-demographic factors only, and the second model added spatio-temporal variables to the analyses. Model coefficients, exponentiated so that they could be interpreted as adjusted odds ratios (ORs), and 95% confidence intervals (CIs) were used to assess the magnitude and significance of adjusted multivariate associations. A *p*-value of below 0.05 was considered significant. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Version 22).

RESULTS

Eight logistic regression models were estimated to predict homicidal strangulation in the City of Johannesburg for the period 2001-2010, using socio-demographic and spatio-temporal variables as predictors. Findings from the series of logistic regression models are described and compared below. The findings are discussed in relation to the model that examined only the socio-demographic variables associated with homicide mechanism (Model 1), and the model that assessed both socio-demographic and spatio-temporal factors (Model 2).

Strangulation Homicide Versus All Other Homicides

Model 1: Analysis of socio-demographic variables

The results of the logistic regression are presented in Table 3. A test of the full model against a constant only model was statistically significant, indicating the set of predictors to be reliably differentiating of homicidal strangulation and all other homicides combined (chi square = 389.801,

p = .000 with df = 8). Indicatively, the model explained 20.2% (Nagelkerke's R^2) of the variance in the dependent variable. The Wald criterion demonstrated that all three socio-demographic variables made a significant contribution to prediction (p < 0.05).

When examining the socio-demographic characteristics that were significant at the multivariate level, it was found that, when compared to the 60+ age group, individuals in the other age groups were between 4 and 5 times less likely to be strangled in relation to all other homicides, pointing to the increased vulnerability of the elderly among the adult groups. Although overall age was significantly associated with homicidal strangulation, the decomposed effects indicated a non-significant result for the 0-14 year age group when compared to the 60+ year age group. Compared to blacks, the Indian group was almost three times more likely to die from strangulation [OR (95% CI): 2.683 (1.277-5.634), p < 0.05] as opposed to the other three leading causes of homicide combined; also compared to blacks, coloureds were marginally less at risk, but still twice more likely to be strangled [OR (95% CI): 2.185 (1.237-3.859), p < 0.05], and whites almost two times more at risk [OR (95% CI): 1.764 (1.139-2.733), p < 0.05]. The odds ratio for sex indicates that when holding all other variables constant and relative to all other homicides, females were almost nine times more likely to die from strangulation [OR (95% CI): 8.508 (6.389-11.331), p < 0.05] than males. Gender was the strongest socio-demographic predictor for homicidal strangulation when considered in relation to all other homicide types combined.

Model 2: Analysis of spatio-temporal variables

The results from Model 2 indicate that the overall logistic regression model was statistically significant (chi square = 442.780, p = .000 with df = 14). Adding the spatio-temporal variables generated a pseudo R^2 (Nagelkerke) of .229, indicating that the second model fit the data slightly better. All the independent variables except the scene of strangulation injury emerged as significant predictors of strangulation homicide at the p < 0.05 level.

As in Model 1, the nature and direction of the relationships between the socio-demographic predictor variables and the dependent variable were very similar (see Table 3). A single difference emerged; when the spatio-temporal variables were added and when compared to the 60+ age group, the odds of younger children (0-14) being strangled increased almost two-fold [OR (95%

CI): 1.851 (1.005-3.411), p < 0.05], relative to all other homicides. Compared to nighttime strangulations, fatal strangulation was almost two-and-half times more likely to occur during the daytime [OR (95% CI): 2.286 (1.668-3.133), p < 0.05] relative to all other homicides. The risk of being strangled during the weekday was higher by almost one-and-a half times [OR (95% CI): 1.371 (1.014-1.855), p < 0.05] compared to the weekend when considered in relation to all other homicides. In terms of seasonality, when compared to spring, strangulations were more than two times likely to occur in autumn [OR (95% CI): 2.195 (1.404-3.430), p < 0.05], slightly more than the risk of occurrence in summer [OR (95% CI): 2.138 (1.367-3.344, p < 0.05] and winter [OR (95% CI): 1.799 (1.147-2.822), p < 0.05], relative to all other homicides.

Table 3. Logistic regression analysis for strangulation versus all other homicides, City of Johannesburg, 2001-2010

Independent Variable	Model 1			Model 2		
	Exp(B)	95% CI for Exp(B)		Exp(B)	95% CI for Exp(B)	
		LL	UL		UL	LL
Socio-demographic Variables						
Age						
0-14 yrs	1.751	.959	3.199	1.851*	1.005	3.411
15-29 yrs	.236*	.144	.388	.278*	.168	.459
30-44 yrs	.200*	.122	.327	.227*	.138	.375
45-59 yrs	.218*	.124	.384	.238*	.135	.421
60+ yrs	.	.	.	.	.	.
Race						
Indian	2.683*	1.277	5.634	2.552*	1.224	5.323
Coloured	2.185*	1.237	3.859	2.224*	1.254	3.946
White	1.764*	1.139	2.733	1.694*	1.090	2.633
Black	.	.	.	.	.	.
Sex						
Female	8.508*	6.389	11.331	7.802*	5.809	10.479
Male	.	.	.	.	.	.
Spatio-temporal Variables						
Time of Day						
Day	…		…	2.286*	1.668	3.133
Night	…		…	.	.	.
Day of Week						
Weekday	…		…	1.371*	1.014	1.855
Weekend	…		…	.	.	.
Season of Year						
Summer	…		…	2.138*	1.367	3.344
Autumn	…		…	2.195*	1.405	3.430
Winter	…		…	1.799*	1.147	2.822
Spring	…		…	.	.	.
Scene of Injury						
Private	…		…	1.067	.785	1.449
Public	…		…	.	.	.

Likelihood Ratio Tests: Model Chi-Square = 389.801 p = .000   Model Chi-Square = 442.780 p = .000
Pseudo R-Square: Nagelkerke = 0.202   Nagelkerke = 0.229
N = 9920

Note. *p < .05; Exp(B) = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit.
The reference category for the dependent variable is All Other Homicides.

Strangulation Homicide Versus Firearm, Sharp Object and Blunt Object Homicide

Model 1: Analysis of socio-demographic variables

Findings from the series of regression models that examined strangulation homicide, where the reference category was firearm, sharp object and blunt object homicide respectively, indicated that the overall models were statistically significant at the $p < 0.05$ level (chi square = 631.354, p = .000 with df = 24), with a pseudo R^2 (Nagelkerke) value of .071. The Wald criterion established that all the independent variables were significant in determining risk for homicidal strangulation ($p < 0.05$).

The effects for age were relatively similar to Model 1 of the previous series of regression models. Here too, the risk for strangulation among the elderly was elevated, with the likelihood of being strangled highest in this age category in relation to each of the other causes of homicide (see Table 4, 5 and 6). Also of statistical significance, when compared to the elderly (60+ years), children (0-14 years) were more than two times likely to die from strangulation relative to sharp object homicide [OR (95% CI): 2.164 (1.057-4.432), $p < 0.05$]. It is worth noting that although overall age was significantly associated with homicidal strangulation, the decomposed results indicated that there was no significant effect for the 0-14 year age group when compared to the 60+ year age group relative to firearm and blunt object homicide, and the 15-29 year age group in relation to blunt object homicide.

The odds of strangulation for Indians, coloureds and whites, when compared to blacks, varied in relation to firearm, sharp object and blunt object homicide. Indians were approximately five times [OR (95% CI): 5.278 (2.289-12.174), $p < 0.05$] and three times [OR (95% CI): 3.199 (1.381-7.410), $p < 0.05$] more likely to be strangled relative to sharp and blunt object homicide respectively. The risk of strangulation for coloureds, in comparison to blacks, was about two-and-a-half times more relative to firearm homicide [OR (95% CI): 2.548 (1.429-4.544), $p < 0.05$] and blunt object homicide [OR (95% CI): 2.382 (1.267-4.479), $p < 0.05$]. Whites were about three times more at risk for fatal strangulation [OR (95% CI): 3.192 (1.928-5.286), $p < 0.05$] as opposed to blunt object homicide, and two-and-a-half times more at risk [OR (95% CI): 2.613 (1.617-4.223), $p < 0.05$] in relation to sharp object homicide. The decomposed results indicated that compared to blacks, there was no significant difference in the odds of Indians and whites being

strangled as opposed to being victims of firearm homicide, and being coloured was not a significant predictor of fatal strangulation relative to sharp object homicide. That is, Indians and whites were not significantly more at risk than blacks for strangulation compared to firearm homicides, and coloureds were not significantly more vulnerable to strangulation than blacks when compared to the risk of death from sharp object injury. Finally, the risk of strangulation homicide increased significantly when the homicide victim was female as opposed to being male, in relation to firearm, sharp object and blunt object homicide. At almost a ten-fold likelihood [OR (95% CI): 9.501 (7.099-12.716), $p < 0.05$], the risk of female homicidal strangulation was most pronounced relative to firearm homicide, and least indicated in relation to blunt object homicide [OR (95% CI): 6.669 (4.849-9.173), $p < 0.05$]. Overall, the socio-demographic variables were strongly associated with homicidal strangulation.

Model 2: Analysis of spatio-temporal variables

The full models for firearm, sharp object and blunt object homicide tested as statistically significant (chi square = 983.963, p = .000 with df = 42). Indicatively, the models explained 10.9% (Nagelkerke's R^2) of the variance in the dependent variable when the spatio-temporal explanatory variables were introduced, suggesting that Model 2 fit the data better for each of the regressions. Scene of death was not a significant predictor of strangulation. All the other independent variables were significant in determining risk for homicidal strangulation at the $p < 0.05$ level.

The effects of age and race assumed a similar association with the dependent variable as observed in Model 1 (see Tables 4, 5 and 6). Again, the risk of strangulation homicide was significantly higher for females than males when compared across all three comparison homicide categories. The decomposed results indicated the risk for strangulation to be significantly higher during the day than at night relative to firearm homicide, at almost three times the likelihood [OR (95% CI): 2.657 (1.935-3.650), $p < 0.05$], and in relation to sharp object homicide, at two-and-a-half times the likelihood [OR (95% CI): 2.280 (1.650-3.151), $p < 0.05$], but not significant for blunt object homicide. Although overall day of death was significantly associated with homicidal strangulation, the decomposed effects indicated that weekdays, compared to weekends, was a significant predictor of strangulation in relation to sharp object [OR (95% CI): 2.121 (1.555-2.893), $p < 0.05$] and blunt object homicide [OR (95% CI): 1.382 (1.005-1.902), $p < 0.05$], but not statistically

significant in relation to firearm homicide. Similar to Model 1 in the comparison between strangulation and all other homicides, when compared to spring, the risk of strangulation during the other seasons was almost double when examined in relation to firearm, sharp object and blunt object homicide respectively.

Table 4. Logistic regression analysis for strangulation homicide versus firearm homicide, City of Johannesburg, 2001-2010

	Model 1			Model 2		
	Exp(B)	95% CI for Exp(B)		Exp(B)	95% CI for Exp(B)	
Independent Variable		LL	UL		UL	LL
Socio-demographic Variables						
Age						
0-14 yrs	1.775	.937	3.365	1.869	.977	3.572
15-29 yrs	.177*	.106	.296	.202*	.120	.340
30-44 yrs	.153*	.092	.254	.171*	.102	.286
45-59 yrs	.176*	.099	.314	.190*	.106	.340
60+ yrs	.	.	.	.	.	.
Race						
Indian	2.095	.989	4.438	1.999	.950	4.205
Coloured	2.548*	1.429	4.544	2.563*	1.430	4.594
White	1.289	.823	2.018	1.227	.781	1.929
Black	.	.	.	.	.	.
Sex						
Female	9.501*	7.099	12.716	8.704	6.447	11.752
Male	.	.	.	.	.	.
Spatio-temporal Variables						
Time of Day						
Day	…		…	2.657*	1.935	3.650
Night	…		…	.	.	.
Day of Week						
Weekday	…		…	1.128	.832	1.529
Weekend	…		…	.	.	.
Season of Year						
Summer	…		…	2.249*	1.433	3.528
Autumn	…		…	2.144*	1.368	3.359
Winter	…		…	1.697*	1.079	2.669
Spring	…		…	.	.	.
Scene of Injury						
Private	…		…	1.081	.794	1.472
Public	…		…	.	.	.

Likelihood Ratio Tests:	Model Chi-Square = 631.354 p = .000	Model Chi-Square = 983.963 p = .000
Pseudo R-Square:	Nagelkerke = 0.071	Nagelkerke = 0.109
N = 9920		

Note. *$p < .05$; Exp(B) = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit.
The reference category for the dependent variable is Firearm Homicide.

Table 5. Logistic regression analysis for strangulation homicide versus sharp object homicide, City of Johannesburg, 2001-2010

Independent Variable	Model 1			Model 2		
	Exp(B)	95% CI for Exp(B)		Exp(B)	95% CI for Exp(B)	
		LL	UL		UL	LL
Socio-demographic Variables						
Age						
0-14 yrs	2.164*	1.057	4.432	2.305*	1.114	4.768
15-29 yrs	.215*	.124	.372	.267*	.153	.465
30-44 yrs	.198*	.115	.342	.235*	.135	.407
45-59 yrs	.237*	.128	.439	.266*	.143	.494
60+ yrs	.	.	.	.	.	.
Race						
Indian	5.278*	2.289	12.174	4.729*	2.060	10.856
Coloured	1.619	.901	2.910	1.683	.932	3.041
White	2.613*	1.617	4.223	2.425*	1.494	3.937
Black	.	.	.	.	.	.
Sex						
Female	7.720*	5.698	10.460	6.972*	5.099	9.535
Male	.	.	.	.	.	.
Spatio-temporal Variables						
Time of Day						
Day	…	…		2.280*	1.650	3.151
Night	…	…		.	.	.
Day of Week						
Weekday	…	…		2.121*	1.555	2.893
Weekend	…	…		.	.	.
Season of Year						
Summer	…	…		1.976*	1.250	3.122
Autumn	…	…		2.271*	1.437	3.588
Winter	…	…		2.093*	1.320	3.320
Spring	…	…		.	.	.
Scene of Injury						
Private	…	…		.985	.719	1.349
Public	…	…		.	.	.
Likelihood Ratio Tests:	Model Chi-Square = 631.354 p = .000			Model Chi-Square = 983.963 p = .000		
Pseudo R-Square:	Nagelkerke = 0.071			Nagelkerke = 0.109		
N = 9920						

Note. *p < .05; Exp(B) = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit.
The reference category for the dependent variable is Sharp Object Homicide.

Table 6. Logistic regression analysis for strangulation homicide versus blunt object homicide, City of Johannesburg, 2001-2010

Independent Variable	Model 1			Model 2		
	Exp(B)	95% CI for Exp(B)		Exp(B)	95% CI for Exp(B)	
		LL	UL		UL	LL
Socio-demographic Variables						
Age						
0-14 yrs	1.706	.864	3.368	1.807	.911	3.588
15-29 yrs	.724	.418	1.253	.779	.448	1.356
30-44 yrs	.464*	.270	.800	.498*	.288	.862
45-59 yrs	.379*	.205	.701	.398*	.215	.738
60+ yrs	.	.	.	.	.	.
Race						
Indian	3.199*	1.381	7.410	3.224*	1.399	7.433
Coloured	2.382*	1.267	4.479	2.441*	1.295	4.601
White	3.192*	1.928	5.286	3.180*	1.916	5.276
Black	.	.	.	.	.	.
Sex						
Female	6.669*	4.849	9.173	6.307*	4.550	8.744
Male	.	.	.	.	.	.
Spatio-temporal Variables						
Time of Day						
Day	…	…		1.329	.953	1.854
Night	…	…		.	.	.
Day of Week						
Weekday	…	…		1.382*	1.005	1.902
Weekend	…	…		.	.	.
Season of Year						
Summer	…	…		2.033*	1.272	3.247
Autumn	…	…		2.245*	1.405	3.588
Winter	…	…		1.770*	1.105	2.834
Spring	…	…		.	.	.
Scene of Injury						
Private	…	…		1.115	.807	1.539
Public	…	…		.	.	.

Likelihood Ratio Tests:	Model Chi-Square = 631.354 p = .000	Model Chi-Square = 983.963 p = .000
Pseudo R-Square:	Nagelkerke = 0.071	Nagelkerke = 0.109
N = 9920		

Note. *p < .05; Exp(B) = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit.
The reference category for the dependent variable is Blunt Object Homicide.

DISCUSSION

This study investigated the socio-demographic and spatio-temporal factors predictive of homicidal strangulation in the City of Johannesburg, and applied routine activities theory to explain this exceptional instance of non-natural death. The logistic regression findings provide empirical support for the general theoretical argument that homicides are associated with a distinctive combination of demographic and situational factors (e.g., Cao et al., 2008) in an urban context. That is, when all other variables are held constant, both socio-demographic and spatio-temporal predictors appear to distinguish lethal strangulation from other homicides in the City of Johannesburg, thereby supporting the notion that different forms of homicide have different risk patterns. Sex was found to be the most influential predictor of homicidal strangulation. Although the strength of effects varies somewhat across the regression models, the effects are consistently strong, with a staggering sixfold to nearly tenfold likelihood of more female than male deaths from strangulation relative to overall homicide, as well as to each of the other leading causes of homicide in South Africa. Similarly, age emerged as a significant variable in fatal strangulation risk, with the elderly at marked risk of fatal strangulation. The current analysis suggests that children between the ages of 0-14 years are also at greater risk of homicidal victimisation by strangulation. Although race made a statistically significant contribution to prediction across all the regression models, interpretation of the results evinces a pattern that is essentially reflective of the high overall homicidal victimisation risk faced by black South Africans compared to the other race groups, as reported in the literature (Seedat et al., 2009). All the temporal variables exhibited statistically significant effects for homicidal strangulation in relation to the combined and disaggregated leading causes of homicides. The most noteworthy predictive effects were observed for time of day and day of the week, with daytime and weekdays representing the periods of higher risk. In the current analyses, scene of death did not emerge as a significant predictor of strangulation homicide in any of the models. These results are explained below.

The finding that females are disproportionately at risk for fatal strangulation compared to males confirms the risk profile implied in existing South African and other descriptive research on homicidal strangulation (Glass et al., 2008; Hunt et al., 2010; Rodge, Hougen, & Poulsen, 2001; Sanford et al., 2006; Suffla, Van Niekerk, & Arendse, 2008; Verma, 2007; see Study I), but diverges from epidemiological observations that describe a marked male preponderance in

strangulation fatality (e.g., Häkkänen, 2005; Maxeiner & Bockholdt, 2003; Verma & Lal, 2006). When compared to homicide in the aggregate, the findings on fatal strangulation present in stark contrast to the dominant risk pattern established in national and international homicide research, which indicates the concentration of risk to be among males (e.g., Seedat et al., 2009; United Nations Office on Drugs and Crime, 2011). As interpreted in Study I, a possible explanation for the particularly gendered nature of the sex risk profile is that strangulation perpetration, usually by men, targets individuals who are perceived to be physically vulnerable. However, females are also likely to be perceived as a suitable target for reasons that relate to the articulation of gender roles and power relations in society. The perpetration of violence, in particular by males against females, is frequently the result of gendered power inequities that function to exploit distinctions between males and females, be they physical, psychological, sexual, economic or social. It would appear then that strangulation shares the same gendered patterns and facilitators as other forms of violence against women so that the unequal gender relations that serve to enforce and maintain female's subordinate role and that are, in turn, tolerated and supported by socio-political, socio-economic and socio-cultural institutions and arrangements, render females as suitable targets of homicidal strangulation. In contrast, men's violence against other males, is theorised to be largely a function of antagonistic acts of hegemonic masculinity against subordinate forms of masculinity.

Although not directly supported by the data analysed here, it may be speculated that, from a routine activities theory framework, the movement of females into the public domain as a consequence of urbanisation, labour force participation, and increased mobility and freedom of movement additionally increases their risk of victimisation. South Africa's urbanised economy has witnessed the most rapid growth in the City of Johannesburg. Within this context, there has been a notable increase in female mobility for livelihood purposes (Todes, Kok, Wentzel, van Zyl, & Cross, 2010). Cohen and Felson (1979) conceptualise this as risk that is linked to opportunity structures for legitimate activities. However, the micro-geography of homicidal strangulation is not restricted to public spaces. An equally legitimate hypothesis is that a substantial proportion of homicidal risk is associated with intimates, where females represent the large majority of victims and violence is perpetrated within the home (e.g., Swart, 2014; United Nations Office on Drugs and Crime, 2011). According to routine activities theory, this is also a pattern that is reflective of the routines of daily life. In this instance, it may be hypothesised that victims and offenders are in closer spatial

proximity, with violence concentrated in a private place that is devoid of protection due to the lack of capable guardianship, and strangulation representing a proximal act of violence. The dichotomising of space as public and private has not been without critique. This has stemmed largely from critical feminist scholarship on space and violence, which has argued that the public-private division over-simplifies and rigidifies representations of space (e.g., Bonnin, 2000; Meth, 2003; Pain, 2000; Rasool Bassadien & Hochfeld, 2005). Still, in homicide analyses as the kind undertaken in this study, understanding spatial variations in risk offers a valuable opportunity for developing context-specific interventions. The contributions of feminist work serve as a reminder that these need to be informed by a critical understanding of socio-spatial practices and arrangements as they relate to fatal interpersonal violence.

The finding indicating elevated risk for strangulation homicide among the elderly lends empirical support to the descriptive results reported in Study I, as well as elsewhere in the literature (e.g., Suffla et al., 2008). Here too, the age risk profile presents as especially distinct in comparison to the victimisation risk for overall, firearm, sharp object and blunt object homicide, which demonstrates vulnerability in the younger age groups (e.g., Krug et al., 2002). In the main, research findings report that the elderly experience low rates of victimisation and high levels of fear of violent crime in comparison to other age groups, and that elderly women experience the most fear about safety on the streets (Kennedy & Silverman, 1990; Pain, 1997; Policastro, 2013). This of course does not imply that older women are powerless, helpless and dependent (Pain, 1997). Routine activities theory explains this low victimisation rate and reduced vulnerability as the self-protective propensity of the elderly to avoid high risk public spaces, especially at night. However, in the case of strangulation homicide, the risk representation that emerges is one that in fact highlights the risk attributes of a potentially protective factor, where older individuals are victimised in their homes either by those who occupy the same space or by strangers. Under these circumstances, compromised or absent guardianship and the potential privacy of the scene of victimisation, together with their physical vulnerability contributes to the identification of the elderly as suitable targets. These findings suggest that the theoretical concept of exposure is an important and complex one in homicide risk prediction.

The argument made about reduced guardianship in the home context and increased target vulnerability among the elderly appears to obtain support from South African research on the murder-robbery link. Altbeker (2008) hypothesises that there is a relationship between South Africa's rate of robbery and its homicide rate. According to South Africa's crime statistics for 2013-2014, house robberies increased by 7.4% from the previous year, with an average of 53 households attacked each day (Africa Check, 2014). The statistics for the City of Johannesburg are conceivably very similar. Although the lack of perpetrator data does not allow for verification, it is possible that strangulation homicide of the elderly commonly involves house robbery, and that the victims suffer violent death during the course of this theft-related crime. Research has also implicated sexual violence in the fatal strangulation of elderly women (Abrahams et al., 2008; Häkkänen, 2007). Thus, for the elderly, the relative safety of the home is undermined by their vulnerability to fatal strangulation during crimes of robbery and sexual violence, which are driven by offenders' motivation to burgle and/or rape.

Although the effects are not as consistent across the regression models as evident for the elderly group, children between the ages of 0-14 also face greater risk for homicidal strangulation. As with the elderly, the young are suitable targets since they are physically vulnerable and unable to thwart attack. Children, especially in the younger age groups, spend more time in their homes and interact primarily with immediate family members. From a routine activities theory perspective, they are therefore likely to be protected from strangers and criminality, but the same does not apply in the case of threat from family members. In this situation, there is convergence of a perpetrator with motive, a vulnerable victim, and absent or weak guardianship. Kennedy and Silverman (1990) suggest that it is for this reason that children are more likely to be killed near their homes and by a family member. A recent study on child homicide patterns in South Africa indicated that overall, among children under the age of 18 years, most victims were killed by someone known but unrelated to them, followed by mothers, who perpetrated almost half of all the girl homicides (Mathews et al., 2012). Almost a quarter of the girl victims in this study were strangled (Mathews et al., 2012). The findings of the current study therefore echo the growing concern in South Africa about children's vulnerability to homicide.

In relation to blacks, the risk for strangulation death is shown to be higher in all the other race groups if considered across the eight predictive models. As stated, in this instance the findings are more meaningfully understood in inversion -that blacks are less likely to be strangled to death-than explained by particular fatal strangulation risk attributes borne by Indians, coloureds and whites. Nonetheless, further scrutiny is clearly warranted for a more distilled understanding of the race risk profile for strangulation homicide. As it presents, though, this result controverts previous claims that race is a more powerful risk factor than gender; in strangulation homicide, the pattern is evidently converse.

Temporality effects indicated daytime and weekdays to represent the periods of higher risk. These variables were also illuminated in the preceding epidemiological study. The findings of the current study contradict previous South African and international research that reports overall risk to be concentrated at night and during weekends (e.g., Pizarro, 2008; Ratele et al., 2009) accentuating the distinctive temporal risks for strangulation homicide (also see Suffla et al., 2008). These findings also appear to diverge from the traditional emphasis in routine activities theory on night and weekend as indicators of peak risk that is driven by the combination of recreational pursuits, the use of substances, and increased social interaction. In the context of the overall discussion of the study results, it is hypothesised that places characterised by low time and day occupancy rates, and therefore limited capable guardianship, are the most likely to be considered as targets by motivated offenders. As considered in Study I, these are the periods when individuals are home-bound during the day, and when most others are at work or at school, thereby increasing vulnerability to strangulation attack. While seasonality was a statistically significant predictor in the current study, the variation in effects between seasons and across the models did not exhibit a remarkable pattern other than that the risk of strangulation is higher for all the seasons examined in relation to the reference category, that is, spring. Seasonal patterns in violence have been reported to account for a relatively small fraction of the variance in crime rates and risk (Carbone-Lopez & Lauritsen, 2013), if any at all (Björkstén, Kripke, & Bjerregaard, 2009). Carbone-Lopez and Lauritsen (2012) therefore suggest a scrutiny of long-term trends for understanding temporal risk variation in violence, a recommendation that is relevant to this study too.

The non-significant effects for scene of death were entirely unexpected given the descriptive results reported in Study I and also in other studies (e.g., Häkkänen, 2007; Suffla et al., 2008), the emphasis in the empirical literature on crime location and risk, the assumptions of routine activities theory, as well as the arguments developed in the preceding discussion, which suggest the association of homicidal strangulation risk with private places. The altogether non-significant effect of scene of death as an explanatory variable warrants cautious interpretation. This variable was signified by a large number of missing values and a high proportion of cases where scene of death was classified as unknown, resulting in 37.3% of missing cases. It is arguable that had the data been more robust, the effect of scene of strangulation death in the multivariate analysis would have emerged as significant. Accordingly, crime location cannot be discounted as a predictor of fatal strangulation until further empirical analysis is undertaken.

The following methodological limitations of the current study need to be considered. Firstly, missing data represented a challenge; a large number of missing values resulted in the exclusion of a considerable number of cases in the analysis. This was most pronounced for BAC (65%) and scene of death (37.3%). Furthermore, the study drew on a single sample for all the models to minimise uncertainty about whether the observed predictive effects were a function of changes in sample characteristics or a valid representation of lethal strangulation risk. A limitation hereof is the diminished sample size. Although this analysis drew from the NIMSS, which is currently the most reliable source of homicide data for the City of Johannesburg and offers a rich source of data, it does not include perpetrator data, which is likely to offer important information on such factors as the victim-offender relationship and offence motivation. Furthermore, the results cannot be generalised to a larger population of citizens. The data were cross-sectional and therefore examining the stability of the predictor variables over time was not possible. Additionally, the current analyses only included individual-level measures, and therefore did not account for the interaction of demographic and situational risk factors with socio-structural ones. Despite these important caveats, the current study offers valuable theoretical insights into the demographic and situational risk of homicidal strangulation.

CONCLUSION

The current study offers an initial assessment of the socio-demographic and spatio-temporal predictors of homicidal strangulation in an urban South African context, and employs a micro-level theoretical framework to explain its risk attributes. Although routine activities theory is largely untested for its empirical and contextual relevance in low- to middle-income countries such as South Africa, where data do not lend themselves to the direct measurement of routine activities and behaviours, it nevertheless serves as a useful initial explanatory framework for the current study. The analysis reveals that there are several unique socio-demographic and spatio-temporal factors that differentiate fatal strangulation risk from the risk for other causes of homicide. The predictive effects exerted by these factors are particularly stable for sex, age, and time and day of fatal strangulation. It is important to emphasise that although multivariate analysis implies causation, it is employed in this study primarily for the purposes of establishing probabilities, thereby offering initial evidence of fatal strangulation risk. The study also supports the contention that homicide is not a homogeneous crime, but exhibits differentiated socio-demographic and situational risk profiles for the different causes of homicide, which are important to recognise and delineate for the purposes of homicidal strangulation prevention. Thus, the current study reinforces the imperative to study homicidal criminality within a disaggregated analytic frame, and thereby to extend knowledge on fatal strangulation, which in its current form derives almost exclusively from descriptive research. As one response to the further development of scholarship on strangulation homicide, Study III will deepen the analysis on the pronounced gender differentials detected thus far in Study I and Study II.

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STUDY III

RISK FACTORS FOR FEMALE AND MALE HOMICIDAL STRANGULATION IN THE CITY OF JOHANNESBURG, SOUTH AFRICA

Abstract

Sex-specific homicide research highlights the ways in which gender distinctiveness contextualises and explains lethal violence. However, gendered empirical and theoretical applications are almost completely absent in research on homicidal strangulation. Accordingly, the current study employs a sex-disaggregated and comparative research approach to investigate the individual-level risk factors for female and male homicidal strangulation in the City of Johannesburg for the period 2001-2010. The study engages theories of femininities and masculinities to consider sex-specific risk profiles. Data for the study were drawn from the National Injury Mortality Surveillance System. Logistic regressions were conducted separately to examine the independent associations between each of the independent variables and homicidal strangulation in females and in males relative to all other female and male homicides respectively. When strangulation homicide data were disaggregated by sex, differential risks for females and males were uncovered for age, race, day of week, and scene of death. Results indicated the risk for fatal strangulation to be higher for both females and males 60 years and older, but markedly high only for males in the children and adolescent age group. The study isolated risk among Coloured females and white males specifically. Temporal risk patterns denoted the risk for females to be undifferentiated for day of the week, and the risk for males to be higher during weekdays. The findings detected that females are more likely to be strangled in public places, and males in private locations. The study underlines the importance of undoing universalised understandings of homicide risk as they relate to gender.

Keywords: homicide; strangulation; risk; predictors; individual-level; gender; masculinities; femininities; South Africa

The body of scholarship focused on the categorisation of homicidal victimisation by sex is marked by the span of research during the last decade that seeks to explore the patterns and correlates of homicide victimisation among females and males, as well as theoretical considerations that construct fatal violence as a highly gendered occurrence. Gender-focused research is integral to homicide research that disaggregates fatal events into finer conceptual categories to elucidate and explain the individual, situational and structural factors that present as unique across homicide causes and types. The gendering of homicide research is specifically supported by the argument that the inclusion of gender in analyses on lethal violence strengthens theoretical explanations through rejecting erroneous assumptions about similarities between females and males (Browne & Williams, 1993). The inclusion of a gender focus in homicide analyses also develops the potential depth and rigor associated with conducting comparative research, especially as it helps to uncover factors assumed to be universal in explaining female and male homicide occurrence (Steffensmeier & Haynie, 2000). Sex-specific homicide analyses thus highlight the distinguishing nature of gender and gender experiences, and the ways in which this distinctiveness contextualises and explains lethal violence.

Sex-specific homicide studies have focused on female and male homicide individual-level victimisation patterns of occurrence within and between a range of cities and countries (e.g., Hemenway, Shinoda-Tagawa, & Miller, 2002; Kramer & Ratele, 2012; Mathews, 2010; Pridemore, 2003; also see Study II). Studies have also investigated the association of female and male homicide with socio-structural factors, such as gender and economic inequality, urbanisation, social disorganisation, ethnic heterogeneity, family disruption, and the victim-perpetrator relationship (e.g., Agha, 2009; Browne & Williams, 1993; Campbell, Glass, Sharps, Laughon, & Bloom, 2007; Cubbins, Pickle, & Fingerhut, 2000; Frye et al., 2008; Haynie & Armstrong, 2006; Jordan et al., 2010; Lanier & Huff-Corzine, 2006; Madkour, Martin, Halpern, & Schoenbach, 2010; Titterington, 2006; Vieraitis, Britto, & Kovandzic, 2007; also see Study IV).

Notably, these gendered empirical and theoretical applications are almost completely absent in research on homicidal strangulation, both nationally as well as internationally (also see Study II). Published research on homicidal strangulation focuses almost exclusively on descriptive accounts of occurrence (see Study I), with disaggregated and analytic studies on strangulation homicide risk

a rarity in homicide research. At least one study on risk was detected in the literature; the study, an important contribution to the identification of lethal strangulation risk profiles, was undertaken in North America and investigated strangulation homicide risk specifically in the context of intimate partner violence. Using a case control design, this analysis examined non-fatal strangulation by an intimate partner as a risk factor for severe assault, attempted homicide or and completed homicide of women (Glass et al., 2008; also see Wilbur et al., 2001). Glass and her colleagues (2008) established that non-fatal strangulation was associated with over sevenfold odds of becoming a completed homicide.

Given the afore-mentioned gaps in homicidal strangulation research, and consistent with the empirical shifts towards examining the variation that exists across homicide type and gender, this study seeks to build on the descriptive analysis reported in Study I, and the assessment of socio-demographic and spatio-temporal predictors of homicidal strangulation for females and males combined, described in Study II. Following emerging evidence on the distinctive gender differentials in the occurrence and risks of fatal strangulation, and following the logic of the preceding study, Study III employs a sex-disaggregated and comparative research approach to investigate the individual-level risk factors for female and male homicidal strangulation in the City of Johannesburg for the period 2001-2010. The analysis also describes the similarities and differences in risks for female and male strangulation homicide relative to within-sex homicide risk profiles. The study engages a gendered theoretical lens to consider sex-specific risk for lethality. Through disaggregation by sex, the current study thus represents a conceptually- and gender-focused approach.

Specifically, the current study addressed the following two questions:
1. What are the individual-level risk factors that differentiate female homicidal strangulation from all other female homicides in the City of Johannesburg?
2. What are the individual-level risk factors that differentiate male homicidal strangulation from all other male homicides in the City of Johannesburg?

The next section summarises the literature on sex-specific homicide risk. This is followed by a description of the theoretical location of the study and the method. The final sections present and discuss the study findings.

DIFFERENTIAL INDIVIDUAL-LEVEL HOMICIDE RISK BY GENDER

Disaggregated and comparative analyses on female and male homicide victimisation patterns have produced some diverse findings. Where some researchers have assessed homicide patterns between the sexes to be largely similar, others have demonstrated that homicide rates and risks vary considerably by gender. Several North American studies, especially those undertaken in the last century, reported evidence of minimal gender differences in homicide risk (e.g., Brewer & Smith, 1995; Gartner, 1990; Smith & Brewer, 1992). These studies concluded that variation in female homicide risk is determined by factors that assume great similarity with those that influence variation in male homicides (Marvell & Moody, 1999; Steffensmeier & Haynie, 2000), and have perhaps raised more questions about the gendered nature of lethal violence than clarified it. Given social and public concerns about violence against women in particular, homicide research has spawned a plethora of studies that have scrutinised the dynamics underpinning female and intimate partner homicide; attempted to unravel the differential patterns of associations with a range of factors; and adopted gender-specific theories to explain female homicide victimisation (e.g., Abrahams, Mathews, Martin, Lombard, & Jewkes, 2013; Agha, 2009; Campbell et al., 2003; Campbell et al., 2007; Frye et al. 2008; Frye & Wilt, 2001; Garcia, Soria & Hurwitz, 2007; Moracco, Runyan, & Butts, 2003; Pizarro, DeJong, & McGarrell, 2010; Pridemore & Freilich, 2005; Smith, Fowler, & Niolon, 2014; Swatt & He, 2006; Titterington, 2006). In South Africa, the accent on female homicide has come to be complemented by a growing empirical emphasis on males, who are disproportionately the victims of homicides (e.g., Kramer & Ratele, 2012; Ratele, 2010; Ratele, Smith, Van Niekerk, & Seedat, 2011). In general, gendered analyses on homicide have illuminated the extent to which the patterns of overall homicide victimisation are in fact those of male fatal violence, and the degree to which variations in female homicide are concealed by the significantly higher prevalence of male homicides. Studies have resultantly interrogated the universalising of risks and explanations across gender (e.g. Agha, 2009; Marvell & Moody, 1999).

Investigations on individual-level predictors of female and male homicide victimisation have concluded that gender is an influential risk factor in fatal violence (also see Study II). The male-female gap in homicide victimisation is referenced against steady evidence that, at a global rate of 11.9 per 100 000 compared to 2.6 per 100 000 for females (United Nations Office on Drugs and Crime, 2011), males are considerably more at risk of being murdered compared to females. The conspicuous exception here is the gender risk profile for homicidal strangulation, the only external cause of death for which higher risk is demonstrated in females (see Study II). The risk of overall homicide in males is elevated in the 15-29 and 30-44 year age groups relative to other age groups, as well in relation to the estimated risk for females in the same age categories (e.g., Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002; United Nations Office on Drugs and Crime, 2011). Homicide research in South Africa has demonstrated equivalent age risk trends for males (e.g., Kramer & Ratele, 2012; Seedat, Van Niekerk, Jewkes, Suffla, & Ratele, 2009; Thaler, 2011), and also identified male children and adolescents as a high risk group (Mathews, Abrahams, Jewkes, Martin, & Lombard, 2012; Swart, 2014). Research findings have signaled homicide risk among the elderly as well (Jordan et al., 2010). In the case of fatal strangulation, Study II identified this vulnerability for females and males combined. Race disaggregated homicide patterns in South Africa also parallel the evidence from international studies, which shows black males to bear a higher risk of homicide victimisation compared to white males (e.g., O'Flaherty & Sethi, 2010). In South Africa, specifically, there is a seventeen times likelihood of black males between 20-40 years of age being murdered relative to white males in the same age group (Ratele et al., 2011). Furthermore, the extant literature on homicide risk indicates that female homicides are less likely than male homicides to be perpetrated by strangers or acquaintances, and more likely to occur in private locations in comparison to the risk profile for males (e.g., Cao, Hou, & Huang, 2008; Gallup-Black, 2005; Jordan et al., 2010; Swart, 2014; United Nations Office on Drugs and Crime, 2011). The most significant similarity noted between female and male homicide victimisation concerns offender characteristics; the majority of offenders are male regardless of the sex of the victim (Marvell & Moody, 1999). Thus, the reported differences in individual-level risk for female and male homicide victimisation appear to be fairly substantial.

The distinguishing risk characteristics for female homicide, alongside global lifetime prevalence estimates of intimate partner violence, assessed in 2010 to be 30% of females aged 15 and over

(Devries et al., 2013), and public and political discourses on violence against women and girls, has given rise to a growing research tradition on intimate partner homicide. Although the current study does not include data to allow for examination of the victim-offender relationship, the well-defined empirical focus on intimate partner homicide intersects with, and offers valuable insights into overall female homicide victimisation. Recent estimates of intimate partner homicide indicate that at least one in seven homicides globally, and more than a third of female homicides are perpetrated by an intimate partner (Stöckl et al., 2013). In South Africa, in 2009, 57.1% of murdered women were killed by an intimate partner (Abrahams et al., 2013). Females represent the higher proportion of intimate partner homicide victims, and males the higher proportion of intimate partner homicide offenders, with black women at highest risk for fatal intimate partner violence (e.g., DeJong, Pizarro, & McGarrell, 2011; Garcia et al., 2007; Serran & Firestone, 2004; Smith et al., 2014). In fact, intimate partner homicide is reportedly the most common form of lethal violence against adult females (Kivivuori & Lehti, 2012), and found to drive the female homicide rate across countries (Devries et al., 2013). At a rate of 5.6 per 100 000, intimate femicide represents the leading cause of female homicide in South Africa (Abrahams et al., 2013). From a gendered perspective, contributions on intimate partner homicide against women have theorised it as a mechanism employed by men to maintain dominance and patriarchal social relations, and the lethal manifestation of male violence as reflective of male socialisation processes that privilege hegemony, control and proprietary rights over women (e.g., DeJong et al., 2011; Kivivuori & Lehti, 2012; Serran & Firestone, 2004). In turn, intimate partner homicide offending by women is viewed as a defensive reaction to the violent behaviour of the male victim (e.g., Kivivuori & Lehti, 2012; Serran & Firestone, 2004; Swatt & He, 2006). This interpretation has emerged from studies that demonstrate a link between lethal and non-lethal forms of violence. The evidence remains consistent that homicides by intimates are frequently preceded by a history of violence, characterised by coercive control; threats to kill; estrangement; actual or imminent separation; alcohol abuse and illicit drug use; harassment; stalking; and, relevant to this study, previous non-fatal strangulation (Campbell et al., 2007; Garcia et al., 2007; Glass et al. 2008; Jordan et al., 2010; Madkour et al., 2010; Moracco et al., 2003; Smith et al., 2014).

FEMININITIES AND MASCULINITIES: THEORETICAL PESRPECTIVES ON GENDER AND HOMICIDE

Theoretical perspectives on sex-specific homicide patterns broadly translate into two central conceptual frameworks for understanding individual-level risk patterns, theories of femininities and masculinities. Typically, these perspectives focus on gender inequality, gender status, gender hierarchy and gender power, and patriarchy as a source of male-on-male and male-on-female violence. Contemporary homicide research in South Africa draws largely from these theoretical orientations to explain the occurrence and risks of interpersonal violence. While this theoretical alignment is reflective of the growth and contributory value of gender-centred scholarship in South Africa, it is also an indication of the gaps in homicide data, which curtail theory-testing and the development of more exacting explanatory frameworks. The latter is evidenced in sex-specific international studies that have, for example, tested the ameliorative (women's increased social status decreases their risk of homicide victimisation) and backlash (women' increased power increases their risk of homicide victimisation) hypotheses to assess gender inequality as a social-structural correlate of female homicide victimisation (e.g., Haynie & Armstrong, 2006; Pizarro et al., 2010; Pridemore & Freilich, 2005; Reckdenwald & Parker, 2010; Titterington, 2006; Vieraitis et al., 2007; Whaley & Messner, 2002).

Furthermore, there is an increasing shift from more one-dimensional explanations of violence to a convergence of theoretical constructs into integrated and dynamic conceptual frames that are multi-dimensional in nature and that recognise the complex interplay of factors that underpin interpersonal violence (e.g., Barak, 2006). The conjunction of theories of femininities and masculinities in homicide research is supported by the argument that gender categories are socially constructed, relational in nature, and intersect with other social divisions (e.g., Kimmel, Hearn & Connell, 2005; McCarry, 2007). That is, masculinities and femininities are argued to be co-created in the processes through which societies shape conceptions of gender through power relations (Connell, 1995). From this perspective, gender is viewed as a dynamic social structure that resides in social transactions. This gender relations approach also recognises that, in part, gender is negotiated through relationships of power (Courtenay, 2000), which are located and enacted in, among other, men's violence against females and other males.

Feminist perspectives are central in theorising about men's violence against women. In brief, feminist analyses on the subject have argued male violence to have two inter-related functions; at the individual level, men's use of violence seeks to exert power and control over women, and at the structural level, it serves to perpetuate a system of male domination, privilege and entitlement (e.g., Boonzaier, 2003; McCarry, 2007). These gendered processes are embedded in patriarchy, a system and social script of dominance by men over women and by men over other men (Stanistreet, Bambra, & Scott-Samuel, 2005). In South Africa, and equally elsewhere in the world, the resultant gender inequality is manifest and maintained through violence, including homicide (Seedat et al., 2009).

It is increasingly recognised that feminist analyses of violence against women and the role of men therein, as well as the prevention of its occurrence, are incomplete in the absence of a focus on men and masculinities (e.g., Lau, 2008; McCarry, 2007; see Kimmel et al., 2005; Hearn & Whitehead, 2006; Luyt, 2005; McCarry, 2007; Pridemore & Freilich, 2005; Ratele, 2008; Ratele, 2010; Ratele et al., 2011; Redpath, Morrell, Jewkes, & Peacock, 2009; Shefer, Ratele, Strebel, Shabalala, & Buikema, 2007; Stevens, 2008). Notwithstanding positive masculinities, this body of work observes that in South Africa and globally, males are the primary protagonists of interpersonal violence, with the victims of their violent actions and behaviours being both women and men. Hegemonic masculinities are implicated in the use, threat and reproduction of homicidal violence (e.g., McCarry, 2007; Ratele, 2010; Seedat et al., 2009). From the perspective of masculinities theory, there are hegemonic and subordinate forms of masculinity, characteristically based on men's social power (Kaufman, 1999). Hegemonic masculinity, considered to subordinate femininities as well as other forms of masculinity, reflects and influences men's social relationships with women and other men (Courtenay, 2000). In their enactments of violence against women and other males, men demonstrate dominant or hegemonic masculine ideals aimed at structuring, negotiating and sustaining masculinities, and reinforcing a sense of manhood. In general, hegemonic masculinities are encoded in expressions of toughness, fearlessness, bravery and codes of honour which place them at risk of either murdering or being murdered themselves (e.g., Ratele, 2010, Seedat et al., 2009). For example, research has found that gender income equality is experienced by some groups of men as real or perceived status loss, and thereby undermining of their masculinity, resulting in higher rates of female homicide victimisation as

these males react defensively (Pridemore & Freilich, 2005). According to Seedat and his colleagues (2009), in the context of South Africa's high youth unemployment rate, conflicts directed at guarding status and honour against perceived threats are not uncommon, sometimes resulting in fatal violence.

METHOD

Data

Data on all the valid homicidal strangulation cases recorded for the City of Johannesburg for the period 2001-2010 were drawn from the National Injury Mortality Surveillance System (NIMSS). The NIMSS is a mortuary surveillance system that provides information about deaths due to external causes, collated from investigative procedures at forensic pathology service laboratories and state forensic chemistry laboratories (see Introduction to the thesis for a full description of the NIMSS). The data included information on the cause of homicide; socio-demographic profile of each fatal strangulation victim, including age, race and sex; spatial and temporal descriptions of each case, including the time, day and month of the victim's death, and scene of homicidal injury; and the victim's blood alcohol concentration (BAC) level. However, the BAC level of the victim was not included in the current analyses due to the high proportion of missing data (discussed later in this section).

Dependent Variable

Female homicidal strangulation and male homicidal strangulation were coded as the dependent variable for the two discrete analyses that comprise the focus of this study. Following the investigation undertaken in Study II, these dichotomous outcomes were disaggregated here by gender to enable the examination of the differential influence of various factors on the occurrence of the fatal event for females and males specifically. All other homicides recorded for the City of Johannesburg for the specified period served as the reference category for both analyses. Firearm, sharp object and blunt object homicide were not included as additional reference categories in this study given the strong correspondence in patterns noted in Study II between strangulation homicide and all other homicides combined, and all other homicides disaggregated. Of the total of 9920 homicide cases recorded, homicidal strangulation accounted for 2.2% ($n = 218$) of all deaths, representing the smallest proportion of all deaths relative to firearm discharge, sharp object

homicide and blunt object homicide (see Study II). Males represented a disproportionately high percentage of victims for all homicides combined (86.5%, $n = 8580$), with 1% ($n = 88$) occurring from fatal strangulation injury, and females constituted 13.5% ($n = 1340$) of all fatalities, of which 9.7% ($n = 130$) deaths were attributed to strangulation (see Table 1). The strangulation homicide dataset excluded 116 cases with missing data, representing 34.73% of the overall dataset analysed in Study I.

Independent Variables

The independent variables included in the study constellated around two groups of predictors, socio-demographic and spatio-temporal factors. These sets of predictors have been consistently recognised as the factors that account for variations in homicide risk across different contexts and groups (see Study II). Furthermore, the NIMSS provides systematic information about the incidence of non-natural death, thus availing vital descriptions on homicide events in the City of Johannesburg. The socio-demographic set of predictors included two independent variables: 1) age group: 0-14, 15-29, 30-44, 45-59 and 60+ years of age, with the latter coded as the reference group in this five-category variable; and 2) race: Indian, coloured, white and black, with the latter coded as the reference category. The spatio-temporal group of predictors incorporated four variables: 1) time of day: day (05h00-18h59) and night (19h00-04h49), with night coded as the reference category; 2) day of the week: weekdays and weekend (commencing on Friday at 16h00), with the latter representing the reference grouping; 3) month of death by seasonal cycle, with spring coded as the reference category; and 4) scene of death: private and public places, with the latter serving as the reference group.

Cases with missing values were excluded from the analyses. Given the smaller number of cases for which BAC data were available (40.9%) and the substantially reduced sample size that the inclusion of BAC data would have implied, BAC was not included as an independent variable. Furthermore, the analysis of missing values indicated that BAC was Missing Not at Random (MNAR), signifying a non-representative sample and biased estimates, while all the other variables were Missing at Random (MAR). Accordingly, the results are more likely to be representative of strangulation homicide in the City of Johannesburg, and demonstrate predictive effects that are a function of the variables introduced. In this case, there is less of a concern with

decreases in the precision of effect estimates, and of unreliable parameter estimates as a result of inconsistent inputs across the analyses.

Table 1 presents the frequency distribution of all the variables included in the analyses, aggregated for female and male homicide respectively. The majority of female victims were distributed across the 15-29 (37.8%, $n = 507$) and 30-44 (37.5%, $n = 503$) age ranges. Duplicating this profile, a preponderance of male deaths was recorded in these same age categories, 42.2% ($n = 3621$) and 41.2% ($n = 3537$) respectively. Black male (88.3%, $n = 7578$) and female deaths (81.5%, $n = 1092$) accounted for the largest proportion of all deaths in females and males alike. Whereas fewer males were murdered during the day than at nighttime (43.2%, $n = 3709$), more female homicides occurred during daytime (56.3%, $n = 755$). Similarly, there were less male fatalities during the weekday (48.4%, $n = 4153$) than during the weekend, compared to female victims for whom the inverse description is noted (56.3%, $n = 755$). Homicides were almost equally distributed across the season of the year, with a slightly greater clustering around winter and spring for both females and males. Private places were determined to be the scene of injury for the majority of female and male deaths; in women, there was a larger proportion of deaths in private spaces (73.1%, $n = 980$) compared to public places (26.9%, $n = 360$).

Table 1. Characteristics of female and male homicide victims, City of Johannesburg, 2001-2010 (N = 9920)

	Females (N = 1340)		Males (N = 8580)	
	Frequency (N)	**Valid Percent (%)**	**Frequency (N)**	**Valid Percent (%)**
Homicide Mechanism				
Strangulation	130	9.7	88	1
Other	1210	90.3	8492	99
Age				
0-14	65	4.9	108	1.3
15-29	507	37.8	3621	42.2
30-44	503	37.5	3537	41.2
45-59	182	13.6	1016	11.8
60+	83	6.2	298	3.5
Race				
Indian	25	1.9	163	1.9
Coloured	62	4.6	303	3.5
White	161	12	536	6.2
Black	1092	81.5	7578	88.3
Time of Day				
Day	736	54.9	3709	43.2
Night	604	45.1	4871	56.8
Day of Week				
Weekday	755	56.3	4153	48.4
Weekend	585	43.7	4427	51.6
Season of Year				
Summer	316	23.6	2086	24.3
Autumn	326	24.3	2000	23.3
Winter	368	27.5	2256	26.3
Spring	330	24.6	2238	26.1
Scene of Injury				
Private	980	73.1	4431	51.6
Public	360	26.9	4149	48.4

Logistic Regression Analyses

Logistic regressions were conducted separately to examine the independent associations between each of the predictor variables and homicidal strangulation in females and in males in relation to

all other female and male homicides respectively. The logistic regression models allow for analytic descriptions of the variables or risks that distinguish female and male homicidal strangulation from the other leading causes of homicide in the City of Johannesburg, and thereby also allow for a description of the differences in the risks for female and male fatal strangulation. Logistic regression analysis assesses the influence of various factors on a dichotomous outcome by estimating the log of the odds or probability of that event's occurrence, in this case strangulation homicide in females and in males. Logistic regression is also a more statistically appropriate technique for handling dichotomous outcomes than ordinary least squares regression or linear discriminant function analysis (Alderden & Lavery, 2007; Peng, Lee, & Ingersoll, 2002). All the independent variables included in the current analyses were recorded as categorical-level variables, and preliminary analyses were performed to ensure that the assumptions of logistic regression were not violated. All other female homicides combined and all other male homicides combined were coded as the reference categories. As undertaken in Study II, theoretically similar predictor variables were added sequentially to the analyses. Two logistic regression analyses were conducted to assess the risks associated with female and male homicidal strangulation respectively, with each analysis examining a different model, and with all of the independent variables introduced concurrently into each model. The first model examined socio-demographic factors only, and the second model included spatial and temporal variables in the analyses. Model coefficients were exponentiated so that they could be translated into adjusted odds ratios (ORs) and 95% confidence intervals (CIs) were calculated to measure the magnitude and significance of adjusted multivariate associations. A *p*-value of below 0.05 was treated as significant. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS Version 22).

RESULTS

A series of logistic regressions were constructed to predict the probabilities of female and male homicidal strangulation in the City of Johannesburg for the period 2001-2010. Logistic regression estimates were calculated for the effects of selected demographic (Model 1) and situational (Model 2) variables associated with female and male strangulation homicide respectively. The results of the logistic regressions are presented in Table 2, and described and assessed below.

Female Strangulation Homicide Versus All Other Female Homicides

Model 1

The overall model when compared to the constant only model tested to be significant at the $p <$ 0.05 level (chi square = 39.485, p = .000 with df = 7), indicating the probability that the observed values of the dependent variable may be predicted from the observed values of the independent or demographic variables. The Nagelkerke's R^2 indicated a relationship of 6.2% between the predictors and the dependent variable. The Wald statistic demonstrated the significance ($p < 0.05$) of each of the demographic predictors in the model.

At the multivariate level, the analysis revealed age to be a significant predictor of female homicidal strangulation. Based on the preceding analyses (Study I and Study II), the B coefficient's negative direction was as expected. When compared to the 60+ age group, females in the 15-29, 30-44 and 45-49 age categories were respectively 2.62 [OR (95% CI): .381 (.193-.751), p < 0.05], 3.55 [OR (95% CI): .282 (.143-.554), p < 0.05] and 3.88 [OR (95% CI): .258 (.118-.563), p < 0.05] times less likely to be murdered by strangulation relative to all other female homicides. Although the aggregate effect for age was found to be significant, the decomposed effects demonstrated a non-significant result for the youngest age group (0-14 years), also observed in the results of the logistic regression (Model 1) for strangulation and all other homicides combined (Study II). Thus, when disaggregated by sex, the age risk differentials for female strangulation homicide appear to follow the same pattern as that established for all strangulation homicides. When compared to black females, coloured females were found to be two-and-a-half times more likely to die from strangulation [OR (95% CI): 2.527 (1.244-5.089), p < 0.05] as opposed to all other female homicides. The decomposed effects were not significant for Indians and whites when compared to blacks, unlike the effects reported for these two race groups in the logistic regressions analyses for strangulation and all other homicides (Study II).

Model 2

The overall model was significant (chi square = 65.989, p = .000 with df = 13) at the p < 0.05 level, and explained 10.2% (Nagelkerke's R^2) of the variance in the dependent variable with the addition of the temporal and spatial variables, indicating a better model fit than the previous. Excluding day of the week, all the independent variables were significant in determining female

strangulation homicide ($p < 0.05$). Interestingly, in the logistic regression for strangulation and all other homicides combined (Study II), the Wald criterion indicated day of the week to be a significant predictor but scene of death to be non-significant.

After controlling for all the variables in the analysis, age and race were similarly a significant predictor of female fatal strangulation. The direction of the relationship between each of these two independent variables and the dependent variable, as well as their decomposed effects were identical to the results observed for Model 1. Women 60 years and older and coloured females, compared to black females, were thus identified to be most at risk for fatal strangulation relative to all other female homicides. Time of day significantly predicted female homicidal strangulation in relation to all other female homicides. When compared to nighttime strangulations, the risk of being strangled to death during the day was almost two times higher [OR (95% CI): 1.715 (1.141-2.576), $p < 0.05$]. The positive direction of the relationship between time of day and female homicidal strangulation was also reported in Study II for strangulation and all other homicides combined. When compared to spring, females were about two-and-a-half times more likely to be strangled in summer [OR (95% CI): 2.336 (1.297-4.206), $p < 0.05$], slightly less than in autumn [OR (95% CI): 2.087 (1.152-3.780), $p < 0.05$] and winter [OR (95% CI): 1.846 (1.023-3.332), $p < 0.05$]. Here too, the estimated effects correspond with the logistic regression results of Study II for strangulation and all other homicides combined. However, in the current study, scene of strangulation death was found to predict female strangulation homicide. Females were 1.67 times less likely to die in private places [OR (95% CI): .593 (.399-.881), $p < 0.05$] than in public locations relative to all other female homicides. Although the risk distribution between private and public spaces is not highly disproportionate, this finding presents as contrary to initial hypotheses about the private spatial context representing risk (See Study I), and is also inconsistent with the non-significant effects estimated in Study II. It appears, therefore, that the significant effects of this variable have been rendered more evident through both data modelling techniques, as well as the disaggregation of fatal strangulation homicide by sex.

Male Strangulation Homicide Versus All Other Male Homicides

Model 1

The results of the first analysis, which examined only the demographic variables associated with male strangulation homicide victimisation, indicated the overall logistic regression model to be statistically significant at the $p < 0.05$ level (chi square $= 120.250$, $p = .000$ with df $= 7$), with a pseudo R^2 (Nagelkerke) value of .129. The Wald test assessed both independent variables to be statistically significant ($p < 0.05$) in differentiating risk between male strangulation homicide and all other male homicides in the City of Johannesburg.

In the multivariate analysis, the estimated effects for age were similar to those reported for females above. Specifically, males in the 15-29, 30-44 and 45-49 age categories, when compared to the 60+ age group, were respectively 7.25 [OR (95% CI): .138 (.066-.287), $p < 0.05$], 7 [OR (95% CI): .143 (.070-.290), $p < 0.05$] and 5.2 [OR (95% CI): .192 (.086-.429), $p < 0.05$] times less likely to be fatally strangled relative to all other male homicides. These risk estimates are somewhat lower than those reported for females in the same age categories relative to all other female homicides. However, unlike the non-significant effect reported for the child and adolescent female group, and also the effects noted in Study II, males aged 0-14 years were about four times [OR (95% CI): 4.130 (1.855-9.194), $p < 0.05$] more likely to be strangled to death compared to the 60+ age group, relative to all other male homicides. When disaggregated by sex, the high risk of strangulation in very young males is thus made apparent. In the case of males, the decomposed effects for race indicate that in comparison to blacks, Indians are almost three times more at risk for fatal strangulation [OR (95% CI): 2.990 (1.042-8.582), $p < 0.05$] and whites two-and-a-half times more at risk [OR (95% CI): 2.422 (1.275-.4.601), $p < 0.05$] in relation to all other male homicides. The effect for coloured males was non-significant, unlike in the case of female strangulation homicides in the logistic regressions reported above.

Model 2

The results from Model 2, to which the temporal and spatial variables were added, indicate the overall logistic regression model to be statistically significant at the $p < 0.05$ level (chi square $= 167.485$, $p = .000$ with df $= 13$). Indicatively, the model explained 17.9% (Nagelkerke's R^2) of the observed variance in the dependent variable, establishing that the second model fit the data better.

The Wald criterion determined all the independent variables except race and season of year to be significant ($p < 0.05$) in explaining male homicidal strangulation.

The nature and direction of the relationships between age and the dependent variable were almost identical to Model 1. Relative to all other male homicides, the effect estimates once again indicated a pronounced increase in risk for the 0-14 year age group [OR (95% CI): 4.376 (1.914-.10.006), $p < 0.05$] in comparison to the 60+ age category. Although the aggregate effect of race was non-significant, the decomposed effects indicated that when compared to blacks, white males were approximately twice at risk [OR (95% CI): 2.191 (1.138-.4.219), $p < 0.05$] for fatal strangulation in relation to all other male homicides. The effect for Indians approached significance ($p = .055$). As in Model 1, the localised effects were non-significant for coloured males. The probability of being fatally strangled during the day, compared to nighttime strangulation, was more than three times higher [OR (95% CI): 3.133 (1.902-.5.159), $p < 0.05$] relative to all other male homicides. When disaggregated by sex and considered relative to all other male and female homicides respectively, the risk of daytime strangulation was higher in males than in females, and also shown to be elevated relative to the estimated effects observed in the logistic regressions for strangulation and all other homicides combined (Study II). The predictive effects for day of week were also significant, with males almost twice more likely [OR (95% CI): 1.942 (1.199-.3.148), $p < 0.05$] to be strangled during the weekday than during the weekend in relation to all other male homicides. This effect demonstrates a similar association with the dependent variable as observed for the aggregated analyses in Study II (strangulation versus all other homicides combined), but differs from the estimates reported for female strangulation homicides relative to all other female homicides, which indicated day of week to be non-significant. While the overall effect of seasonality was non-significant, the decomposed results showed autumn to be a significant predictor of male strangulations. In comparison to spring, the risk for strangulation death in autumn was two times higher [OR (95% CI): 2.040 (1.047-.3.973), $p < 0.05$] in relation to all other male homicides. Finally, and in contrast to the female strangulation risk patterns reported above, the B coefficient's positive direction indicated that males were twice more likely [OR (95% CI): 2.066 (1.292-.3.305), $p < 0.05$] to be strangled to death in private locations than in public places. In the aggregated analyses undertaken in Study II, scene of death was not significant in predicting

homicidal strangulation. As in the case of females, disaggregation by sex appears to have clarified the finer effects of scene of fatal injury.

Table 2. Logistic regression analyses for female and male strangulation homicide versus all other female and male homicides, City of Johannesburg, 2001-2010

Females

Independent Variable	Model 1 Exp(B)	Model 1 95% CI for Exp(B) LL	Model 1 95% CI for Exp(B) UL	Model 2 Exp(B)	Model 2 95% CI for Exp(B) UL	Model 2 95% CI for Exp(B) LL
Socio-demographic Variables						
Age						
0-14 yrs	1.051	.457	2.420	.999	.426	2.342
15-29 yrs	.381*	.193	.751	.375*	.187	.750
30-44 yrs	.282*	.143	.554	.274*	.137	.549
45-59 yrs	.258*	.118	.563	.264*	.120	.579
60+ yrs	.	.	.	.	.	.
Race						
Indian	2.654	.943	7.469	2.575	.903	7.342
Coloured	2.527*	1.255	5.089	2.559*	1.254	5.222
White	1.496	.850	2.665	1.457	.809	2.621
Black	.	.	.	.	.	.
Spatio-temporal Variables						
Time of Day						
Day	…	…		1.715*	1.141	2.576
Night	…	…		.	.	.
Day of Week						
Weekday	…	…		1.113	.752	1.645
Weekend	…	…		.	.	.
Season of Year						
Summer	…	…		2.336*	1.297	4.206
Autumn	…	…		2.087*	1.152	3.780
Winter	…	…		1.846*	1.023	3.332
Spring	…	…		.	.	.
Scene of Injury						
Private	…	…		.593*	.399	.881
Public	…	…		.	.	.

Likelihood Ratio Tests: Model Chi-Square = 39.485, p = .000 (Model 1); Model Chi-Square = 65.989, p = .000 (Model 2)
Pseudo R-Square: Nagelkerke = 0.062 (Model 1); Nagelkerke = 0.102 (Model 2)
N = 1340

Males

Independent Variable	Model 1 Exp(B)	Model 1 95% CI for Exp(B) LL	Model 1 95% CI for Exp(B) UL	Model 2 Exp(B)	Model 2 95% CI for Exp(B) UL	Model 2 95% CI for Exp(B) LL
Socio-demographic Variables						
Age						
0-14 yrs	4.130*	1.855	9.194	4.376*	1.914	10.006
15-29 yrs	.138*	.066	.287	.194*	.092	.411
30-44 yrs	.143*	.070	.290	.186*	.090	.384
45-59 yrs	.192*	.086	.429	.222*	.098	.501
60+ yrs	.	.	.	.	.	.
Race						
Indian	2.990*	1.042	8.582	2.807	.979	8.052
Coloured	1.424	.500	4.055	1.346	.459	3.947
White	2.422*	1.275	4.601	2.191*	1.138	4.219
Black	.	.	.	.	.	.
Spatio-temporal Variables						
Time of Day						
Day	…	…		3.133*	1.902	5.159
Night	…	…		.	.	.
Day of Week						
Weekday	…	…		1.942*	1.199	3.148
Weekend	…	…		.	.	.
Season of Year						
Summer	…	…		1.723	.874	3.400
Autumn	…	…		2.040*	1.047	3.973
Winter	…	…		1.565	.791	3.098
Spring	…	…		.	.	.
Scene of Injury						
Private	…	…		2.066*	1.292	3.305
Public	…	…		.	.	.

Likelihood Ratio Tests: Model Chi-Square = 120.250, p = .000 (Model 1); Model Chi-Square = 167.485, p = .000 (Model 2)
Pseudo R-Square: Nagelkerke = 0.129 (Model 1); Nagelkerke = 0.179 (Model 2)
N = 8580

Note. *$p < .05$; Exp(B) = odds ratio; CI = confidence interval; LL = lower limit; UL = upper limit.
The reference category for the dependent variable is All Other Female Homicides.   The reference category for the dependent variable is All Other Male Homicides.

DISCUSSION

This study investigated the demographic and situational factors predictive of female and male homicidal strangulation in the City of Johannesburg, and identified the differential risks that exist for females and males when strangulation homicide data are disaggregated by sex. The analysis extends and deepens the study of individual-level risks for fatal strangulation violence through its situation within a gendered perspective. In this respect, the study is supported by the apparent robustness and stability of sex as a predictor of fatal strangulation (see Study II), as well as by the trend to locate disaggregated homicide research within a conceptually comparative framework of analysis. Overall, the findings indicate that when all other variables are held constant, sex-specific risk profiles for fatal strangulation vary somewhat in comparison to sex-aggregated predictors for strangulation homicide (Study II). The findings also demonstrate variation in the significance, strength and direction of predictive effects across sex. The distinctive patterns for age, race, day of week, and scene of death are particularly noteworthy.

The risk for fatal strangulation is distinctly higher for both females and males 60 years and older. These results are contrary to prevailing indications that overall homicide risk is generally greater in younger males (Krug et al., 2002). Explanations related to physical vulnerability and routine activities (Study I and Study II) are equally relevant here. However, when considered from a gender perspective, explanations of risk among the elderly highlight the continuum of masculinity that exists within patriarchy. Given the disproportionate involvement of males in homicide perpetration, the strangulation of older individuals may be attributed both to hegemonic masculinities, which act to exploit the vulnerability of both sexes, and exert power and control, as well as subordinated or victimised masculinities, which are associated with older men's perceived or real loss of status and power, and a relegated and weakened position in the gender hierarchy. In this instance, it is hypothesised to be less likely that the fatal violence is a result of relationship disputes or situations where the offenders' codes of honour and sense of manhood are threatened. Instead, and consistent with previous research (e.g., Roberts & Willits, 2013; Safarik, Jarvis, & Nussbaum, 2002), it is probable that the elderly are being strangled in the commission of other serious crimes, such as non-intimate rape and house robbery, where extreme violence is employed to subdue and to potentially eliminate evidence. This hypothesis is supported by research findings indicating that older victims of violent crime are more likely to be assaulted by strangers and

victimised in their own homes (e.g., Krienert & Walsh, 2010; Safarik et al., 2002). Research on the sexual assault-homicide crime nexus among elderly females reports a pattern of extreme brutality and degradation, and predatory behaviour (Safarik et al., 2002), which is the design of violent masculinities. Fatal strangulation as an end outcome of house robbery may very well follow a similar offending pattern for both females and males. It would appear that traditional values of deference and respect towards the elderly do not necessarily protect the elderly from the violence that sometimes accompanies exertions of power and control. The similarity in homicidal strangulation risk between older women and men suggests that, despite gaps in status and power, risks for elderly females and males may be driven by comparable forces.

When disaggregated by sex, the risk for male child and adolescent fatal strangulation is particularly high. This finding corresponds with the results of a national child homicide study, which estimated the overall male child homicide rate to be nearly twofold the female rate, at 6.9 per 100 000 (Mathews et al., 2012). Mathews and her colleagues (2012) also reported excess mortality among the male adolescent group (27.1 per 100 000). Given physical size differences between child victims and adult perpetrators, it is obvious that younger children are considerably physically vulnerable to strangulation attack. However, the incongruent risk effects for boys and girls in this study suggest the need to consider explanations other than the obvious. It is hypothesised that the elevated risk noted in the current study is driven by higher vulnerability in the adolescent male sub-group. Further disaggregation by age -not possible in this study due to the small dataset- would be required to confirm this hypothesis. Nevertheless, it is suggested that adolescent masculinities embody an ambiguous expression of gender status and gender power that simultaneously accords and denies them power. Males in this age group are likely beginning to be involved in contests for power, domination and influence, and inter-gender conflicts, but yet remain vulnerable to the violence associated with hegemonic masculinities. This explanation is supported by the typology for adolescent homicide victimisation in urban South Africa, which reports the majority of adolescent homicides to be all male victim-offender encounters (Swart, 2014). It is possible then that a unique set of gender dynamics potentially exists that contributes to increased risk for homicidal strangulation among this age group. These interpretations are, however, speculative and therefore require further scrutiny to better understand the gender dynamics that produce risk among male children for strangulation injury specifically.

The predictive effects for race are more difficult to theorise. Coloured females were found to be at a significantly higher risk of being strangled to death in the within-sex analyses, and white males when the stronger within-sex model (Model 2) is considered. These results mirror the race-specific rates reported in Study I. The results for females also parallel findings of previous South African research, which indicated coloured women to have the highest rates of female strangulation homicide (Suffla, Van Niekerk, & Arendse, 2008) and intimate femicide (Mathews et al., 2004). For females, the absence of data on the victim-perpetrator relationship does not allow for more than mere conjecture about the risks related to the relational context of the fatal event. Still, it is plausible that coloured women, through their relative status to men, are the target of expressive strangulation homicide committed by males, which occurs in a social and relationship context of heightened aggression and hostility, and a desire to make the victim suffer (see Salfati, 2000). The relatively high risk of rape homicide among coloured women, in conjunction with the positive relationship between strangulation and rape homicide reported in South Africa (Abrahams et al., 2008) would appear to offer some credence to this hypothesis. Typically, then, males' assertions of power and control over women, together with their socialisation and beliefs about masculinity may influence them to resolve disputes through other than legitimate means, thereby placing females at increased risk for fatal victimisation. It is also accepted that the historical legacy of colonisation and apartheid in South Africa, and internalised aspects of that oppression (see Fanon, 1968) have instigated violence among the historically oppressed (e.g. Lazarus, Ratele, Suffla, Seedat, & Paulse, 2010; Ratele, Suffla, Lazarus, & Van Niekerk, 2010), and perhaps become further encoded in gender relations. With respect to the effects for white males, it is suggested here too (see Study II) that this finding may be more revealing of the lower risk of strangulation for males from the other race groups than a conceptually meaningful value showing white males to be disproportionally at risk for homicidal strangulation. An alternative explanation is that the higher probability of strangulation death among white males is linked to the observed age effects, and therefore that this group of males is largely represented by elderly white men being strangled in the context of instrumental homicide, or homicide motivated by gain. Importantly, it appears that in the context of the current study, race may be operating as a proxy for other social differentials, such as class, geography and identity, to which this study is not sensitive. Overall, empirical research exploring the interaction effects between race and gender is lacking (Vieraitis &

Williams, 2002) so that much is yet to be accounted for in understanding the precise relationship between these two variables.

Temporal patterns exhibited some variation in the current study that were undetected in Study II. Whereas daytime is shown to be a period of higher risk in the sex disaggregated analyses as well, the effects for day of week emerge as non-significant for females, thereby diverging from the results of the aggregated analyses. Overall, these findings are inconsistent with established patterns in international and national homicide research that indicate risk to be higher at night and during weekends (e.g., Pizarro, 2008; Kramer & Ratele, 2012; Ratele, Swart, & Seedat, 2009). From a gender perspective, nighttime and weekend victimisation risk is typically explained by spatio-temporal patterns associated with recreational activities, and masculinity characteristics associated with conquest, prowess, risk-taking, defence of honour and fearlessness (e.g., Ratele, 2010), with the convergence of these features resulting in conditions conducive to violence. It is suggested that the gendered explanations for the temporal risk profile of strangulation attack are not particularly dissimilar, but that the inverse time of day and day of week pattern noted here is reflective of the opportunistic or predatory nature of strangulation homicide, and therefore particularly of the exploitative character of violent masculinities. That is, the power, control and force that translates into fatal strangulation injury is exerted in the more exploitable spatio-temporal contexts of low time and day occupancy, increased levels of social isolation and vulnerable targets. The day of week effects for females suggest that the perpetration of strangulation violence, and the attendant performance of violent masculinities does not distinguish by day of week specifically; females' vulnerability is dispersed across the week. Although statistically significant, the predictive effects for seasonality did not exhibit a conceptually coherent risk profile. Seasonal patterns in interpersonal violence usually account minimally for variances in crime rates and risks (Björkstén, Kripke, & Bjerregaard, 2009; Carbone-Lopez & Lauritsen, 2013).

The sex-specific effects for scene of strangulation homicide exhibited a pattern that was altogether obscured in Study II, where it was hypothesised that the size of the dataset may have accounted for the surprising non-significant result. However, the sex disaggregated analysis revealed not only significant effects for both females and males, but also interesting differences. Although relatively marginal in effect, females were found less likely to be strangled in private locations, with the

direction of predictive effects the opposite for males. Prior research (e.g., Häkkänen, 2005; Henderson, Morgan, Patel, & Tiplady, 2005; Suffla et al., 2008), as well as initial occurrence descriptors reported in Study I have suggested the reverse pattern. The current findings support the argument that some females are more vulnerable away from home because they are more accessible targets to strangers (Marvell & Moody, 1999). Based on the explanations offered in Study II, the higher risk of strangulation death in public places may not pertain to the elderly sub-group; further disaggregated analyses would be required to corroborate this assumption. Nonetheless, it is inferred here that where females have higher levels of mobility, as in the case of younger individuals, there is increased exposure to situations wherein females' relative or absolute status is juxtaposed against that of males', and therefore heightened risk for victimisation by males employing violence to exercise dominance over women. The findings for males may be reflective of interaction with age and temporal effects, described above, and again point to the possibility of fatal strangulation risk in the commission of instrumental crime. Gender differences in the physical location of fatal violence are typically explained through the notion of facilitating places (see Miethe, Regoeczi, & Drass, 2004). From this perspective, female homicide is frequently a result of abuse by male intimate partners that is perpetrated within the home, whereas for men contests for power are concentrated in public spaces, rendering public settings a facilitating context for male homicides. However, it is likely that homicide in general, or some at least homicide types, have become more diverse in their risk profiles over time, revealing unique and emergent risk characteristics, which increasingly appears to be the case for homicide by strangulation. The intricacies of location of strangulation event therefore need to be further explored through an examination of the interactive effects between scene of strangulation fatality and other demographic and situational variables.

The aforementioned findings need to be interpreted within the context of the following limitations. Firstly, the data and sample size were limited; missing and incomplete data resulted in the elimination of a relatively high percentage of cases in the current analyses, including the complete exclusion of BAC data, with disaggregation further contributing to a smaller number of observations drawn for the logistic regressions. The analyses undertaken here were exclusively dependent on NIMSS data; although the NIMSS represents a valuable, and currently the most complete, source of homicide data for the City of Johannesburg, it does not register perpetrator

information. Prior research has demonstrated the offender profile to be a significant variable in predicting sex-specific homicide. This study is therefore lacking in data that is likely to further illuminate the risks associated with lethal strangulation. Furthermore, the limited sample size did not lend itself to the examination of interactive effects, and therefore observations on the convergence of the examined variables in predicting female and male fatal strangulation are only conjectural at this time. The study findings are not generalisable. Since the data were cross-sectional, it was not possible to observe the constancy of predictors over time. The current analyses did not include socio-structural variables; the findings are therefore not sensitive to the potential interacting influences of individual-level measures with broader contextual variables on predictions of sex-specific fatal strangulation. Given the social ecology of homicide, more refined risk analyses of strangulation homicide risk will benefit greatly from the construction of regression models that consider both individual-level and socio-structural variables (see Paper IV for investigation of the socio-structural determinants of strangulation homicide). While the theoretical constructs adopted in the current study provide a relevant and responsive conceptual framework for explicating the results, the explanatory power of sex-specific analyses will be optimised through empirically testing gender-based theories. Finally, the multivariate analyses employed in this study are principally to determine probabilities rather than causation, thereby advancing initial hypotheses about fatal strangulation risk by gender. Notwithstanding these cautions, the current study provides important evidence on the gender gradient in homicidal strangulation risk, and its location within social constructions and performances of gender and gender relations.

CONCLUSION

The current study fills a void in the study of homicidal strangulation by examining individual-level risks from a sex-specific perspective. Initial evidence indicates both overlap and divergence in relation to individual-level risks for overall strangulation homicide, and also exposes gender-patterned risks that appear to be unique to strangulation homicide. The findings therefore further distinguish lethal strangulation risk profiles, and highlight the value of examining within-sex and between-sex differences in homicide risk. Results indicate the risk for fatal strangulation to be higher for both females and males 60 years and older. When disaggregated by sex, findings reveal that the risk for lethal strangulation is also markedly high for male children and adolescents. The predictive effects for race in this study isolated risk among Coloured females and white males

specifically. The study further uncovered temporal risk patterns for homicidal strangulation, which denote females' risk to be undifferentiated for day of the week, and the risk for males to be higher during weekdays. The sex-specific analyses also illuminated previously undetected effects for scene of strangulation homicide, indicating females to be more likely to be strangled in public places, and males in private locations.

The results underline the importance of undertaking a sex-disaggregated and comparative approach to homicide research, and the associated requisite to undo universalised understandings of homicide risk. Although some of the explanations offered are conjectural at this time, the study lends support to the integration of a gendered theoretical perspective for explaining fatal strangulation at the individual level, and thereby contributes to the development of a more complete empirical and theoretical consideration of strangulation homicide. Study IV will build on the preceding studies by shifting the analytic focus from individual- to neighbourhood-level determinants of fatal strangulation.

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STUDY IV

NEIGHBOURHOOD CORRELATES OF HOMICIDAL STRANGULATION IN THE CITY OF JOHANNESBURG, SOUTH AFRICA

Abstract

There is a growing body of research on the socio-structural determinants of homicide. However, the scientific study of the relationship between social structure and homicide in South Africa is in a nascent stage. Drawing on the structural theories of strain and control, the current study examined the neighbourhood correlates of homicidal strangulation in the City of Johannesburg for the period 2001-2010. Specifically, the study investigated whether differences in neighbourhood, characterised by key social conditions related to economic disadvantage, family structure, population density, residential mobility and demographic composition, were related to rates of homicidal strangulation. Area-level descriptions for the City of Johannesburg were derived from the South African National Census, and data on strangulation fatalities were extracted from the National Injury Mortality Surveillance System. The results demonstrated partial support for the theories of strain and control, and offer initial evidence of the complex and seemingly variable risk factors for fatal strangulation in South Africa's largest metropolis. The results also indicated that the effect of theoretically and empirically derived socio-structural factors on homicidal strangulation in the City of Johannesburg is variant for different socio-demographic groups, with significant effects most distinct for blacks. The study recognises strangulation as a unique phenomenon that is distinct from overall homicide, and offers initial theoretical contributions to homicide research in South Africa.

Keywords: homicide; strangulation; neighbourhood; correlates; socio-structural; strain; control; South Africa

Research on the socio-structural determinants of homicide has grown rapidly over the last two decades, with analyses focusing on explanations of inter-unit variation in homicide rates (e.g., McCall, Land, & Parker, 2010; Ousey, 1999; Pridemore, 2002) and extending their theoretical interests to include a wider focus on the predictors of homicide (e.g., Frye et al., 2008; Titterington; 2006). The scientific study of the relationship between social structure and homicide traces back to the seminal contributions of Wolfgang on homicide patterns (1958), and Shaw and McKay (1942) on crime mapping, and has since sprung a concentration of empirical evidence that has in turn been evaluated (e.g., Land, McCall, & Cohen, 1990; McCall et al., 2010), and theoretically reviewed and tested (e.g., Sampson & Lauritsen, 1994; Tcherni, 2011). Within the extant studies, this growing body of empirical research, much of it emerging from North America, has established the association of neighbourhood-level characteristics with the spatial patterning of homicide rates, demonstrating the effect exerted by contextual disadvantage. The essential thesis of this socio-ecological sphere of homicide research is that neighbourhood characteristics exercise influence on criminal violence that is not exclusively attributable to individual-level factors and cultural values. Although some variance has been reported across studies, factors such as economic disadvantage, racial and ethnic heterogeneity, mobility and community change, housing and population density, and family structure have emerged as leading explanations of neighbourhood-level homicide risk for both females and males (e.g., Avakame, 1997; Dobrin, Lee, & Price, 2005; Frye et al., 2008; Kubrin & Herting, 2003; Madkour, Martin, Halpern, & Schoenbach, 2010; Sampson & Lauritsen, 1994; Steffensmeier & Haynie, 2000).

Despite South Africa's elevated homicide rate, estimated to be seven times the global average at 64.8 per 100 000 (Norman, Matzopoulos, Groenewald, & Bradshaw, 2007), and the widespread scholarly attention that this secures, the ecological study of homicide in South Africa is in a nascent stage. While there are numerous descriptive analyses of homicide victimisation in post-apartheid South Africa (e.g., Abrahams et al., 2009; Kramer & Ratele, 2012; Ratele, Smith, Van Niekerk, & Seedat; 2011; Seedat, Van Niekerk; Jewkes, Suffla, & Ratele, 2009; Suffla, Van Niekerk, & Arendse, 2008), neighbourhood-level studies have trailed, in large part due to the unavailability of reliable unit-specific homicide data and to methodological challenges related to incompatible spatial boundaries between homicide geodata and census geography (see Breetzke, 2010a). Where

studies exist, these have focused on a range of crime types, including homicide (e.g., Breetzke, 2010a, 2010b; Swart, 2014; Swart, Kramer, Ratele, & Seedat, 2015).

Earlier South African studies established: 1) a positive relationship between poverty, low social status, deficient social structures and crime (Gilfillan, 1999); 2) socio-economic factors such as income, age and education to be more significant predictors of crime than deterrence variables (Brown, 2001); 3) low income per capita, high female to male ratio, high degree of urbanisation, high level of unemployment and young age to be significantly associated with high crime levels (Blackmore, 2003); 4) violent crimes to be significantly linked to police station areas occupied by dwellers with no housing and by blacks (Schwabe & Schurink, 2000); and 5) inequality to be a determinant of crime in general (Demombynes & Özler, 2005). It appears that aggregation-level and statistical application challenges introduced limitations into these studies, implying that some caution is required in the interpretation of some of these findings (also see Breetzke, 2010a). More recently, Breetzke (2010a) examined a host of socio-structural theorisations of crime in relation to contact crime rates in an urban South African context (also see Breetzke, 2010b), and demonstrated support for a social disorganisation explanation of crime, as well as inconsistency in the effect of socio-structural factors on contact crime rates based on race. Interestingly, he found that a decrease in the percentage of unemployed residents is associated with an increase in the contact crime rate in black communities. Breetzke cites the nature of contact crime in South Africa as a likely explanation; he suggests that most contact crime perpetrated in the country is of a social or domestic nature involving individuals known to each other, and possibly less attributable to an individual's employment status than to other strains placed on personal relationships, such as substance abuse. While the generalisability of this argument may be debatable given the incomplete information about victim-offender relationships in homicide data in South Africa, Breetzke's thesis draws attention to the potential confounders that may conceal the true relationship between socio-structural factors and homicide. In contrast, a more recent study on neighbourhood characteristics and adolescent homicide victimisation in the City of Johannesburg associated poverty and deprivation with increased levels of male and female homicide, and observed female-headed households to have an inverse correlation with adolescent homicide (Swart, 2014). In a further study by Swart, Kramer, Ratele, and Seedat (2015), findings similarly indicated that concentrated disadvantage was significantly positively associated with male

homicide in the City of Johannesburg, irrespective of race, and female-headed households significantly negatively associated with the homicide rate of white males and males of mixed heritage. These investigations add to the burgeoning interest in area-level attributes of fatal interpersonal violence within the social sciences, public health field and criminology studies in South Africa. Overall, the research findings reviewed here are referenced against the persisting influences of South Africa's apartheid and colonial history, which have contributed to chronic poverty, inequality and social exclusion along a racial gradient, and that are manifest in the spheres of education, health, employment, welfare, human settlement, family structure and access to infrastructure.

An extensive search within both the national and international corpus of literature on neighbourhood-level determinants of homicide did not yield any studies that have specifically examined area disadvantage and homicidal strangulation. In general, analyses are either coarsely disaggregated in terms of mechanism of death and type of homicide, exemplified by the focus on female and intimate partner homicide for example (Frye et al., 2008; Madkour et al., 2010; Titterington, 2006) or not disaggregated at all. Within the body of research on fatal strangulation specifically, studies have been limited to post-mortem examinations of victims and epidemiological descriptions (see Study I). Yet, in many contexts, including South Africa, strangulation presents as a leading external cause of homicide, especially among females (Suffla et al., 2008; also see Study I), comprising a significant proportion of lethal interpersonal violence, and thereby meriting closer investigation towards theoretically-informed explanations of the phenomenon and the development of population-based and local-level intervention measures.

Considering South Africa's homicide profile, the intersection between violence, social disadvantage and neighbourhood setting, and the demonstrated gap in area-based investigations on homicidal strangulation in South Africa, the current study examined the socio-structural determinants of homicidal strangulation in the City of Johannesburg. In this way, the inquiry seeks to extend the epidemiological (Study I), and individual and situational risk (Study II and Study III) analyses undertaken in the preceding studies to determine the community-level risks that exist within the homicidal strangulation risk factor continuum for the City of Johannesburg. The City is among the fastest growing urban areas nationally and worldwide. Although identified as the

economic hub of the country, the City of Johannesburg is faced with complex challenges related to urbanisation, poverty and inequality, and social exclusion, and mirrors South Africa's quadruple burden of disease as it relates to intentional and unintentional injury, the HIV/AIDS pandemic, infectious diseases, and the growing incidence of lifestyle diseases (City of Johannesburg, 2011; Mayosi et al., 2012).

SOCIAL STRUCTURE AND HOMICIDE: THEORETICAL PERSPECTIVES AND EMPIRICAL EVIDENCE

The theoretical and empirical contributions on social structure and homicide have generated several explanations for the cross-sectional variation in homicide rates. These draw principally from structural theories, which are generally differentiated by their accent on the constructs of strain and control (see Land et al., 1990; Pridemore, 2002; Sampson & Lauritsen, 1994). Strain theories posit that the strain of deprivation and structural inequalities may impel people to commit crime, whilst control theories contend that crime occurs when social bonds are weakened or are not well established. These assumptions serve as the theoretical grounds for the current study. Specifically, and aligned with structural models of homicide, this study invokes theories of economic deprivation (strain), and social disorganisation (control) as the theoretical base to the research inquiry. Economic deprivation is also a constituent of control theory; however, following its singular and consistent prominence in the empirical literature on the socio-structural determinants of homicide, and application as a distinct exogenous construct in many area-level studies on homicide, it is presented here as a conceptually discrete and strain-focused theoretical entity. The discussion that follows briefly sketches each theoretical strand, explores its use in prior research, and considers its relevance to this research.

Economic Deprivation

From a strain theory perspective, economic deprivation is considered to be a key contributor to urban violence. Strain is operationalised as either absolute or relative deprivation, typically indexed on the basis of low levels of income, high levels of unemployment, low levels of educational attainment and the Gini coefficient. Although highly correlated (Pridemore, 2002), discrepant explanations account for the relative importance and relationship of each to homicide. While some researchers theorise that the social and psychological strain engendered by absolute

deprivation results in higher rates of homicide, others posit that awareness of the inequitable distribution of resources, especially if perceived to be a consequence of racial discrimination, and the consequent competition for limited material and social resources may be accompanied by a range of agitating psychological manifestations, including feelings of injustice, anger, hostility, anxiety, alienation and hopelessness, which in turn can lead to fatal violence (e.g., Avakame, 1997; McCall & Nieuwbeerta, 2007; Pridemore, 2002; Williams & Flewelling, 1988). According to Kovandzic and colleagues (1998), under conditions of absolute deprivation, violence represents an accessible means of coping with everyday hardships. Crime avails resources to those faced with chronic unemployment or low-paying jobs, with criminal activity frequently requiring or resulting in violence as an instrumental act. They argue that absolute deprivation also cultivates expressive violence, which is a consequence of the dehumanising effects of extreme poverty. Challenging the absolute deprivation argument, many scholars contend that relative deprivation is in fact the more important mechanism that leads to strain and higher homicide rates (see Pridemore, 2002). It is suggested that under conditions of relative deprivation, individuals draw social comparisons with others, evaluate their socio-economic position relative to certain reference groups, recognise socio-economic inequities to be unfair, and react to these with violence. Kovandzic et al. (1998) explain that frustration and resentment may result from the struggle to attain what others possess or achieve culturally defined success, which may manifest in both instrumental and expressive violence.

The above theoretical explanations suggest that rising poverty and income inequality will produce increasing rates of violent crime, including homicide. However, a review of the numerous studies that have tested the theory of economic deprivation reveals stark empirical disparities, with studies demonstrating null, significant and non-significant effects of economic deprivation on homicide rates, thus yielding inconclusive results. This conflicting evidence has been attributed to methodological variations and errors, level of aggregation, use of unsuitable measures, nature of the data used, samples, time periods studied, model specifications, and also theoretical ambiguities and inadequacies (Land et al., 1990; Messner & Tardiff, 1986; also see Ousey, 2000; Pridemore, 2002; Pratt & Lowenkamp, 2002).

Correcting for the errors and inconsistencies observed in earlier studies, a well-cited study by Land and colleagues (1990) found that of all the socio-structural covariates analysed, their resource

deprivation/affluence index, comprising measures of both absolute and relative deprivation, had the strongest and most consistent effect on homicide victimisation across levels of aggregation and time periods. In a subsequent meta-analysis of studies that investigated the association between poverty and violent crime, Hsieh and Pugh (1993) concluded that resource deprivation is significantly associated with especially homicide. Other researchers who have employed similar techniques have since indicated relatively even empirical support for the supposition that socio-structural indicators of economic deprivation predict rates of homicide (McCall & Nieuwbeerta, 2007; United Nations Office on Drugs and Crime, 2011). These more consistent results, which are deemed to have emerged from methodologically sound analyses, thus indicate a positive correlation between selected measures of area poverty and homicide.

In contrast, findings on inequality and the spatial variation of homicide rates continue to be somewhat variable. One of the major issues in the discussion of inequality is that of race. In a landmark study on inequality and crime, Blau and Blau (1982) established that inequality based on race and ethnicity provides a more robust explanation of homicide rates than overall inequality of wealth. However, this thesis has failed to receive support across other North American studies. Many North American investigations into the effect of economic inequality on racially disaggregated homicide rates indicate that inequality has little or no effect on black homicide rates, but is positively associated with the homicide rates of whites (e.g., Haynie & Armstrong, 2006; Kposowa, Tsunokai, & McElvain, 2006; Ousey, 1999). This finding has been explained by the high level of resource deprivation in many African American neighbourhoods, which is considered to moderate inequality and its effect on homicide rates. However, the precise nature of this moderating process is not altogether clear. Nonetheless, there is general consensus in the literature that high levels of economic inequality are exacerbated by racial residential segregation, which may elevate urban crime levels, particularly in black neighbourhoods (Haynie & Armstrong, 2006; Lee, 2000; Parker & McCall, 1999). This body of research highlights the concepts of social isolation and concentration effects in explanations about the effect of the ecological separation of the races on rates of black homicide. According to Wilson (1987, 1996), race-based residential segregation has created socially isolated geographic clusters of poverty and discouraged contact between blacks and mainstream middle-class groups, thereby limiting the disadvantaged groups' access to opportunities, job accessibility and social networks, and therefore their economic, social

and geographic mobility. These social and economic dislocations in urban black neighbourhoods are considered to result in a further clustering of characteristics of community disadvantage, including rampant poverty, unemployment and lack of educational success, resulting in what has been termed as "concentration effects" (Wilson, 1987), frequently used to describe centres of extremely concentrated disadvantage. Researchers argue that under conditions of such structural restraint, violence assumes legitimacy in modes of interaction and as a source of status attainment. Importantly, concentration effects have resulted in the absolute and relative dimensions of deprivation becoming less distinct over time, resulting in methodological challenges in separating regression effects and in researchers now frequently combining the two in a single deprivation index (Land et al., 1990; Ousey, 2000).

Endemic poverty and rising structural inequality, inherited from apartheid, are among the serious challenges facing South Africa currently. While existing macro-level South African studies also point to the association between poverty and the country's high crime rates (see Breetzke, 2010a), it needs to be considered that the observed link is mediated by complex social mechanisms. It is furthermore important to recognise and emphasise that most South Africans who subsist under conditions of economic deprivation do not engage with violence; it is obvious that people respond to deprivation in a multiplicity of ways. Since the aim of this study is to account for neighbourhood-level variation in homicidal strangulation rates, it is assumed here that in the aggregate economic deprivation heightens a community's vulnerability to the criminogenic outcomes of increases in strain.

Social Disorganisation

Theories of social disorganisation expound that the disruption of social bonds and group solidarity through structural barriers diminishes the ability of communities to control its members, thereby predisposing them to commit crime (Land et al., 1990; Pridemore, 2002). Derived from the scholarship of Wirth (1938), and Shaw and McKay (1942), this variant of social control theory has come to represent the theoretical foundation for contemporary studies on the ecology of violence. Wirth (1938) recorded that large population size, high density and greater heterogeneity of urban areas construct transitory and superficial interpersonal relationships, frequently lessening shared cultural understandings and other forms of social cohesion. Shaw and McKay (1942) augmented

this argument by proposing two additional contextual indicators, economic hardship and population mobility, with the list of socio-structural variables subsequently expanded to include such factors as family disruption (Sampson & Lauritsen, 1994). Within the homicide literature, these macro-level forces represent the commonly acknowledged constituents of social disorganisation. The central tenet of social disorganisation theory is that these and related community-level characteristics weaken the local community social organisation, including informal social control, understood as the capacity of groups to regulate their members in accordance with desired social codes (Sampson, Raudenbush, & Earls, 1997), which in turn accounts for the variation in crime rates. The section to follow explains and reviews the primary indicators of social disorganisation.

Social disorganisation theory continues to receive considerable empirical attention at various levels of aggregation. In what is considered to be a milestone in homicide research, Land et al. (1990) established that findings across different time periods and geographical units tend to be fairly variable. They concluded that collinearity among the socio-structural covariates included in studies explained much of the inconsistency observed in earlier analyses. They also found that the most consistent socio-structural predictors of the North American homicide rate across time and levels of analysis were those related to population structure (size and density), resource deprivation/affluence (including measures of absolute and relative deprivation), and percentage divorced males (relating to family disruption). Twenty years later the explanatory power of these covariates was empirically assessed and supported in a North American study by McCall and her colleagues (2010), and continue to be employed in homicide research across countries.

Population structure is viewed as potentially undermining social relationships, and thereby weakening social integration and control in urban settings (McCall & Nieuwbeerta, 2007). Within this formulation, homicide is theorised as a consequence of urban anonymity and the related lessening of guardianship behaviours. It is argued that the larger the number of residents and households sharing common living spaces, the lower the proportion of the population an individual recognises, thus increasing the vulnerability of people residing in heavily populated areas (Pridemore, 2002). The spatial distribution of homicide is further influenced through the built environment of urban settings where multiple and closely erected dwelling units may increase

opportunities for crime and obstruct defense against victimisation. Several investigations have reported a significant association between population structure and homicide (see Land et al., 1990; McCall et al., 2010). Specifically, absolute population size has been shown to be positively associated with homicide rates (Pridemore, 2002).

Family disruption is one of the more invariant predictors of homicide rate that has emerged from the social disorganisation literature. Family is formulated as an important mechanism of social control in its attempt to respond to urban disadvantage. Land and colleagues (1990) found that family disruption, indexed as the percent divorced, to be either significantly positive or null, a result that has generally endured across subsequent studies (e.g., Beaulieu & Messner, 2010; McCall & Nieuwbeerta, 2007). The examination of the community-level consequences of family structure is based on the assumption that high levels of family disruption tend to facilitate crime by decreasing community networks of informal social control (Tcherni, 2011). Another widely used indicator of family structure, the percent of households that are female headed, appears to be an equally robust correlate of homicide. In her study of female and male homicide across 1 600 counties in the United States, Schwartz (2006) determined that family structure exerted the strongest effect on homicide compared to other ecological variables, including socio-economic disadvantage. Similarly, in an earlier study, Sampson (1985) had found that homicide rates were two to three times higher in neighbourhoods with more elevated levels of family disruption, regardless of determinants such as percent black and poverty. Many of these analyses thus determined that the effect of family disruption is typically independent and large (Sampson & Lauritsen, 1994). However, until more recently, much of this research did not account for the multiplicity in family structure observed in urban contexts, the social mechanisms evident in diverse family forms, and the link hereof to homicide. In a unique study, which extends the examination of the relationship between family and urban homicide beyond the conventional focus on family disruption, Parker and Johns (2002) established that diversity in family structure has a differential impact on race-specific homicide, and that non-traditional family forms are not necessarily positively associated with black homicide victimisation in urban areas.

As an element of social disorganisation, ethnic and racial heterogeneity is regarded as a potential obstacle to local integration and the realisation of shared goals. That is, the presence of a

heterogeneous population could be seen to challenge the establishment of a strong network of relations within the community and the creation of supportive norms and contexts. Indexed as percentage black, the racial composition of a neighbourhood has been found to be a strong predictor of homicide rate in many North American studies (e.g., Ousey, 2000). This is frequently ascribed to the frustration and sense of alienation that is the result of discrimination, marginalisation, and the resultant response to secure respect and honour. While some studies have observed that percentage black predicts crime even when other indicators of economic strain and social disorganisation are controlled (see McCall & Niewbeerta, 2007), others have found a distinctly attenuated effect of race and ethnicity when other factors are controlled (see Sampson & Lauritsen, 1994; Jones-Webb & Wall, 2008). Accordingly, while some research suggests that heterogeneity is a strong correlate of homicide rates, other studies and theoretical contributions have tendered strong critiques of this finding. These have questioned the assumption that racial composition has unique explanatory power, arguing that the relationship between percentages of different racial groups in an area and homicide rate may be due to a range of other correlating factors that overlap with race and ethnicity. The latter is related to the argument that blacks and whites occupy vastly different ecological contexts, with blacks typically residing in resource-deprived conditions, and exposed to manifold disadvantages and adversities, and whites much less so (see Tcherni, 2011).

A smaller but no less important contribution to the literature on disaggregated homicide rates and social disorganisation is work on the socio-structural factors associated with female homicide victimisation specifically. This research has evolved somewhat separately from research on racially disaggregated homicide. Corresponding with the focus on socio-economic inequality and victimisation rates, and drawing from feminist theory, much of this inquiry has examined gender inequality and female homicide. Using measures of control (and also strain), studies have supported both the backlash hypothesis, which contends that gender equality is positively associated with men's fatal violence against women, as well as the ameliorative hypothesis that considers women's increased social status to insulate them from violence and therefore decrease their risk of homicidal victimisation (Haynie & Armstrong, 2006; Pizarro, DeJong, & McGarrell, 2010; Titterington, 2006; Whaley & Messner, 2002). This body of research has not only underlined

the masculinised sub-culture of violence, but also the need for gender stratification in the explanation of macro-level determinants of homicide.

Shaw and McKay (1942) reported high residential mobility to also have adverse consequences for social control and integration into local social networks. From this perspective, a high rate of mobility is argued to disrupt the construction of social relationships and weaken community controls though producing anonymity and feelings of impermanence, and undermining institutional development. It appears that studies on mobility have not been as wide-ranging as analyses on some of the other socio-structural factors reviewed here. In the main, research has found a significant positive relationship between residential mobility and rates of violent victimisation, particularly in low-income neighbourhoods. Sampson and Lauritsen (1994) concluded that the mobility-income interaction holds important consequences for violence, and underline the finding that where mobility and neighbourhood change is related to violence, it is typically associated with neighbourhoods becoming increasingly impoverished. In at least one study where high mobility was found to be negatively associated with homicide rates, the researchers urged for caution in the interpretation of the result, pointing out that high mobility neighbourhoods in the city that was analysed were located along the periphery of the city where homicide rates were low (Wang & Arnold, 2008). In another study that demonstrated a similar finding, albeit within a limited North American sample, investigators offered a more convincing counter-claim to the commonly held notion that immigration is criminogenic through its association with weakened social control. Lee, Martinez and Rosenfeld (2001) have speculated that community social control may in fact be strengthened where immigration acts as a stabilising and revitalising influence on economic, social and cultural institutions. In this regard, Sampson et al. (1997) found empirical evidence for the hypothesis that collective efficacy mediates a significant portion of the association between residential stability and rates of interpersonal violence (also see Cantillon, Davidson, & Schweitzer, 2003).

It is worth emphasising here that social disorganisation theory postulates that it is the level of community social disorganisation that mediates the relationship between a neighbourhood's socio-structural characteristics and homicide rates, thereby providing an explanatory framework for this association. It does not construct disadvantaged neighbourhoods as inherently disintegrated or

predisposed to crime, but argues that it is the deleterious social conditions that contribute to high homicide rates. Cantillon and his colleagues (2003) caution against this frequent misinterpretation and misapplication of the framework, citing the instance of social disorganisation having been deployed in previous research as a descriptor of disadvantaged settings, and also of the eventual outcomes of neighbourhoods. This is an especially critical issue in the context of research on racial differences in the rate of crime, and of course South Africa's socio-political history, which rendered black and poor individuals and communities as deficient. Accordingly, the critical contribution of this classic theoretical perspective is the recognition that violence is driven by persisting socio-structural forces and that its prevention is therefore ultimately bound to processes of social transformation.

The discriminatory legislation that governed apartheid continues to have an adverse spatial, economic and social impact on the structure of South African society (also see Breetzke, 2010b, 2012). Post-apartheid South Africa therefore represents a unique socio-political and socio-economic milieu within which to test the applicability of structural theories of violence. Drawing on the theoretical traditions delineated above, noting the well-documented problems linked to social disadvantage that continue to plague post-apartheid South Africa, and following recent investigations on the neighbourhood-level predictors of homicide in South African cities, this study examined the neighbourhood correlates of homicidal strangulation in the City of Johannesburg for the period 2001-2010. Specifically, this area-level analysis investigated whether differences in neighbourhood, characterised by key social conditions related to economic disadvantage, family structure, population density, residential mobility and demographic composition were related to levels of homicidal strangulation. To the author's knowledge, the current study is the first to investigate the neighbourhood correlates of homicidal strangulation, and complements analyses on individual-level attributes and variables of homicidal strangulation. The following three study questions were examined:

1. Which clusters of socio-structural area attributes are descriptive of the living situations of the residents of the City of Johannesburg?
2. Do these clusters of disadvantage impact on homicidal strangulation in the City of Johannesburg?
3. What is the differential influence of neighbourhood disadvantage on homicidal strangulation

risk for females, males, adults and blacks?

METHOD

An ecological analysis of select area-level correlates of homicidal strangulation was applied to establish whether neighbourhood socio-structural characteristics were associated with homicidal strangulation in the City of Johannesburg for the period 2001-2010. Ecological studies on homicide investigate risk factors based on populations that are defined by geography (Jones-Webb & Wall, 2008). In keeping with the methods adopted in ecological studies on homicide, the current study: 1) delineated the unit of analysis; 2) for the dependent variables, extracted data on strangulation fatalities from the National Injury Mortality Surveillance System (NIMSS) (see Introduction to the thesis for a detailed description); 3) for the explanatory variables, derived area-level descriptions for the City of Johannesburg from the 2001 South African National Census, which provided the most recent and comprehensive census data at the time that the analysis was undertaken; 4) conducted a principal components analysis to combine the explanatory variables that cluster into single factors; and 5) fitted binomial regression models to examine the relationships between neighbourhood characteristics and homicidal strangulation of females, males, adults and blacks.

Unit of Analysis

The 2001 South African Census data allow for the disaggregation of information by enumerator area, identified by province, local municipality, main place name and subplace name, with subplace representing the lowest geographical level (Statistics South Africa, 2003a). The areas of interest approximate those of the official suburbs demarcated by local town councils and the South African Surveyor General (see Van Niekerk, Reimers, & Laflamme, 2006). In this study, area-based comparisons were conducted at the subplace level. The unit of analysis was therefore residential areas in the City of Johannesburg, distinguished by subplace names provided by census data. The 2001 Census demarcated 684 subplaces for the City of Johannesburg, comprising of living precincts that primarily include suburbs, but also sections of a township, smallholding, village, sub-village, ward or informal settlement (Statistics South Africa, 2003b). Of these, 132 were smaller living zones that were located within larger residential areas. Due to the fact that the available homicide data were specific to only the larger geographical unit, that is, the larger areas,

these 132 areas were merged to comprise a total of 40 residential areas. Eighty four subplaces, including nature reserves, industrial parks, hospitals, universities and recreational areas, were excluded from the analyses since these registered a restricted number of permanent residents, as were areas with a population of less than 200. The final number of residential areas included in the analyses was 508.

Previous studies have employed a range of units, including countries (e.g., Cole & Gramajo, 2009; Ouimet, 2012), counties (e.g., Madkour et al., 2010; Schwartz, 2006), cities (e.g., Jones-Webb & Wall, 2008; McCall & Nieuwbeerta, 2007) and neighbourhoods (e.g., Dobrin et al., 2005; Frye et al., 2008). The choice of level of aggregation appears to be determined by theoretical concerns, the availability of data, variability in homicide rates and socio-demographic characteristics, and geographical boundaries. Notwithstanding the variation and debates on aggregation level, Land and colleagues (1990) argue that a general theory of socio-structural covariates of homicide should have the capacity for multiple levels of analysis. It is also maintained that neighbourhoods are important units of analysis in their own right in research that seeks to better understand the effects of social ecology on crime (Sampson, Morenoff, & Gannon-Rowley, 2002). In this study, the neighbourhood-level of aggregation was supported by the availability of data, the theoretical assumption that neighbourhoods tend to be more homogenous ecological units than larger aggregations, and the absence of South African research on neighbourhood correlates of homicidal strangulation.

Dependent Variables

Four dependent variables, drawn from the NIMSS database for the period from 2001-2010, were considered for this study: 1) number of female homicidal strangulation victims; 2) number of male homicidal strangulation victims; 3) number of adult homicidal strangulation victims; and 4) number of black homicidal strangulation victims for the City of Johannesburg for the period 2001-2010. Although it is possible that the predictors of homicidal strangulation in the City of Johannesburg differ across age and race groups, due to the size of the dataset the current analysis was limited to the 15-59 year age category, specified here as the adult group following the World Health Organization's classification (World Health Organization, 2008), and to black victims. These groups accounted for the higher proportion of cases, approximately 72% and 73% of all

valid cases respectively. Resultantly, the lower number of homicide victims in the younger (0-14 years) and older (60+ years) age categories, and of victims classified as Indian, coloured and white did not allow for analysis. Previous research has found the association between age structure and homicide victimisation to differ with level of aggregation, while percentage black is often consistently positively correlated with homicide rates (McCall & Nieuwbeerta, 2007).

To ensure the stability and sufficiency of estimates, homicidal strangulations for each of the indicated variables were represented by the combined total of deaths across the study period. Consistent with the approach advocated by Osgood (2000), homicide counts were preferred to the use of homicide rates since a sizeable number of neighbourhoods registered no homicidal strangulations for the selected period. Osgood (2000) argues that low counts of crime are usual for offense-specific analyses, and that these tend to be too small to generate rates that reflect appropriate distributions and the necessary accuracy. The neighbourhoods specified as the suburb of strangulation injury in the NIMSS dataset were matched to neighbourhoods indicated by subplace names in the 2001 Census.

Explanatory Variables

Following the theorisations of and research trends on the socio-structural predictors of homicide reviewed above, and the availability of South African specific data, 11 explanatory variables that were considered to be descriptive of the social and economic living circumstances of the City of Johannesburg were extracted from the 2001 Census (Statistics South Africa, 2003a). The selected measures are a summative representation of the national (e.g., Breetzke, 2010a, 2010b; Seedat et al., 2009; Swart, 2014; Swart et al., 2015) and international (e.g., Agha, 2009; Frye et al., 2008; Kubrin & Herting, 2003; Land et al., 1990; Pridemore, 2002; Wang & Arnold, 2008; Tcherni, 2011) theoretical and empirical literature on the socio-structural determinants of homicide. Table 1 provides a description of the explanatory variables used in the study and their distribution parameters, or mean, minimum and maximum values, calculated for each of the identified 508 suburbs of the City of Johannesburg. The variables were classified into five conceptual domains: 1) poverty and deprivation (indicated by low household income, unemployment and low educational attainment); 2) family disruption (indicated by female headed households and divorced status); 3) population density and housing (indicated by household density and proportions of

informal dwellings); 4) residential mobility (indicated by population turnover and proportions of owned dwellings); and 5) demographic composition (indicated by percentage of black individuals and non-citizens in the population). The explanatory variables included in the study account for most of the socio-structural correlates that comprise the focus of research on area disadvantage and homicide, and represent an optimal selection of indicators for the current study.

Table 1. Description of explanatory variables and their distribution parameters, calculated for each of the 508 suburbs of the City of Johannesburg

Domain & Variable	Social Characteristic	Mean	Min	Max
Poverty and deprivation				
1. Low household income	Percentage of households earning less than R9600 annually	22.21	0.00	88.00
2. Unemployment	Percentage of persons unemployed in 15 to 64 year age group	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
Family disruption				
4. Female-headed household	Percentage of female-headed households	37.12	0.00	71.43
5. Divorced	Percentage of persons divorced aged 15 and older	5.14	0.00	14.96
Population density and housing				
6. Household density	The number of residents per the number of household rooms (excluding kitchens and bathrooms)	.79	.32	3.81
7. Informal dwelling	Percentage of households living in informal dwellings	9.50	0.00	97.79
Residential mobility				
8. Population turnover	Percentage of persons ages five and over who have changed residences in the past five years	29.8	1.20	82.17
9. Owned dwellings	Percentage of owner-occupied dwellings	49.13	0.00	99.10
Demographic composition				
10. Black residents	Percentage of black residents	45.90	1.49	100.0
11. Non-citizenship	Percentage of non-South African citizens	4.66	0.00	31.13

Research on homicide has observed high multicollinearity among the socio-structural predictors of homicide rates (Land et al. 1990). Since multicollinearity results in unstable and unreliable regression coefficient estimates in response to minor changes in the model or the data, results about individual explanatory variables and their relative contribution to the regression model may be distorted. To reduce problems associated with multicollinearity, a factor analysis was conducted to combine the explanatory variables that cluster together into single factors, that is, to index data and construct dimensions from ecological data. For this study, a principal components factor

analysis was performed using orthogonal rotation (varimax with Kaiser normalisation). Principal components analysis is a statistical procedure that is performed to systematically reduce a set of possibly correlated variables into a smaller and conceptually more coherent set of uncorrelated variables that are then used as the independent or explanatory variables (Dunteman, 1989). These are called principal components and represent a linear combination of the original variables. Principal components factor analysis is therefore commonly undertaken to simplify a dataset before a regression analysis is conducted (Dunteman, 1989). A three-factor model was derived that explained 73.7% of the cumulative variance (see Table 2). These three neighbourhood factors comprised the explanatory variables for the study, representing indicators of the key factors theorised to be associated with homicidal strangulation rates in the City of Johannesburg. The dependent variables and the outcomes of the exploratory factor analysis were linked by neighbourhood.

Table 2. Pattern matrix of 11 explanatory variables with factor loading values for each

Variable	Varimax Rotated Factor Pattern		
	Factor 1 Socio-economic Disadvantage	Factor 2 Residential Mobility	Factor 3 Female-headed Households
Low household income	**.898**	-.237	.021
Low educational attainment	**.844**	-.314	-.103
Unemployment	**.840**	-.368	-.109
Household density	**.839**	-.121	-.132
Owned dwellings	**-.781**	-.259	-.024
Black residents	**.776**	-.122	-.296
Informal dwelling	**.753**	-.177	-.078
Population turnover	-.179	**.774**	-.050
Non-citizenship	-.090	**.834**	.038
Female-headed household	.013	-.086	**.916**
Divorced	-.527	.149	**.618**

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

Factor 1 accounted for 50.6% of the variance between the three neighbourhood factors, and consisted of percent low household income, percent low educational attainment, percent unemployment, household density, percent owned dwellings and percent black residents. Since these measures are primarily indicators of poverty and economic deprivation, and therefore of high socio-economic burden, factor 1 was characterised as *socio-economic disadvantage*. Prior research has demonstrated comparable factor loadings on indicators of economic strain, and of percent black in the population where blacks tend to be disproportionately concentrated in high-density poverty areas (e.g., Kubrin, 2003; Land et al., 1990; Sampson & Lauritsen, 1994), as is the case in South Africa. That is, race-class intersections in post-apartheid South Africa, which are a legacy of apartheid, demonstrate that poverty, wealth and inequality continue to be racialised (see Whitehead, 2013). Unlike in some studies (e.g., Hannon, 2005; Strom & MacDonald, 2007; Wang & Arnold, 2008), percent female-headed households did not load on this factor, but exhibited correspondence with those studies in which the measure was a representation of family structure

and composition or family disruption (e.g., Cubbin, LeClere, & Smith, 2000; Parker & Johns, 2002; Swart, 2014). The second factor was identified as *residential mobility*, and accounted for 12.9% of the variance. This factor included percent population turnover and percent non-South African citizens, thereby emphasising change to neighbourhood composition. Factor 3, labelled as *female-headed households*, accounted for 10.2% of the variance, and loaded highly on percent female-headed households and percent divorce. This factor pertains to diversity in family structures and is reflective of the existence of multiple family forms in urban areas (see Parker & Johns, 2002). In contrast to its loading on factor 1, the factor scoring for divorce on this component appears to suggest that diversification from traditional family forms does not necessarily reflect non-intact or disintegrated families in these areas.

Regression Analysis

Poisson-based regression models, which relate explanatory variables to dependent variables that are counts of events, have been found to be better suited to the analysis of aggregated homicide data (Osgood, 2000). Aggregated homicide data typically yield low counts; for example, of sub-populations such as females and males, and specific age categories or race groups. Furthermore, it has been observed that crime or rare-events data seldom exhibit equal means and variances (Piza, 2012). The statistical rationale for the use of the Poisson regression approach in studies of crime therefore emerged from the attempt to address the problem of prediction errors and biased regression coefficients associated with crime rates based on small counts, and is now well established (see Osgood, 2000). Negative binomial regression, the Poisson-based regression model that is considered most widely available for this purpose, was applied to account for the highly skewed and over-dispersed dependent variables, which represent count data and which are prevalent in analyses of homicide data (see Osgood, 2000). Accordingly, four negative binomial regression models were fitted to analyse the relationships between neighbourhood characteristics and homicidal strangulation of females, males, adults and blacks. The modelling approach adopted therefore accounted for the unique distribution of the homicidal strangulation count data. Following support for its use in homicide research (Osgood, 2010; Piza, 2012), it is suggested that the application of negative binomial regression preserved the validity and statistical power of the analysis.

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Given the documented limitations associated with victimisation rates based on small counts and the resultant use of homicide counts in the current analysis, variation in the size of the population at risk across neighbourhoods was controlled for by including the natural logarithm of the population at risk as an offset variable with a fixed coefficient of one to the regression models. This procedure standardises the regression model by transforming the counts of homicidal strangulation into values that are the equivalent of a homicide rate for each neighbourhood (Osgood, 2000). The final regression model for each of the four dependent variables consisted of the three neighbourhood factors and the natural logarithm of the population at risk (i.e. total female, male, 15-59 year old and black population) as an offset. All analyses were conducted using the Statistical Package for the Social Sciences (SPSS Version 22).

A test for spatial autocorrelation was not performed in the current study due to the small sample size. Spatial autocorrelation measures the degree to which indicated spatial features and their associated data values tend to be either clustered or dispersed in space, and is germane in the study of a wide range of ecological phenomena. In homicide research, this therefore tests the degree to which levels of homicide in one neighbourhood are likely to influence the same in surrounding neighbourhoods. However, in the case of small datasets, including the additional parameters for spatial models tends to destabilise the model parameters. Furthermore, spatial autocorrelation in this case is tested on very few data points that may then distort the spatial correction.

RESULTS

A total of 334 homicidal strangulations were registered for the City of Johannesburg for the period 2000-2010, of which 194 (58.1%) were female victims and 140 (41.9%) were males, 203 (60.1%) were adult victims (15-59 years), and 242 (72.5%) were black. Of these homicides, 39 (11.7%) were excluded from the analyses due exclusively to lack of information on the suburb of homicidal strangulation injury. The regression models were therefore based on a total of 295 homicidal strangulation cases (see Table 3). The number of cases extracted from the NIMSS represents the majority, but not necessarily all the fatal strangulation events for the City of Johannesburg for the period 2001-2010. For reasons related to under-reporting and misreporting, it is not possible to determine the exact percentage of these NIMSS-recorded cases relative to what potentially may be the actual total number of strangulation deaths that took place in the City of Johannesburg for

the decade under study. This is a challenge not unlike the difficulties encountered in many other contexts, where the systematic, accurate and comprehensive surveillance of fatal injuries is hindered by either non-existent or under-developed data collection systems (e.g., European Association for Injury Prevention and Safety Promotion, 2010; Langley, 2004; Krug, Dahlberg, Mercy, Zwi, & Lozano, 2002).

Table 3. Homicidal strangulation per neighbourhood in the City of Johannesburg, 2001-2010 (N = 295)

	Total	Mean	Standard Deviation
All homicidal strangulations	295	.58	1.670
Homicidal strangulation of females	171	.34	.753
Homicidal strangulation of males	120	.24	1.049
Homicidal strangulation of adults	184	.36	1.224
Homicidal strangulation of blacks	211	.42	1.433
N of neighbourhoods		508	

The standardised coefficients and the standard errors for the four negative binomial regression models are presented in Table 4. The results indicate that residential mobility was significantly related with the homicidal strangulation of both females ($\beta = .262$, $p < .01$) and males ($\beta = .421$, $p < .001$), with one unit change in residential mobility resulting in an increase of 30% in female deaths and 52% in male deaths (following the method used by Kubrin [2003], percentage change $= 100 \times [\exp(.421) - 1]$). The remaining two factors, socio-economic disadvantage and female-headed households, were not shown to be significant in predicting female and male homicidal strangulation.

In contrast, female-headed households was significantly negatively related to adult strangulation homicides ($\beta = -.278$, $p < .05$), with a unit increase in this factor being associated with a decrease of 24% in these fatalities. Socio-economic disadvantage and residential mobility were not significant in explaining adult homicidal strangulations.

Two of the three neighbourhood factors were significantly related to the fatal strangulation of blacks. Residential mobility was significantly positively associated with strangulation homicides (β = .247, p < .05), while socio-economic disadvantage was significantly negatively associated with these deaths (β = -.345, p < .01). One unit change in residential mobility in the neighbourhood leads to an increase of 28% in the strangulation deaths of black residents. In contrast, one unit change in socio-economic disadvantage within the neighbourhood results in a 29% decrease in these deaths. Female-headed households was not significantly associated with the strangulation homicide of blacks.

Overall, the results of the four regression models were similar for female and male homicidal strangulation, with residential mobility significantly positively associated with both sexes. Residential mobility was in fact significantly positively associated with all the dependent variables except adult homicidal strangulation. Its impact was observed to be greatest for male strangulation deaths.

Table 4. Negative binomial regression results for neighbourhood characteristics on homicidal strangulation, City of Johannesburg, 2001-2010

Variable	Homicidal Strangulation of Females		Homicidal Strangulation of Males		Homicidal Strangulation of Adults (15-59 years)		Homicidal Strangulation of Blacks	
	β	SE	β	SE	β	SE	β	SE
Socio-economic Disadvantage	-.060	.1053	-.059	.1190	-.018	.1073	-.345**	.1049
Residential Mobility	.262**	.0992	.421***	.1067	.165	.0958	.247*	.0970
Female-headed Households	-.202	.1345	-.096	.1476	-.278*	.1334	-.080	.1375
Intercept (constant)	-8.965***	.1130	-9.265***	.1267	-9.345***	.1164	-8.737***	.1198
Likelihood Ratio Chi-Square	9.497*		16.157***		7.806*		16.385***	

*=p<0.05,**= p<0.01, ***p<0.001

DISCUSSION

This study examined the relationship between neighbourhood socio-structural characteristics and homicidal strangulation in the City of Johannesburg between 2001 and 2010. The findings are mixed in relation to expectations derived from the structural theories within which this analysis is located. Results indicate that, when all other variables are held constant, socio-economic disadvantage has a null effect with respect to the homicidal strangulation of females, males and adults, but is evidently predictive of lower strangulation rates among black residents of the city. In accordance with social disorganisation theory, residential mobility was highly correlated with the rate of homicidal strangulation, with the strongest effect noted for males. Diverging from the theoretically expected direction, female-headed households was found to have a protective effect against adult strangulation homicides. Collectively, the results suggest that the impact of theoretically and empirically derived socio-structural factors on homicidal strangulation in the City

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of Johannesburg is variant for different socio-demographic groups, with significant effects most distinct for blacks.

The findings of the current study fail to support the theoretical assumption that high levels of socio-economic burden in neighbourhoods tend to be predictive of high levels of fatal violence. These results clearly run counter to current prevailing claims in the national and international literature about the relationship between economic deprivation and urban homicide rates (McCall & Nieuwbeerta, 2007; Swart, 2014; Swart et al., 2015), especially when considered against the rapid rate of urbanisation in the City of Johannesburg and the concomitant poverty and unemployment facing residents (De Wet, Patel, Korth, & Forrester, 2008).

Indeed, the finding that socio-economic disadvantage is negatively correlated with strangulation rates among blacks is somewhat unexpected. In the main, previous research has demonstrated a positive correlation between socio-economic disadvantage and homicide. On average, black South Africans reside in neighbourhoods characterised by high levels of poverty, unemployment, educational barriers, and dense and informal housing settlements, all of which are markedly in contrast to the economic organisation that typically shapes the living conditions of white South Africans, and are generally associated with unequal victimisation on the basis of race (e.g., Shaw & Gastro, 2001). In the City of Johannesburg, specifically, the primary differences between the city's neighbourhoods tend to be socio-economic in nature and even now characterised by apartheid's divisive spatial legacy, with the wealthy largely occupying the north of the city and the poor, usually black, residing in the south, inner city and on the margins of the city in townships. Post-apartheid Johannesburg thus comprises of different classes of neighbourhoods within mostly mono-racial areas of the city. Moreover, and in keeping with the discussions on social isolation and concentration effects resulting from the ecological separation of the races, the residential segregation legislated under apartheid has contributed to interpersonal violence being concentrated in poor black neighbourhoods. To return to the results then, according to some homicide researchers, extreme structural disadvantage, in part explained by social isolation and concentration effects, may account for this non-linear decelerating relationship (Hannon, 2005; Kposowa et al., 2006; Lee, 2000). They suggest that a high threshold of resource deprivation in such harsh living environments, rather than race itself, may produce sub-cultures that sanction and

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regulate violence, with these contributing to normative inversion and supplanting socio-structural factors as the primary correlates of violent crime. Although this theory cannot be corroborated here, it is plausible that as a proximal crime and sometimes a crime of passion, homicidal strangulation in some contexts is more significantly associated with normative inversion than it is with socio-structural factors. An alternative explanation for the inverse relationship between socio-economic disadvantage and the homicidal strangulation of blacks in the City of Johannesburg, as well as for the non-significant effects observed may be that in the impoverished neighbourhoods where most blacks reside, strangulation is less frequently employed as a method of murder relative to firearm discharge, and sharp and blunt object injury. In this respect, the epidemiological profile of homicide in the City of Johannesburg for the years 2001-2010 indicates that 59.4% of victims died from firearm discharge, 23.2% from sharp object injury and 15.9% from blunt object injury, with strangulation accounting for 1.6% of all deaths (see Study I). Perhaps, then, this finding is more reflective of the chosen mode of killing than it is a veritable claim about the link between socio-economic disadvantage and the fatal strangulation of blacks.

The other significant characteristic of neighbourhoods associated with homicidal strangulation rates in the City of Johannesburg is residential mobility, an aggregated measure of population turnover and non-citizenship. In accordance with social disorganisation theory, mobility was significantly positively associated with the rate of lethal strangulation for females, males and blacks. In the international homicide literature, this is a commonly reported finding for all lethal violence, and a result that is shared with a recent study on the predictors of male homicide in the City of Johannesburg (Swart et al., 2015), as well as Breetzke's (2010) macro-level analysis of contact crime in the City of Tshwane (Pretoria). It is, however, contrary to the findings of Swart's (2014) study on the correlates of adolescent homicide in the City of Johannesburg, but she attributes the null effect to the likelihood that residential mobility is less relevant for adolescents than it is for adults. Residential mobility exerted the strongest influence on male homicidal strangulation. Although not quite equal given the exclusion of three race groups in the current study, this finding bears some resemblance to the male homicide study by Swart and her colleagues (2015), which found residential mobility to be positively associated with black males. Post-apartheid Johannesburg has come to be the main destination for migrants from other parts of the country and the African continent, with rapid immigration becoming a defining characteristic of

the city (see Peberdy, 2010; Peberdy, Crush, & Msibi, 2004). Notwithstanding the increasing feminisation of migration, the majority of internal and cross-border migrants still tend to be black males. Out-migration, due to factors such as the insecurity of livelihoods, and poor basic amenities and social services in especially low-income neighbourhoods, is also not uncommon. According to social disorganisation theory, the potentially destabilising sequelae of such mobility include reduced social cohesion. Following this reasoning, it is conceivable that the accelerated rate of urbanisation and migration in the City of Johannesburg has weakened informal social controls over collective life in contexts of mobility and change, increasing risk of fatal strangulation for almost all of the socio-demographic groups included in this study, but particularly for men. One possible explanation hereof is that while economic imperatives drive residential mobility for both men and women, social ties significantly influence women's decisions about where and whether to move (see Kihato, 2013). It may be speculated that, relative to men, this social aspect of mobility in women likely functions to attenuate women's risk of homicidal strangulation as it is linked to residential mobility, thus signifying the gendered nature of mobility that appears to create increased risk for lethal homicidal strangulation in men.

The findings of the current study sharply contradict the theoretical assumption that high levels of family stability function to realise social norms related to safety and maintain effective social control, whereas high levels of family disruption are violence-producing. The effect of female-headed households, here indexed as percent of female-headed households and percent divorced, did not present in the theoretically expected direction and, contrary to the reported strong effect in much of prior homicide research, was found to be significantly negatively associated with the rate of homicidal strangulation in adults in the City of Johannesburg. This result bears parallels with the South African studies by Swart (2014) and Swart et al. (2015), which demonstrated a similar inverse correlation between level of female-headed households and rate of homicide. As with these two studies on area disadvantage, and unlike those that show the measures of female-headed households and divorce to be highly correlated with economic disadvantage (Land et al., 1990; Strom & MacDonald, 2007, Wang & Arnold, 2008), in the current study female-headed households and marital dissolution did not correlate with measures of poverty and deprivation. While this may account for family structure not being predictive of fatal strangulation, it does not necessarily explain the negative effect detected here.

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Previous explanations suggesting that the presence of higher concentrations of female-headed households in neighbourhoods may be associated with a less entrenched dominant masculinity ideology, which is frequently implicated in violence, may very well hold true (e.g., Swart, 2014). However, for purposes of stimulating further enquiry, it may be useful to consider that the protective influence of female-headed households is a distinctive feature of the South African context and particularly the nature of family structure in the country. Parker and Johns (2002), for example, determined that non-traditional family forms are not necessarily positively associated with homicide victimisation in urban areas in North America; however, their finding was limited to black homicide victimisation. Nonetheless, such results point to the possible influence of social processes that mediate the family structure-homicide relationship. In South Africa, non-traditional family types characterised by extended kinship ties that transcend time and space are common in the urban landscape. In fact, the emergence of female-headed households, at least in black communities, traces back to the pre-apartheid era. This phenomenon was shaped by such factors as the rise of capitalism in South Africa, land dispossession, migratory labour, traditional social norms, and the agency of individuals to effect life choices related to family (e.g., Amoateng & Heaton, 2007; van Driel, 2011). It is not inconceivable, then, that in many South African communities, the non-traditional family culture has over time developed forms of social control and indigenous mechanisms for accessing extra-familial sources of support that mitigate against the lack of community social integration and social cohesion theorised by the social disorganisation perspective. This may in part explain the observed buffering effect of female-headed family conditions on the fatal strangulation of adults. As with socio-economic disadvantage, another explanation is that the negative association observed and the null effects for females, males and blacks is in actual fact reflective of the reduced risk of being strangled relative to death from firearm discharge, and sharp and blunt object injury in the City of Johannesburg. It is, however, important to note that these results need to be interpreted with caution as the measure did not include households with children.

The findings discussed here ought to be considered in the context of a number of limitations. Some of these are inherent to cross-sectional, place-based research. Firstly, as is the case with all place-based research, generalisability of the findings to other urban areas in South Africa is limited. Secondly, since the results are based on 2001 census data and homicide data spanning the period

2001-2010, research based on more recent census records may yield a different set of findings based on changes in population data, and neighbourhood characteristics and boundaries. It may be then that the correlates examined are historically contingent; if so, it is not possible to know if the findings reported here are valid over time or whether they are reflective of the post-apartheid social structure in the sesquidecade following South Africa's transition to democracy. However, previous area-level studies have noted that the overall pace of change in neighbourhoods is typically moderate (Frye et al., 2008; Jones-Webb & Wall, 2008). Notwithstanding the rapid rate of urbanisation in the City of Johannesburg, it is possible that the neighbourhood-level factors considered were reasonable approximations of neighbourhood conditions at the time of each strangulation death. Thirdly, although the study contributes to a growing body of work that disaggregates homicide events into meaningful units of analysis, doing so here resulted in analyses based on a relatively small number of strangulation deaths. Further, missing data represent a common shortcoming in homicide research; in this study, a number of cases (11.7%) could not be included due to incomplete homicide geodata. It is recognised that a smaller number of cases may result in structural models being sensitive to slight changes in model specification (Pridemore, 2002). To address this concern, at least in part, the study applied techniques appropriate to the study of small or rare events. As recommended by Osgood (2000), this included the use of homicide count data and the application of negative binomial regression. Still, the small dataset on which the study is based did not allow for the control of spatial autocorrelation for reasons already noted, and it is therefore not known if or to what extent this influenced parameter estimates. For this reason, it was also not possible to examine racial invariance and effects as they relate to children. Additionally, it is important to note that the collection and publication of South African homicide data, like in many other low- and middle-income contexts, is still a relatively new phenomenon. Official crime statistics, as recorded by the South African Police Service, are frequently questioned for accuracy and completeness. Data reporting systems such as the NIMSS are in a developmental stage and also face challenges related to unavailable or missing data, highlighting the assiduous concern with the reliability and validity of homicide data. Nonetheless, the current research draws from what is considered to be the most systematic source of homicidal strangulation data in the City of Johannesburg. Finally, for similar reasons, variables measuring mediating social mechanisms, such as collective efficacy and sense of community (see Cantillon et al., 2003; Sampson et al., 1997), were not included in the current investigation. Comprehensive

neighbourhood-level data for such variables are simply non-existent, for the City of Johannesburg and as much for the remainder of the country. Accordingly, it is recognised here that the observed effects do not suggest a direct causal link between socio-structural factors and fatal strangulation, but are to be understood as potentially a result of complex mechanisms that have not been studied here.

CONCLUSION

The empirical analysis described here may be the first in South Africa and internationally to examine the influence of neighbourhood-level factors in shaping risk of homicidal strangulation specifically. The use of theoretically derived and empirically tested neighbourhood-level indicators of socio-structural determinants is a strength of this study. Located within a disaggregated data approach, the study findings demonstrate partial support for the theories of strain and control, and offer initial evidence of the complex and seemingly variable risk factors for fatal strangulation in South Africa's largest metropolis. Even with the caveats noted above, the study offers initial theoretical contributions to homicide research in South Africa, and therefore beyond the countries of the North where much of this type of research has been undertaken; advances support for analyses of the neighbourhood socio-structural context towards a more refined understanding of the predictors of specific mechanisms of death in urban South Africa; and recognises strangulation as a unique phenomenon that is distinct from overall homicide.

Finally, it is important that research such as this observes South African urbanity in its own right rather than have it be defined by how cities in other parts of the world have come to evolve and be characterised. It is likely then that ecological analyses of homicide in South Africa will yield critical and original conceptualisations of the neighbourhood correlates of fatal violence and of its prevention.

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CONCLUSION

Following the evidence gap in the extant literature, the current research examined the incidence, distributions, individual and situational predictors, and structural determinants of homicidal strangulation in an urban South African context. The study may represent one of the first empirical investigations that also attempts to offer theoretically-derived explanations of homicidal strangulation in South Africa. The study engages select micro-level and macro-level theories that focus on the intersection between vulnerability and routine activities, gender and neighbourhood derivatives of violence to explain the social ecology of lethal strangulation. The study is aligned with the increasing trend towards disaggregating overall homicide into more defined and conceptually meaningful categories of homicide so as to identify the distinctive characteristics and patterns of the different causes of fatal violence.

This concluding section attempts an integrated summary of the research findings that have emerged from the descriptive and multi-level analytic investigations undertaken across the four studies. In synthesising the key results that have been described and explained in the studies, the summation offered here is considered against the stated aims and objectives of this thesis, highlights the unique trends and patterns that appear to characterise homicidal strangulation in an urban South African context, and reflects on the contributory value of this body of work to scholarship on homicide generally, and strangulation homicide specifically. The Conclusion also includes a focus on implications for policy and practice, the overall limitations of the research, and directions for future research.

SUMMARY OF RESEARCH FINDINGS

The opening study of the current research, which drew on data for a ten-year period (2001-2010) and served as the platform for the analytical work that followed, offered an epidemiological description of strangulation homicide. As the fourth leading cause of homicide in the City of Johannesburg, fatal strangulation registered a rate of 0.09 per 100 000 population. Reflective of the gendered nature of strangulation, the female rate was 1.03 per 100 000 population and the male rate was 0.74 per 100 000 population. These rates were found to be concentrated among the elderly, coloured females and white males.

In this research, the striking female preponderance in victimisation appears to be a distinct phenomenon of homicidal strangulation victimisation. This finding receives ambiguous support from past studies on fatal strangulation, which have shown mixed evidence on the gender characteristics of strangulation homicide (e.g., Häkkänen, 2005; Joshi, Thomas, & Sorenson, 2012; Thomas, Joshi, & Sorenson, 2013; Suffla, Van Niekerk, & Arendse, 2008; Verma, 2007). The higher female occurrence in homicidal strangulation is attributed to both physical vulnerability, as well as the manifestation of injurious gendered, criminogenic and psycho-social mechanisms that result in murder (also see Glass et al., 2008; Thomas et al., 2013). The age pattern for lethal strangulation is also distinct in relation to widely established research evidence that shows younger adults to be over-represented in homicide events (e.g., Ratele, Smith, van Niekerk, & Seedat, 2011). Here too, the physical vulnerability of the elderly, especially females (e.g., Nelson & Huff-Corzine, 1998; Safarik, Jarvis, & Nussbaum, 2000), is implicated in the elevated mortality rates that have been reported. In the current study, the vulnerability of the elderly is also conjectured to be the outcome of a constellation of social factors, such as widowhood and longer life expectancy, which likely function to engender risk. Race-specific homicidal strangulation rates represent yet another distinctive, albeit more initial, epidemiological description of mortality from strangulation. In contrast to the findings reported in this study, the majority of homicides, when measured in the aggregate, occur among black males (Seedat, Van Niekerk, Jewkes, Suffla, & Ratele, 2009; United Nations Office on Drugs and Crime, 2011).

When these socio-demographic variables were subjected to analytic investigation, the results revealed several unique predictive patterns that differentiate homicidal strangulation risk from risk for the other leading causes of homicide, and also homicidal strangulation risk by gender. The results support the claim that demographic variation represents one of the most robust explanations for the disproportionate distributions of homicide risk (e.g., Cohen & Land, 1987; Fox & Piquero, 2003; Trussler, 2012). Sex was found to be the strongest predictor of homicidal strangulation, confirming that females are at a substantially higher risk for fatal strangulation. Similarly, age emerged as a significant socio-demographic predictor of strangulation. The elderly were found to be at elevated risk of fatal strangulation; whereas research on aggregated homicide suggests that risk for victimisation decreases with age (see United Nations Office on Drugs and Crime, 2011), the inverse pattern appears to characterise strangulation homicide risk. Although the effects for the

youngest age category were less consistent across the logistic models that were performed in Study II, children between the ages of 0-14 years were also found to be susceptible to strangulation death. However, when disaggregated by sex, the risk for male children and adolescents was shown to be distinct and marked. This finding is consistent with the risk profiles described in a national child homicide study, showing high mortality among the male adolescent group (Mathews, Abrahams, Jewkes, Martin, & Lombard, 2012). The predictive effects of race were rendered more evident and conceptually well-defined in the sex-specific analysis. Study III uncovered and isolated risk among coloured females and white males specifically. The black-white homicide risk gap, which illuminates the disproportionate vulnerability faced by black individuals, has been shown to stable and persistent (e.g., Cubbin, LeClere, & Smith, 2000; O' Flaherty & Sethi, 2010; Kramer & Ratele, 2012). However, disaggregating homicide rates very distinctly exposes obscured risks and yields finer insights into homicide victimisation by race.

Spatio-temporal data indicated that most strangulations occurred during the day and weekdays, and in private settings. The analytic studies (Study I and Study II) confirmed that spatio-temporal variables are influential in predicting strangulation homicide risk. The temporal risk profiles for homicidal strangulation largely corresponded with the epidemiological descriptions noted in Study I. These findings diverge from the risk descriptions of aggregated homicide, which report risk to be concentrated at night and during weekends (e.g., Pizarro, 2008; Ratele, Swart, & Seedat, 2009; United Nations Office on Drugs and Crime, 2011). However, when examined by gender, the risk for female strangulation was evenly distributed across the week. In contrast, the risk for male strangulations was elevated during weekdays. Although space did not emerge as a significant factor in the sex-aggregated study (Study II), when considered by gender, this variable acquired statistical significance. The gendered nature of spatial risk was highlighted, indicating higher risk for female fatal strangulation in public spaces, and for males in private spaces. The direction of predictive effects was found to be the opposite of that hypothesised in previous research on homicidal strangulation (e.g., Häkkänen, 2007; Suffla et al., 2008).

The socio-structural analysis demonstrated the differential effects of socio-economic disadvantage, residential mobility and female-headed households on homicidal strangulation. Contrary to empirically-derived expectations (see McCall & Nieuwbeerta, 2007), socio-economic

disadvantage was predictive of lower fatal strangulation rates among black residents of the City of Johannesburg. Residential mobility was strongly correlated with the rate of homicidal strangulation for females, males and blacks. In the main, these results are consistent with the effects detected in other studies on homicide and area disadvantage (e.g., Sampson & Lauritsen, 1994; Swart, Kramer, Ratele, & Seedat, 2015). As with socio-economic disadvantage, the effects for female-headed households did not present in the theoretically expected direction (e.g., Schwartz, 2006). This variable was found to be negatively correlated with adult strangulation homicides in the City of Johannesburg.

The foregoing findings add to the body of scholarship that provides empirical support for the theoretical argument that homicides are associated with a distinctive combination of individual, situational and socio-structural factors (see Figure 1). The distinctive contributory value of this research is that it reveals empirical relationships that are indicative of risk for homicidal strangulation specifically, and uncovers unique and emergent patterns in fatal strangulation victimisation. Furthermore, the research offers initial explanations of the factors and processes that constitute fatal strangulation risk.
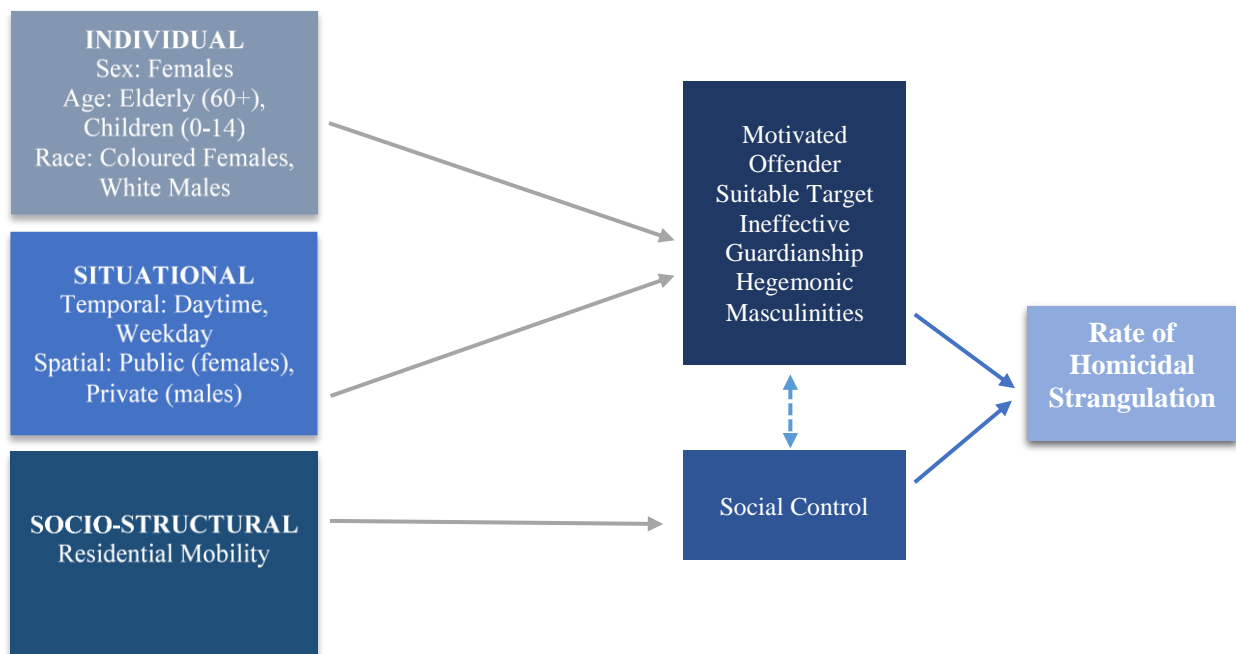

Figure 1. Risks and explanations for homicidal strangulation

When read together, and explained by routine activities theory, the intersection between a motivated offender, suitable target and ineffective guardianship appears to create individual and situational risk for homicide victimisation. In the case of the current research, this convergence of opportunity-producing factors is evident in relation to both socio-demographic and spatio-temporal factors. The effects of these variables are further understood though an appreciation of the enactments of femininities and masculinities. When the level of analysis is shifted from the individual to the neighbourhood level, the risk effects and potentially protective influences of strain and control are made evident.

From a routine theories perspective, it is suggested that the movement of females into the public space as an outcome of urbanisation, and therefore the attendant increase in mobility and freedom of movement for females residing in the City of Johannesburg (see Todes, Kok, Wentzel, van Zyl, & Cross, 2010), potentially exposes them to increased risk for strangulation homicide. However, the spatial risk for female fatal strangulation is not limited to public spaces. It is hypothesised that the risk for female strangulations in private settings is associated with both perpetration by intimates, as well as vulnerability in the elderly. The routines of daily life bring victims and offenders together in space, and where the threat or history of violence is concentrated in a private place that is characterised by a lack of capable guardianship, the risk for a fatal strangulation event is raised. Research on homicide among elderly females suggests that strangulation is not an uncommon mechanism of death when the context of violence includes sexual assault (Abrahams et al., 2008; Häkkänen, 2007; Safarik et al., 2002). However, females are also vulnerable as a function of gendered power inequities that act to facilitate violence, which in turn is commonly associated with the performance of hegemonic masculinities (e.g., McCarry, 2007; Ratele, 2010; Seedat et al., 2009).

Explanations located in routine activities theory have in the past focused on conceptualisations of reduced homicide victimisation among elderly, facilitated by such factors as their self-protective tendency to avoid fear-arousing situations, including public places. However, the strangulation homicide risk profiles observed in this research question this theorisation. Here, it is hypothesised that older individuals are strangled in their homes in situations that are likely characterised by compromised or absent guardianship and relative social isolation that, together with their physical

vulnerability, contributes to their identification as suitable targets. It is also speculated that the elderly are strangled in the commission of other crimes, such as house robbery and sexual violence (also see e.g., Roberts & Willits, 2013; Safarik et al., 2002). When considered from a gender perspective, explanations of risk among the elderly highlight the performance of hegemonic masculinities, which act to exploit the vulnerability of both sexes. It would seem, thus, that traditional values of deference and respect towards the elderly do not necessarily protect the elderly from violence. Despite gaps in status and power between elderly females and males, it appears that the risk for strangulation in this age group is driven by somewhat comparable forces.

As with the elderly, the young are suitable targets as a consequence of their physical vulnerability. From a routine activities theory perspective, it is suggested that guardianship failures, resulting in loss of protection, increase vulnerability for victimisation by both strangers and family members (also see Mathews et al., 2012; Swart, 2014). When disaggregated by sex, predictive effects are positive only for male children and adolescents, and are marked in strength. It is hypothesised that the elevated risk reported in the current study is driven by higher vulnerability in the adolescent male sub-group, whose members embody an ambiguous expression of gender status and gender power that likely renders them vulnerable to the violence associated with hegemonic masculinities (also see Swart, 2014). Since only conjectural here, this explanation warrants further examination towards an improved understanding of the gender dynamics that engender fatal strangulation risk among male children.

In this study, predictive effects for race are less easy to theorise. Higher risk in coloured females may be attributed to a combination of factors that are reflective of their target status (see Abrahams et al., 2008), as well as gendered mechanisms that subject them to the violence associated with hegemonic masculinities. In the case of white males, the higher risk of strangulation death may be an outcome of interactive effects with age, suggesting that this group of males is largely represented by elderly white men who are strangled in the commission of other crime, such as house robbery. It is also hypothesised that race may be a proxy indicator for social differentials that are not examined in the current study.

The spatio-temporal effects detected in the current study also appear to diverge from the conventional emphasis in routine activities theory on night and weekend as times of peak risk. Here, it is hypothesised that places characterised by low time and day occupancy rates, and therefore decreased guardianship, are very likely considered as targets by motivated offenders. While gendered explanations for the temporal risk profile of fatal strangulation are not particularly dissimilar from those for homicide in the aggregate, the inverse time of day and day of week pattern reported in this study is argued to be indicative of the opportunistic or predatory nature of strangulation homicide, and therefore also of violent masculinities that are enacted in spatio-temporal contexts of low time and day habitation, increased levels of social isolation and vulnerable targets. From a routines activities theory approach, the sex-specific effects for scene of strangulation may be explained by the vulnerability of females who, when away from home contexts, are potentially more accessible targets to strangers (also see Marvell & Moody, 1999). Furthermore, contexts characterised by higher levels of mobility in females may give rise to increased risk exposure wherein females' relative or absolute status in relation to men is made more stark, therefore heightening the risk for victimisation by males. The findings for males are hypothesised to be reflective of the interaction of sex with age and temporal effects, thereby locating fatal strangulation risk in the context of instrumental crime.

From an explanatory framework, the socio-structural correlates of homicidal strangulation may be suggestive of the unique urbanity that characterises South African cities. The negative association between fatal strangulation rates among blacks and socio-economic disadvantage may be explained by conditions of extreme structural disadvantage, typified in part by social isolation and concentration effects, which function to produce sub-cultures that authorise and regulate violence and that supersede socio-structural factors as the primary correlates of violent crime (see Hannon, 2005; Kposowa, Tsunokai, & McElvain, 2006; Lee, 2000). Alternatively, this relationship is more indicative of the chosen mode of killing than it is a true claim about the link between socio-economic disadvantage and the fatal strangulation of blacks in the City of Johannesburg. The effects for residential mobility, which exerted the strongest influence on male homicidal strangulation, may be a consequence of weakened informal social controls in the context of the City's accelerated rate of urbanisation and migration. Of interest is the apparent gendered nature of mobility. It is suggested that, relative to men, social ties significantly influence women's

decisions about mobility and change, thereby attenuating women's risk of homicidal strangulation. The effect of female-headed households may be associated with reduced exposure to violent masculinities, as has been described in previous South African research (Swart, 2014). However, these results may also be reflective of the potentially protective influence of female-headed households, and the influence of social processes that mediate the family structure-homicide relationship.

IMPLICATIONS FOR PRACTICE AND POLICY

The findings highlight several implications for practice and policy towards the mitigation of urban-based homicidal strangulation risk. These pertain to community- and city-level interventions that focus on both places and people. As the findings of this research have shown, fatal strangulation is a multifaceted phenomenon that requires multi-dimensional and multi-level interventions directed at several points of its social ecology.

Prevention programmes that are gender- and age-sensitive are essential for decreasing strangulation risk and homicide. Existing prevention initiatives that address violence against women need to be strengthened, and additional evidence-based and gender-specific interventions need to be developed to especially address the distinct risks that predispose females to fatal strangulation. These may include dedicated policing teams; accessible and affordable support services and networks that contribute to the provision of capable guardianship across spatial contexts; and legislation aimed at protecting women. Similar interventions are implied for the protection of the elderly, and children and adolescents. The strengthening of social protection systems that improve the effectiveness of guardianship; provide safety nets; buffer against social isolation; promote cultural norms that emphasise respect for the elderly; and promote positive adult involvement in the monitoring and supervision of children and adolescents represent important considerations for prevention efforts aimed at these risk groups. As is well established by now, and a growing focus in South Africa, violence prevention initiatives must necessarily incorporate a focus on men and masculinities that challenges the social norms that condone violent masculinities, and thereby address men's perpetration of violence against females, other males, and the elderly and the young.

Universal screening for the physical and psychological manifestations of strangulation within health care contexts represents an important strategy for the recognition, management and prevention of fatal strangulation risk in females, especially given that non-lethal strangulation is a known predictor for fatal violence against women experiencing intimate partner violence. (e.g., Glass et al., 2008; Thomas et al., 2013; Wilbur et al., 2001). Furthermore, health professionals need to be trained to adequately identify fatal strangulation risk so that they can intervene appropriately in situations that reveal evidence of non-fatal strangulation. Lethality risk assessment tools used in health and social care systems elsewhere in the world have been reported to be useful in identifying risk for victimisation among females, and supporting the implementation of domestic violence prevention programmes to contain the threat of escalating violence leading to a fatal event (see Garcia, Soria, & Hurwitz, 2007).

Policy that is city-wide and assumes an inter-sectoral approach to social development is an important tool to address the urban conditions that contribute to residential instability. This is of course closely intertwined with the socio-economic conditions that give rise to residential mobility in the first place. Despite the observed effects of socio-economic disadvantage, the interpretations of results offered here indicate clearly that the risk of lethal strangulation in the City of Johannesburg is contingent on a range of socio-economic characteristics of the neighbourhoods that people inhabit. Equally, interventions to build and strengthen collective efficacy and community connectedness in dynamic neighbourhood contexts in the City of Johannesburg are potentially valuable in promoting community solidarity, social cohesion and social inclusion, and thereby strengthening neighbourhood safety nets and protective mechanisms that moderate risk of fatal violence.

RESEARCH LIMITATIONS

The study findings need to be considered within the context of several limitations. These are summarised below.

Firstly, this research suffered from a number of data gaps. Although the research drew from a well-established injury mortality surveillance system, which is currently the most reliable source of homicide data for the City of Johannesburg, the number of strangulation events studied is relatively

small. This is, however, not uncommon in homicide research that disaggregates data to analyse the peculiarities of different mechanisms of death. The dataset was characterised by missing values for several variables, which resulted in the exclusion of a considerable number of cases in the analyses, including the complete omission of BAC data in Study II and Study III, and cases with incomplete homicide geodata in Study IV. When numerators are small, minor changes in frequency can potentially create instability in rates. A smaller number of cases may also result in changes in model specifications, thereby introducing instability in structural models and potentially resulting in some findings that are less than robust. In Study IV, the size of the dataset did not allow for the control of spatial autocorrelation; it is therefore unclear if or to what extent this may have influenced parameter estimates. Furthermore, the results of Study IV are based on 2001 census data. Accordingly, research that draws from more recent census records may yield a different set of findings based on changes in population data, and neighbourhood characteristics and boundaries. Variables measuring mediating social mechanisms were not included in Study IV since neighbourhood-level data for the City of Johannesburg are largely unavailable. Due to data gaps, the theoretical constructs employed in Study II and Study III could not be empirically tested.

The NIMSS does not include perpetrator data. Given the theoretical explanations offered in this research, information on the offender profile, victim-offender relationship and offence motivation will very clearly further illuminate the risk for homicidal strangulation. While information on perpetrators may be accessed through police case records, police data in South Africa tends to be of poor quality and therefore limits case docket analysis. Prior South African research drawing on offender data has reported significant information gaps on the offender and precipitating circumstances of the homicide (e.g., Abrahams et al., 2009; CSVR, 2008; Swart, 2014). Since the problem of incomplete perpetrator data, as well as problems of access to perpetrators themselves is not uncommon in the global context, homicide research tends to focus on victims rather than offenders (Riedel & Regoecz, 2004). Additionally, the analyses undertaken in Study II and Study III only included individual-level measures; consequently, the findings are not sensitive to the potential interacting influences of individual-level measures with socio-structural variables on predictions of fatal strangulation. Furthermore, the limited sample size did not lend itself to the assessment of interactive effects among the examined variables themselves. Therefore,

observations on the convergence of variables in predicting strangulation homicide remain tentative in this study.

The limitations that are inherent to cross-sectional, place-based research apply to this research as well. The cross-sectional design of studies does not allow for the assessment of processes of change, and the inference of causation based on findings. Accordingly, this research does not examine the stability of the predictor variables over time or quantify causation. It does, however, raise hypotheses for the further investigation of lethal strangulation in the City of Johannesburg, as well as in other contexts. Furthermore, the generalisability of the findings is limited.

Despite these important caveats, the current research offers important empirical evidence and theoretical insights into a rare event that has earned only very partial scrutiny in international and national research.

DIRECTIONS FOR FUTURE RESEARCH

The study results indicate several implications for future research. To expand on the current analyses, prospective investigations should strive to incorporate additional urban, as well as rural, geographic regions for which homicide data are available, which will yield a larger sample and possibly more robust findings, and also test the generalisability of the current findings. This is an equally useful consideration for countries that already have good homicide data. Furthermore, the inclusion of offender data will enhance the explanatory power of the modelling undertaken in this research, and address some of the complex questions that this research raises. However, given the concern about the poor quality of police records, it would not be sufficient to rely solely on police records. Homicide research would benefit greatly from data collection that is directed specifically at lethal violence, and that thereby adheres to the standard definitions of homicide and, in this case, homicide by strangulation homicide; requirements for more accurate and internationally comparable data; as well as statistical capacity requisites (also see United Nations Office on Drugs and Crime, 2011). The inclusion of offender and victim-perpetrator relationship data, including information on perpetrator motives, mobility and behaviours, will also contribute to an improved understanding of the precise dynamics underpinning female and male strangulation homicide. This focus on perpetrators is likely to be deepened through methods of qualitative research, such as

individual interviews or focus groups. Risk for homicidal strangulation may be further clarified by both quantitative and qualitative research undertaken on the experiences of women who have survived strangulation, as well as with individuals known to strangulation victims. For example, a discourse analytic or phenomenological approach to the study of non-fatal strangulation is likely to offer in-depth insights into the social ecology of attempted, as well as fatal strangulation. Additionally, future area-level studies may want to include socio-structural factors not captured by the covariates used in the current study.

More refined risk analyses of strangulation homicide will require the construction of regression models that consider individual, situational and socio-structural variables. At both methodological and theoretical levels, the examination of interaction effects and the integration of multi-level variables in future analyses will significantly further understandings of the social aetiology of fatal strangulation. In this way, studies may produce more stable findings, clarify the indistinct effects reported here, uncover moderating and protective effects, and ultimately add to the explanatory power of analyses on strangulation risk. Wells and Chermak (2011), for example, suggest that existing research and theory on homicide is not wholly clear about the risk and protective functions of certain characteristics, and the extent to which the local context can moderate their effects. Research also needs to be undertaken towards testing relevant theoretical constructs. It may then be that predictive research on homicidal strangulation is undertaken with stronger theoretical guidance and rigour. Advanced knowledge on the gender dynamics that underpin lethal strangulation specifically, and the micro-macro risk nexus for homicidal strangulation will in turn inform and encourage a holistic approach to prevention.

Following the trend towards disaggregation, future research should undertake a more fully racially disaggregated analysis to determine the differential aspects of risk across racial groups. There is substantial evidence in the homicide literature that points to racial disparities in homicide victimisation. In the context of South Africa's racialised history especially, and given the oft-times unsupported racialised portrayal of crime in the country, it would be important not only to identify racial variance in the effects of individual, structural and socio-structural factors on homicidal strangulation, but also potentially to inform public discourses on the basis of research evidence.

Given the cross-sectional nature of this study, and with the availability of the 2011 South African Census data, longitudinal analyses are recommended to improve the understanding of neighbourhood-level social processes that unfold over time and that influence patterns of homicidal strangulation in the City of Johannesburg. Here too, the availability of relevant data that allows for future research to test for mediating effects between urban disadvantage and homicidal strangulation in the urban context will likely extend existing knowledge on fatal strangulation. For example, such research could shed insight into the interesting but surprising findings related to the protective influence exerted by socio-economic disadvantage and female-headed households on some groups, and ultimately on the complex relationships between neighbourhoods and homicide. These recommendations not only make a case for comprehensive, accurate and timeous homicide data, but also foreground the value of intra-city or local level data to inform differentiated neighbourhood-level planning and action.

For research on strangulation to obtain strong policy relevance and to contribute meaningfully to the prevention of fatal strangulation, the recommendations noted here represent an important imperative for future studies and also contribute to extending the four-step public health model towards the development, strengthening and refining of interventions. While singularly the public health approach cannot address the complexity of homicidal strangulation, alongside criminal justice and human rights responses to violence, its science-based and multidisciplinary approach offers an important conceptual tool for understanding and preventing violence. In turn, the related socio-ecological model of violence prevention represents a useful framework to differentiate between the multitude of influences on fatal violence, and their complex and interactive effects, as well the conscription of appropriate theorisations of lethal strangulation.

CONCLUDING COMMENTS

This research demonstrates that homicidal strangulation in the City of Johannesburg is a unique phenomenon that is distinct from overall homicide. In extending the research on fatal strangulation, the study underscores at least three key issues that bear noting. First, the study reinforces the value of disaggregated studies on homicide. The evidence from this analysis confirms that the disaggregated effect in homicide victimisation is distinctive from the overall effect, and that homicides vary along a number of significant dimensions and characteristics, as has been patently

revealed in the strength and direction of predictive effects, reported above. The research endorses the argument that empirically and theoretically homicide is not a homogenous phenomenon but varies in its incidence and risk profiles, as well as in its explanatory frameworks. Second, the disproportionality of females in strangulation homicide is remarkable in the context of the national and international homicides profiles, and draws attention to its particularly gendered manifestation. This demographic warrants further empirical scrutiny to better understand its intersections with other social factors and processes, and to guide interventions towards greater specificity and effectiveness. Finally, and congruent with similar assessments (e.g., Paulozzi, Mercy, Frazier, & Annest, 2004; World Health Organization, 2014), this study offers compelling evidence for the need to strengthen data collection systems in South Africa, such as the NIMSS. The collection and publication of South African homicide data, like in many other low- and middle-income contexts, is still a relatively new phenomenon. Data reporting systems are thus in a developmental stage and face challenges related to, among other, unavailable or missing data, highlighting the assiduous concern with the reliability and validity of homicide data. Investment in the national research infrastructure is therefore critical for the timely collection and dissemination of more complete, accurate and quality data on the different mechanisms of death, and ultimately for the purposes of planning, resource allocation, practice and policy. The availability of comprehensive data will of course also enable more in-depth and conclusive analyses of the strangulation -and homicide-phenomenon in South Africa. Beyond these imperatives, the prevention of homicidal strangulation in South Africa is contingent on processes of social transformation that assure safety, equity, justice and human rights.

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APPENDICES

Appendix A: Ethical Clearance[6]

UNISA
Department of Psychology

Ethical Clearance for M/D students: Research on human participants

The Ethics Committee of the Department of Psychology at Unisa has evaluated this research proposal for a Higher Degree in Psychology in light of appropriate ethical requirements, with special reference to the requirements of the Code of Conduct for Psychologists of the HPCSA and the Unisa Policy on Research Ethics.

Student Name: Shahnaaz Suffla   **Student no.** 47293411

Supervisor: Prof Mohamed Seedat   **Affiliation:** Institute for Social & Health Sciences, Unisa

Title of project:

> Female Homicidal Strangulation in an Urban South African Context: An Investigation of Proximal and Distal Factors

The proposal was evaluated for adherence to appropriate ethical standards as required by the Psychology Department of Unisa. The application was approved by the Ethics Committee of the Department of Psychology on the understanding that secondary sources are to be used, that no identifying information through which the sources of original data can be determined will be made available, and all conditions related to confidentiality of the information as stipulated in the ethics form will be met to the satisfaction of the supervisor.

Signed:

Prof P Kruger
[For the Ethics Committee   ]
[Department of Psychology, Unisa]

Date: 12 November October 014

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[6] The title of the thesis was amended with approval following ethical clearance.