Young Black Men's Risk to Firearm Homicide in Night Time Johannesburg, South Africa: a Retrospective Analysis based on the National Injury Mortality Surveillance System

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Abstract

Based on data from the South African National Injury Mortality Surveillance System (NIMSS), an epidemiological surveillance system of fatal injuries, this article reports on a retrospective analysis of the data on homicide in Johannesburg, South Africa. In South Africa, as is the case in other African countries, the collection of comprehensive, quality injury data, on which inferential analyses can be conducted, remains a challenge. As such, the analysis here was drawn from the NIMSS for homicides in Johannesburg for the years 2001 to 2005, as this period offered one the most complete datasets for homicide for the city. Focusing on the 5153 night time homicide victims, a binary logistic regression model was utilised to identify the likelihood of specific risk factors occurring in certain groups of people and contexts. The results illustrate that sex, race and time at night are particularly important risk factors for night time firearm homicide and the most at-risk population for night time homicide is urbanised young black men. The article concludes with a discussion of implications the results might have for preventative efforts, calling for programming targeted at young black men. Limitations of the investigation are noted.

Keywords: firearm, homicide, Johannesburg, interpersonal violence, night time, South Africa, young black males

INTRODUCTION

Reports indicate that acts of violence claims more than 1.6 million lives globally every year (Matzopoulos, Bowman, Butchart & Mercy, 2008a). Violence here is taken to refer to "the intentional use of physical force or power, threatened or actual, against oneself, another person, or against a group or community that either results in or has a high likelihood of resulting in injury, death, psychological harm, mal-development or deprivation" (World Health Organisation (WHO), 1996, p.2-3). This definition covers a broad range of possible circumstances of which homicide or murder is only one. In addition to the latter, there are different types of fatal and nonfatal violence including self-directed, interpersonal and collective violence. Over 90% of these reported violent deaths occur in low- and middle-income countries (LMICs) such as South Africa. Global burden of disease estimates indicate that 31% of violent deaths in 2000 and 34% of violent deaths in 2001 were a result of homicide. Homicide rates were highest in developing countries which included those in sub-Saharan African (Rosenberg et al., 2006). Homicide is defined as "injuries inflicted by another person with intent to injure or kill by any means" (International Classification of Disease Manual, 1980, p.1042), and accordingly, culpable homicide is excluded from this definition.

Seedat and colleagues indicate that South Africa had an estimated 59 935 injury-related deaths in 2000 (157.8/100 000 population), with approximately half of these fatalities caused by interpersonal violence, "four and a half times the proportion worldwide" (2009, p.68). Estimates are that around 1.75 million South Africans every year seek medical attention for non-fatal injuries associated with violence (Seedat et al., 2009). Currently, "violence is the second leading cause of premature death" in South Africa (Doolan, Ehrlich & Myer, 2007, p.1) with firearms having been estimated to account for 54% of homicides in the year 2000 and these homicides tended to increase substantially at night time

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(Prinsloo, Matzopoulos & Sukhai, 2003). In view of such figures, Norman, Matzopoulos, Groenewald and Bradshaw (2007, p697) argue that South Africa's homicide rate places the country "among the most violent countries in the world" despite reported decreases in recent years. These figures call for a strengthening in both research and prevention interventions as they relate to violence, particularly homicidal violence, and its tendency to be linked to both firearms and night time.

Researchers have indicated that the costs of violence are high, affecting the law enforcement and health care systems as well as the economy and social capital (Rosenberg et al., 2006). These costs, be they financial, political or emotional, severely impact all levels of the ecological system. Over and above the impact on families and relationships, violence undercuts a nation, community or neighbourhood's socioeconomic development and cohesion. Even then, "international recognition of and assistance for injury control efforts are well below the levels directed at other health problems, particularly in developing countries" (Norman et al., 2007, p.695). It is therefore crucial that effective and contextually appropriate interventions are developed to reduce levels of violence in these countries. Yet there are very few studies concerning violence that have been conducted in LMICs despite the fact that these countries experience more violence than higher income countries. In fact, as Rosenberg et al. (2006) have suggested, the lack of available data is a result of the same factors that lead to a violent culture. Such factors include economic disparities, fragile social, political and judicial systems and social instability. The knowledge gaps concerning violence need to be addressed so that adequate prevention strategies can be developed. This development is imperative as prevention has shown to be less costly than dealing with the consequences of violence (Dahlberg & Krug, 2002).

Attempts to understand violence in South Africa have noted that the country's past was, up until the achievement of democracy in 1994, characterised by apartheid state repression, national liberation struggle, arbitrary detentions, political unrest and violence. Additionally, rapid urbanisation, glaring racial and gender socioeconomic inequalities, widespread poverty, high unemployment, high levels of alcohol and drug abuse, patriarchal views of manhood, and a weak uneven police enforcement of laws are part of an ensemble of factors that characterise post-apartheid South Africa. Thus studies analysing homicide in South Africa cannot but keep this context in mind and regard homicide as an incident that occurs at the nexus of multiple and interacting social factors (Ratele & Suffla, 2010; Seedat et al, 2009).

Given its status as one of the most unsafe countries across the globe (see Institute for Economics and Peace, 2010), post-apartheid South Africa requires research that elucidates the nature, magnitude, distribution and patterns of the different forms of violence confronting it so as to inform effective policy-making and programming. In view of international studies which have shown homicide to be unevenly distributed across groups and locations (e.g., O'Flaherty, & Sethi, 2010; Ratele, 2010), some important research questions in the context of South Africa include: Which groups are least and which are most vulnerable for homicide in South Africa? Where and when are people most at risk? What weapons are used to kill?

In light of the substantial burden of fatal and non-fatal injuries caused by firearms in the country, this article reports on homicide risk factors in night time Johannesburg, South Africa. Situated in Gauteng Province (which is one of nine provinces of South Africa), Johannesburg is considered as "the economic capital of South Africa, generating some 17 percent of SA's wealth" (Official Website of the City of Johannesburg, 2011). Even though South Africa and Johannesburg face high levels of violence and socioeconomic inequality, the city prides itself with the fact that it is "ranked No. 1 in Africa and No. 11 globally as best emerging market centre of commerce" (MasterCard 2008 Survey). Johannesburg's rapidly emerging economy is said to be due to the city's "visionary leadership, diversification to globally fast growing sectors, its socio-economic development and a conducive climate for foreign direct investment (FDI)" (Official Website of the City of Johannesburg, 2011).

The ultimate goal underlying this work is violence prevention, and given the clear ineffectiveness of current initiatives directed at violence prevention in South Africa, novel, and possibly interdisciplinary, frameworks are called for. While a public health approach involves identifying the scope of the problem, pinpointing risk factors that increase the likelihood of homicide and consequently developing interventions based on this (Rosenberg et al., 2006), it tends to be silent on factors such as the history of racial inequality, gender power, and constructions of masculinity. In contrast, critical social psychological approaches demonstrate the importance of understanding homicide risk as embedded in the history and contemporary dynamics of a society and social groups (Stevens, Seedat and van Niekerk, 2004). A public health approach is important in that it stresses that violence can be both countered and prevented (Mercy, Rosenberg, Powell, Broome & Roper, 1993), which is significant as homicide as a health and social concern is often relatively ignored despite its impact on families, neighbourhoods, communities, nations, and the world (Murray & Lopez, 1997). At the same time, critical social psychological approaches to violence situate it in its societal context, specifically the historical web of political, economic, gender and racial contexts that shape what people do in relation to other people and the external world (Laubscher, 2005; Mkhize, 2004), including the conditions that makes them vulnerable to early death. Such a framework allows for the demonstration of how understandings of particular behaviours become framed by social processes, history, space and social practices.

In line with these questions and goals, this study analysed data originating from the National Injury Mortality Surveillance System (NIMSS). A binary logistic regression analysis was conducted on data arising from Johannesburg across the period of 2001 to 2005 with the aim of identifying major risk factors for homicide by firearm discharge in the context of night time Johannesburg in the post-apartheid South African landscape. One of the few epidemiological surveillance systems of fatal injuries in Africa, the NIMSS, alongside difficult to access and problematic South African police data, offers the best available data on homicide in Johannesburg. While the authors recognise that data arising from 2001 to 2005 may not be entirely applicable in 2012 Johannesburg, it must be noted that this was the largest dataset available at the time of analysis as NIMSS datasets only become available two to three years after data capturing. Furthermore, it is hoped that the analysis of this dataset will inform future analyses of more recent data with the objective of identifying both persistent and changing trends across time.

FIREARM HOMICIDE

The presence of a firearm in an altercation massively increases the likelihood of mortality (Mercy et al., 1993). Firearms are central to interpersonal violence and their lethality results in both nonfatal and fatal injuries that have enormous human and economic costs. Additionally, global increases in homicide are almost always correlated with increased homicides by firearm discharge. Furthermore, access and availability of firearms places the firearm owners and their families at risk.

In the United States of America firearms are the second leading cause for mortality across the age groups of 10 to 34 (Mercy et al., 1993). This parallels South African data which has revealed that most firearm homicide occurs in the age groups of 15 to 34 (Prinsloo et al., 2003). A study conducted by Norman et al. (2007) showed that 54% of all homicides in South Africa in the year 2000 were firearm related. Another study by Prinsloo and colleagues (2003) demonstrated that 46% of homicides in Cape Town in 2001 were firearm related. Homicide by firearm discharge is clearly an enormous problem in South Africa.

RISK FACTORS FOR HOMICIDE BY FIREARM DISCHARGE

There is no single risk factor for violent interactions but instead a range of complex interacting factors that can be understood by way of the ecological model (Rosenberg et al., 2006). Risk factors at the individual, relationship, community and societal levels and their relationships need to be taken into account in trying to understand violent interactions and programming

for violence prevention. Here, critical social psychologists can play an important role by disentangling the intricate web and histories that produce homicide risk and the underlying meanings of the lives of those vulnerable to violence, as well as paying attention to factors that have the potential to prevent violence. Stevens, Seedat and van Niekerk (2004, p.13-14) have said that contemporary South Africa "has undoubtedly been influenced and shaped by its violent history of racism and oppression", and psychologists should assist in "locating current manifestations of violence within ideological, historical and material context if comprehensive understandings of such manifestations are to be generated alongside appropriate forms of social action aimed at preventing them."

For Mercy et al. (1993) violence risk cannot be understood outside of fundamental societal issues such as economic problems, unemployment, racism and social inequalities. Additionally, large differences exist across different cultural, racial, ethnic and social economic groups in any one country in terms of risk, employment opportunity and resource access (Dahlberg & Krug, 2002). In South Africa there are a range of contributions to violence including poverty, inequality, corruption, gender inequalities, widespread patriarchal notions of manhood, and social change (Seedat et al, 2009; Ratele & Suffla, 2010). Furthermore, "the underlying determinants of violence, many of which are a legacy of the apartheid past, are intertwined with the disintegration of the social fabric" (Norman et al., 2007, p.697).

DEMOGRAPHICS

Demographics account for individual characteristics that increase the likelihood of susceptibility to homicidal violence. Global burden of disease estimates have demonstrated that homicide rates differ according to gender and age. For example, global burden of disease estimates in 2000 revealed that 77% of homicide victims were males with the highest rates occurring in the age range of 15 to 29 (Dahlberg & Krug, 2002). Estimates in 2001 displayed that male homicide rates were six times greater than female rates in the age group spanning 15 to 24. In other age groups this ratio showed a slight decrease but continued to display much higher rates for males (Rosenberg et al., 2006). With regards to the intersection of race, gender and age, Hammond and Yung (1993) have indicated that black male youths are most often the victims of firearm homicide in America.

Global estimates in 1990 portrayed that 40% of world homicides occurred in sub-Saharan Africa. Furthermore, interpersonal violence accounted for one in six male deaths in this region (Murray & Lopez, 1997). A study conducted by Bradshaw and colleagues (2005) a decade later found that the male mortality rates from injury deaths were three times higher than for those of females and that homicide was the leading cause of fatal injury for males. In another study it was shown that while South African females have a much lower risk for homicidal violence than their male counterparts, they are still seven times more likely to be a victim than other females across the world. Similarly, children in South Africa had homicide rates that were double the global average. Such results have led to the conclusion that gender inequality, intimate partner violence, and child abuse are serious problems in South Africa (Norman et al., 2007) that are directly related to the substantial homicide rate. In the most recent study regarding homicide demographics in the 2001 to 2005 cohort, Prinsloo and colleagues (2003) have reported that males account for firearm homicide nine times more than females and that firearm homicide is most pronounced in the 15 to 24 year age group.

LOCATION

Income inequality and poverty are global risk factors for all forms of violence (Rosenberg et al., 2006). For instance, Mercy et al. (1993, p.10) found that homicide victimisation rates are consistently highest in those parts of cities characterised by impoverishment. Violence is also more common in areas where there is little social and institutional support as well as in physically deteriorating areas (Dahlberg and Krug, 2002).

In South Africa, the highest rates of injury death occur in Gauteng and the Western Cape which are the most developed provinces with the largest metropolitan areas (Bradshaw et al., 2005). Additionally, urbanised areas with increased population density have been found to have higher homicide rates in South Africa (Matzopoulos, Bowman & Mathews, 2008b).

BLOOD ALCOHOL CONCENTRATION AND POINT IN TIME

While there are differences across countries, over half of the victims and perpetrators of global violence have been found to be under the influence of alcohol at the time of a violent interaction (Odero, 2003). This is particularly the case with males (Rossow, 2001). Alcohol plays a role in increased aggression and impaired judgement amongst victims and perpetrators. It also seems to be related to night time violence which is significant as between 65% and 80% of violent incidences occur between 6pm and 6am (Odero, 2003).

More than half of South African victims of intentional injuries test positive for alcohol consumption (Matzopoulos et al., 2008b). In a study conducted by Norman and colleagues (2007), 53% of individuals with fatal injuries in South Africa in 2001 tested positive for alcohol. In another study conducted in Cape Town in 2001 by Prinsloo et al. (2003), victims of firearm homicide were less impaired than victims of non-firearm homicides. There was also an increase in firearm homicides at night time. Further, while non-firearm homicides tended to occur on the weekends, firearm homicides were more evenly distributed across the week.

For Rosenberg et al. (2006, p.761) "an understanding of the epidemiology and aetiology of violence and prevention provides important insights into the spectrum of policies and interventions that can be drawn on to prevent violence in LMICs." South African communities are characterised by limited resources resultant from the uneven distribution of wealth in the country and as such prevention is a more cost-effective approach than one that might deal with the consequences of current or past violent interactions. In line with the general goals of the NIMSS, this study thus aims to provide information about the risks associated with firearm homicides in night time Johannesburg and recommend primary prevention strategies to policy makers, service providers and key stakeholders such as the forensic medico-legal services, the national crime prevention strategy and violence and injury prevention agencies (Donson, 2008). Such information is based on the following research questions. Who is at risk for firearm homicide in night time Johannesburg? In what areas of Johannesburg is night time firearm homicide most likely to occur? Do certain days of the week and certain times of the night increase the likelihood of firearm homicide in night time Johannesburg? Does alcohol consumption increase the risk of being a victim of firearm homicide in night time Johannesburg?

METHODS

In South Africa, as is the case in other African countries, the collection of comprehensive, quality injury data remains a challenge. Without such data, definitive analyses of injury generally and homicide specifically, but also what works for violence prevention, are rendered difficult. The data used here was drawn from the NIMSS database for homicides in Johannesburg for the years 2001 to 2005. This period offered one of the most complete datasets for homicide for the entire city. The limitation of utilising data for the period 2001–2005 is plain as the situation may have changed since then, but this can only be known when new data is available on which further analyses can be performed.

The NIMSS is an epidemiological surveillance system that is captured by South African mortuaries to detail natural and non-natural deaths in terms of the individual's demographics, scene and time of death and causes of death. The Johannesburg database for 2001 to 2005 consists of 9484 subjects of which 5153 were victims of night time homicide.

As there have been previous descriptive analyses of the NIMSS database, this study performed a secondary analysis on the NIMSS with the intention of focusing on those of the 5153 subjects that were subjected to night time homicide. Specifically, the study utilised a binary logistic regression model in order to identify the likelihood of particular risk factors occurring in certain groups of people and contexts. Logistic regression models "assume that a person's risk of disease is a specified mathematical function of his exposure to different risk factors" (Coggon et al., 1993, p.19). That is, the model predicts the probability of an outcome according to a set of predictors or independent variables (Peng, Lee & Ingersoll, 2002). In this particular case, the binary variable representing the outcome was presence (outcome=1) or absence (outcome=0) of firearm homicide. The NIMSS profiles each deceased subject according to 21 variables (Donson, 2008). This particular study utilised the town of injury, blood alcohol concentration levels, time of death, day of death as well as demographic variables such as racial group, gender and age as binary predictors in the model. In view of the fact that the large number of towns across Johannesburg make analysis difficult, towns were organised into 12 areas according to the socio-economic status of each town as well as in terms of the proximity between various towns. Additionally, because times and days of injuries are often missing from the NIMSS database, times and days were calculated according to the times and days of deaths. It must therefore be noted that these results may not be entirely accurate as injury and death do not always occur simultaneously. This may lead to slightly biased results which may, in turn, have implications for recommended primary prevention.

ANALYSIS AND RESULTS

The data was initially subjected to a range of descriptive techniques in accordance with the identified risk factors. These indicated that 67% of all homicides in Johannesburg across the years 2001 to 2005 involved firearms. Additionally, 54% of homicides occurred at night time and, more importantly, of these night time homicides, 71% were firearm related. These figures confirm that night time firearm homicide is significantly concerning in the South African context and warrants the further analyses taken up by this study. With regards to sex, 89% of all firearm homicides resulted in male deaths while only 9% resulted in female deaths. The age group spanning 25 to 34 had the highest rate, consisting of 35% of all firearm homicides. This was followed by the 15 to 24 age group which was composed of 17% of firearm homicides. The highest rate of firearm homicides was amongst blacks, making up 88% of all firearm homicides. The NIMSS indicates location by the variable 'town of injury'. Towns were grouped according to proximity and social economic characteristics. Frequency graphs demonstrated that 50% of firearm homicides occurred in central Johannesburg and surrounding areas. This was followed by Soweto and surrounding areas with 28% of firearm homicides. The majority of firearm homicide victims tested negative for alcohol consumption. Most of these firearm homicides occurred between 9pm and 11pm followed closely by homicides occurring between 6pm and 8pm. Furthermore, 21% of these deaths occurred on a Saturday and this was followed closely with 18% occurring on a Sunday.

A series of binary logistic regressions were performed on the 5153 night time homicide cases. The outcome variable was the presence or absence of firearm homicide. The independent variables were re-coded into binary variables in accordance with the above descriptive results. As such, the age groups of 15 to 34 were collapsed into one category. Likewise, blacks were retained as a single separate category while the other racial groups were collapsed into a single category. Locations were divided into central Johannesburg and other and night time was divided into 6pm to 11pm and 12am to 6am. Finally, days of the week were categorised according to weekends and weekdays. Groups that the literature and the descriptive statistics imply increase risk (black, males, weekend, central Johannesburg, 15-34 years, 18h00-23h00pm) were coded as one. As victims of firearm homicide tend to be less impaired by alcohol than those of non-firearm homicides (Prinsloo et al., 2003), zero blood alcohol concentration was coded as one. Groups that the literature and the descriptive

statistics imply increase protection or are not associated with firearm homicide were coded as zero. Missing values were also coded as zero. These imputations decrease bias as well as increase confidence in the meaning of significant results for risk factors by assuming that missing values only represent protective factors and not risk factors (Paik & Sacco, 2000).

Initially a two-way table with measures of association was run for each predictor variable as a function of the outcome variable in order to ascertain the degree of association between the two variables (Whitley, 2002). Binary logistic regressions reporting odds ratios were then run for each predictor paired with the outcome variable. Finally, a multivariate binary logistic regression was run for all the predictors in order to cross-check the adjusted odds ratios with the unadjusted odds ratios, ascertain the total percentage of outcome variance explained by the predictors and to check for any interactions amongst the predictors. Multivariate binary analyses conduct separate models for the relationship between the outcome variable and the predictor variables as well as for the association between pairs of predictors (Carey, Zeger & Diggle, 1993).

Table 1 presents the results from the above-mentioned analyses. For both the two-way tables and the odds ratios, all the predictors had significant p-values. However, these p-values may be biased by the large sample size and thus confidence intervals are more meaningful descriptions of significance in this case (Whitley, 2002). For the race predictor, 90.5% of firearm homicides occurred among blacks. Additionally, blacks are 27% more likely to be affected by night time firearm homicide than other racial groups (OR 1.27, 95% CI 1.04-1.55). While race is clearly a risk factor, it does only explain 0.08% of the variance in the outcome variable (Pseudo R^2=0.0008). For the gender predictor, 90.2% of firearm homicides resulted in male deaths. The male population is 79% more likely to be affected by firearm homicide at night than the female population (OR 1.79, 95% CI 1.49-2.16). However, once again, only 0.5% of the variance in firearm homicides can be explained by this predictor (Pseudo R^2=0.005). With regards to the day of death, 41.6% of firearm homicides occurred on the weekend. Moreover, the odds ratios (OR .86 95% CI .76-.98) imply that the weekend seems to be a protective factor for firearm homicides at night. Only 0.4% of the outcome variance is explained by this predictor (Pseudo R^2=0.004). For the town of injury, 53% of night time firearm homicides occurred in central Johannesburg. Firearm homicides are 16% more likely to occur in central Johannesburg than in other areas (OR 1.16 95% CI 1.03-1.32). Again, only 0.2% of the outcome variance can be explained by this predictor (Pseudo R^2=0.002). With regards to alcohol, only 37.8% of the subjects had zero blood alcohol concentration. The odds ratio for this predictor was extremely high (OR 2.62 95% CI 2.25-3.05) and this predictor seems to be explaining much more of the outcome variance than the other predictors (Pseudo R^2=0.03). However, it must be acknowledged that 1686 of the cases were missing data concerning blood alcohol concentration and such a large set of missing data may bias the results (Paik & Sacco, 2000). For the age predictor, 54.7% of firearm homicides occurred in the 15 to 34 age group. This age group is 31% more likely to be subjected to night time firearm homicide than other age groups (OR 1.31 95% CI 1.16-1.49). The age predictor only explains 0.3% of the outcome variance (Pseudo R^2=0.003). In terms of the time of death, 60.1% of all night time firearm homicides occur between 6pm and 11pm. Firearm homicide is 51% more likely to occur in this time range than at any other times of the night (OR 1.51 95% CI 1.33-1.71). The time of death explains 1% of the variance in night time firearm homicide and thus has a higher explanatory power than most of the other predictors (Pseudo R^2=0.01). More importantly, only 5.1% of the outcome variance is explained by all of the predictors together (Pseudo R^2=0.05). The unadjusted and adjusted odds ratios are only slightly different and so there are no concerns about possible interactions amongst the predictors.

Table 1. Odds ratios for predictor variables as functions of the outcome variable (absence or presence of homicide)

Predictor	Column Percentage n/N (%)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)	p-value
Race	Black 3292/4630 (90.5) Other 347/523 (9.5)	1.25 (1.03-1.51)	1.27 (1.04-1.55)	0.02
Sex	Male 3282/4564 (90.2) Female 357/589 (9.8)	1.66 (1.39-1.99)	1.79 (1.49-2.16)	0.00
Day of Death	Weekend 1514/2264 (41.6) Weekday 2125/2889 (58.4)	.73 (.64-.82)	.86 (.76-.98)	0.02
Town of Injury	JHB Central 1929/2654 (53) Other 1710/2508 (47)	1.26 (1.11-1.42)	1.16 (1.03-1.32)	0.02
Blood Alcohol Concentration (BAC)	Zero 1376/1653 (37.8) Positive 2263/3500 (62.2)	2.72 (2.35-3.14)	2.62 (2.25-3.05)	0.00
Age	15-34 years 1992/2723 (54.7) Other 1647/2430 (45.3)	1.3 (1.15-1.46)	1.31 (1.16-1.49)	0.00
Time at Night	18h00-23h00 2186/2914 (60.1) 00h00-06h00 1453/2239 (39.9)	1.62 (1.44-1.83)	1.51 (1.33-1.71)	0.00

The possible bias generated by missing data concerning blood alcohol concentration supported the need to conduct a second set of analyses. The missing data for this variable was excluded from this analysis, leaving 3467 cases. The results demonstrated that 54.8% of the cases had zero blood alcohol concentration. However, the odds ratios continued to be extremely high (OR 2.9 95% CI 2.46-3.46). Additionally, blood alcohol concentration explains 4.7% of the outcome variance (Pseudo R^2=0.047). A multivariate binary logistic regression model demonstrated that 6.5% of the outcome variance can be explained by all the predictors together (Pseudo R^2=0.065). Again, there seems to be no interacting effects amongst the predictors.

DISCUSSION

Given the lethality of firearms and their ability to cause injuries across long distances as compared to other weapons such as knives or blunt objects, the presence of a firearm during a violent interaction considerably increases the likelihood of mortality (Mercy et al., 1993). This study supports previous studies which demonstrated that a large percentage of South African homicides are firearm related (Norman et al., 2007; Prinsloo et al., 2003). Furthermore, the results of the initial descriptive analysis clearly demonstrated that while homicide by sharp or blunt objects may occur in the South African context, these make up only a small percentage of mortalities resulting from violence as compared to firearm related incidents. The figure representing firearm-related deaths also increases at night time, suggesting that risks increase with time associated with leisure, darkness and after work hours. More concerning is that despite the attempts made by the amended South African Firearms Control Act (Act 60 of 2000) to decrease access to firearms (Gun Control Alliance, 2001), firearm-related homicides still rank highest with regard to violence-related mortality. This may be an indication of the easy availability of firearms in South Africa, but also other factors that increase young black males' risk to homicide.

A number of risk factors for night time firearm homicide were identified. Firstly, blacks are more at risk for firearm homicides than other racial groups in Johannesburg. However, as other research has cautioned, statistics based on race should be interpreted with caution as this may be indicative of other risks linked to violence such as inequality, unemployment, poverty, constructions of masculinity, and concentration of alcohol outlets (Mercy et al., 1993; Ratele, Smith, van Niekerk & Seedat, 2011). In accordance with global burden of disease estimates this study reported that males are 79% more likely to be at risk for night time firearm homicide than females (Dahlberg & Krug, 2002). In fact, sex seems to be the strongest risk factor for firearm homicide. In line with Cape Town data from a study conducted by Prinsloo et al. (2003), this study demonstrated that the age group ranging from 15 to 34 is most at risk for firearm homicide in Johannesburg. However, the difference between this age group and other age groups is not as pronounced as expected. Nonetheless, overall, the data seems to suggest that young black males are the most at risk population in urban South Africa. This finding is disconcerting as this is the group that is said to be, alongside young women and men from other races, the generation that will be responsible for the prospective economic, political and social future of Johannesburg and South Africa. Their risk to premature death from homicide, and what this vulnerability suggests about South African society, is disquieting.

Studies have reported that densely populated urbanised areas, such as central Johannesburg, have higher homicide rates (Matzopoulos et al., 2008b). As expected, the present study showed that the firearm homicides increase in central Johannesburg and the surrounding areas. However, the difference between Johannesburg and other locations is also not as striking as expected. An even more unexpected result is that the weekend appears to be a protective factor rather than a risk factor for firearm homicide, most usually as a result of increased alcohol consumption during this period. This is, however, in accordance with Prinsloo and associates' (2003) finding that while non-firearm homicides tend to occur on the weekends, firearm homicides are more evenly distributed across the week. Regardless, the finding of that study does not

coincide with the descriptive statistics in the present study which show that more firearm homicides occur on the weekend. Accordingly, a second binary logistic regression was run which included Friday as part of the weekend. However, this made little difference to the results. This is most likely due to the week/weekend being a difficult binomial variable as each component cannot be evenly split. For this reason, the descriptive statistics may be more useful in this instance although further work should still be conducted as a means to explain this discrepancy.

A major risk factor for firearm homicide seems to be the time of night. Specifically, risk increases between 6pm and 11pm at night. This is a significant result as it implies that crime prevention strategies need to be intensified during early and late evening rather than after midnight. A possible suggestion for this peak at this particular time of night is that crime-related firearm homicides may occur during post-work hours associated with family gatherings and leisure when people are relaxed and least expect a violent incident to occur. The peak also coincides with hours during which alcohol consumption takes place. However, blood alcohol concentration levels were ambiguous in this study. While the two-way tables suggested that fewer subjects were intoxicated at the time of death, the odds ratios still remained very high, even when accounting for missing data. Moreover, of all the predictors, blood alcohol concentration seems to be explaining most of the overall variance in firearm homicides. While other studies suggest that victims of firearm homicide are generally less intoxicated with alcohol than victims of non-firearm homicides (Prinsloo et al., 2003), alcohol clearly plays an important role in firearm homicides. The overall variance in this data suggests that alcohol is a risk factor however definitive conclusions based on blood alcohol concentration should be interpreted cautiously given that very few bodies are tested for alcohol use on admission to South African mortuaries. This variance may therefore not reflect the true proportion of intoxicated victims during a homicide incident.

Collectively, the predictors only explain a very small amount of the outcome variance. It may thus be that there are additional factors that have not been measured in this study that could account for more of the outcome variance. Even then, age, sex, neighbourhood densities and characteristics, time of night, race and alcohol are clearly important risk factors to take into account in violence prevention programming. In view of the adopted public health model that purports violence to be preventable, these risk factors should be central to policy-making decisions and prevention strategies. In particular, these risk factors point to the need for primary prevention models that target densely populated and urbanised areas of Johannesburg. Additionally, alcohol needs tighter regulation and young black males need to be integrated into prevention programmes to equip them with measures should they encounter a violent situation.

In addition to the risk factors emerging from the analysis, other underlying factors such as legacy of apartheid struggles typified by armed struggles, racialised economic inequality and unemployment, sex/gender power and patriarchal masculinity, neighbourhood living conditions, social capital and connectedness, the uses of leisure, alcohol use/abuse and a sense of hope for the future need to be understood as playing significant roles in homicide (Ratele et al, 2011; Ratele & Suffla, 2010; Seedat et al, 2009). These socio-historical features of the South African landscape contribute to the levels of firearm-associated homicide. Future research on the firearm homicide vulnerability of urban young black men in night time Johannesburg should take cognisance of these issues.

CONCLUSION
Research has suggested that certain prevention strategies targeting firearms can decrease mortality rates. For example, positive effects have been demonstrated by laws that prohibit being armed in public spaces (Mercy et al., 1993) as well as laws that restrict access to guns (Dahlberg & Butchart, 2005). Other strategies have included safe storage of firearms,

waiting periods before the purchase of firearms and the requirement that all firearms be registered. There are, however, few studies to demonstrate the effectiveness of such procedures (Rosenberg et al., 2006). Additionally, the South African Firearms Control Act (Act 60 of 2000) does attempt to draw on such prevention strategies and laws albeit, as demonstrated by this study, with minimal effect (Gun Control Alliance, 2001). It is therefore important to identify actual risk factors that contribute to firearm homicide in order to guide effective and empirically-driven prevention strategies. These may include better policing of firearm access and ownership as well as implementing laws that illegalise the carrying of firearms in contexts where alcohol consumption occurs.

Prevention is more cost-effective than dealing with the consequences of violence (Dahlberg & Krug, 2002). Primary prevention strategies are thus imperative for a South African context characterised by limited resources. Based on the evidence generated by this study, prevention strategies in Johannesburg should focus more on central Johannesburg and, while avoiding racial profiling, pay increased attention to violence prevention in respect of young black men. Interventions should be attentive to temporality, with night time between 6pm and 11pm shown to increase vulnerability to fatal violence. Furthermore, alcohol intake needs to be regulated more closely. Importantly, any intervention to take place in South Africa needs to take into account other factors that contribute to violence such as unemployment, racism, social inequality, poverty, unemployment, income inequality, masculinity constructions and gender inequality (Dahlberg & Krug, 2002; Norman et al., 2007). In short, night time firearm homicide of young black men cannot be understood outside of the wider South African context and future preventative strategies need to work across all levels of the ecological model in order to have a long-term impact.

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