Suicide mortality in the South African context

Exploring the role of social status and environmental circumstances

Stephanie Burrows

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Exploring the role of social status and environmental circumstances

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Dedicated to the victims and survivors of suicide in recognition of their pain and anguish.
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List of Publications

The thesis is based on the following publications, which will be referred to in the text by their Roman numerals:


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**Terminology**

CITIES: The focus of the thesis is on the urban environment, and data are gathered from a number of cities. The cities are referred to by the municipalities’ names so as to indicate the clearly defined areas they represent, and to highlight that the issues raised not only relate to urban development, but are also municipal concerns. The table below shows the new municipalities’ names, and the old well-known names of the urban centres they now incorporate.

<table>
<thead>
<tr>
<th>New name of municipality</th>
<th>Incorporating the urban centre of</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Tshwane</td>
<td>Pretoria</td>
</tr>
<tr>
<td>City of Johannesburg</td>
<td>Johannesburg</td>
</tr>
<tr>
<td>eThekwini</td>
<td>Durban</td>
</tr>
<tr>
<td>City of Cape Town</td>
<td>Cape Town</td>
</tr>
<tr>
<td>Nelson Mandela</td>
<td>Port Elizabeth</td>
</tr>
<tr>
<td>Buffalo City</td>
<td>East London</td>
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</tbody>
</table>

INCOME LEVELS: The thesis avoids the use of the terms ‘developed countries’ and ‘developing countries’ because of the judgement implications inherent in them. Instead, it uses broad income levels to differentiate countries on a basis that is meaningful for health outcomes. These levels follow the World Health Organization classifications into two groups, high-income countries and low- and middle-income countries.

RACE: For South African data, the thesis makes use of the term ‘race’ and the categories subsumed within this label, based on the South African Population Registration Act of 1950: ‘Asian’, ‘Black’, ‘Coloured’ and ‘White’. Coloureds are defined as those with mixed racial origin. Although the preferred term locally is ‘population group’, the more easily understood term ‘race’ has been used. It is recognised that these racial categories are a social construction that serves certain political purposes. As specified in the reports of the system that collects these data, the use of the terms does not imply any acceptance of the racist assumptions on which these labels are based. Nor is it implied that such categories have any anthropological or scientific validity. The race groups are gross proxy measures of social groupings in South Africa and give no indication of intra-group diversity. However, there remain
important differences between racially-defined groups in the share of ill-health, mediated by social and economic factors, and the terms are used to reflect the differential manner in which apartheid impacted (and still does) on the lives and health of South Africans. For research undertaken outside of South Africa, the thesis uses the terms employed by the researchers themselves as far as possible.

SEX: To distinguish between male and female deaths, the term `sex´ is used in the thesis in the sense that it describes distinctive physiological features related to being male or female. On the other hand, the term `gender´ encompasses various social, psychological and occupational characteristics that are attributed to being male or female, the meanings of which are dependent on social norms.

SUICIDE MORTALITY: There has been much debate regarding the terminology to describe suicidal behaviour in its various forms, a discussion of which is beyond the scope of this thesis. The term `suicidal behaviour´ as used in the thesis broadly refers to a wide range of self-destructive behaviour that extends from thoughts of killing oneself to self-inflicted death. The term `suicide mortality´ is employed to denote deaths by suicide, although the shorter term `suicide´ is also used.
### Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>BAC</td>
<td>Blood Alcohol Concentration</td>
</tr>
<tr>
<td>CI</td>
<td>Confidence Interval</td>
</tr>
<tr>
<td>ECDS</td>
<td>Empirical Criteria for the Determination of Suicide</td>
</tr>
<tr>
<td>NIMSS</td>
<td>National Injury Mortality Surveillance System</td>
</tr>
<tr>
<td>OCDS</td>
<td>Operational Criteria for the Determination of Suicide</td>
</tr>
<tr>
<td>OR</td>
<td>Odds Ratio</td>
</tr>
<tr>
<td>RR</td>
<td>Rate Ratio</td>
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<td>WHO</td>
<td>World Health Organization</td>
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Abstract

Suicide is a serious public health problem worldwide, but is differentially distributed across social groups and regions. Understanding these differences contributes to our knowledge regarding suicide mortality aetiology and is essential for appropriate strategies for management and prevention.

With post-apartheid transitional South Africa as the setting, the goal of this thesis is to advance knowledge of the relationship between social status (race and sex), contextual factors and suicide mortality. The accuracy of the suicide data used is also assessed.

All five studies forming the thesis are based on the National Injury Mortality Surveillance System (NIMSS), currently the only source of epidemiological data on suicide mortality in South Africa. Census figures provide denominator data and area attributes. Inputs from experts and additional victim data are gathered from the medico-legal system.

The first three studies investigate the relative importance of suicide across socio-demographic groups, compared to other injury deaths (Study I), across six cities (Study II), and within one city – Tshwane (Study III). As in other settings, mortality by suicide is unequally distributed across socio-demographic groups, with the distributions varying across cities. While Blacks have the highest absolute numbers both overall and across most sex-specific groups and cities, males and Whites are typically most affected when rates are calculated. For all races except Whites, suicides are concentrated in the younger age groups.

Study III additionally examines how the cross-sectional clustering of socio-economic and environmental descriptors of Tshwane residential areas impacts on the suicide outcome for different groups. Main dimensions of the living circumstances of residential areas (i.e., socio-economic circumstances, economic need, and matrimony) are found to influence age-adjusted suicide rates for both sexes but minimally so for
race groups. Less favourable clusters of circumstances have a protective effect.

Suicide data accuracy is assessed in the last two studies, each examining different points in the medico-legal system. Decisional processes of those medical practitioners who are asked to determine the apparent manner of death of each case entered in the NIMSS are assessed in semi-structured interviews (Study IV) and dockets produced from standard medico-legal investigation procedures serve as the gold standard against which to compare NIMSS certifications (Study V). Medical practitioners differed considerably in their opinions both regarding the quality of the data currently at hand for suicide determinations, and in the applicability of the U.S.-developed criteria to the South African context. Despite this, the accuracy of the suicide determinations was high, at least in the one city (Tshwane) studied.

In sum, suicide mortality in post-apartheid South Africa varies widely across sex and race groups, with city and living area factors seeming to influence these differing outcomes, more so for sex than for race. Although suicides are outnumbered by other injury deaths overall, this is not the case for several sex-, race- and age-specific groups, and rates indicate that suicide mortality is a substantial public health burden that should no longer be given low priority in the health system. Medical practitioner expertise appears to provide accurate input for the determination of suicide deaths.

Key words: suicide, transition, socio-demographic groups, context
“Even if suicide is the result of an individual decision, it neither originates nor is committed in a vacuum.”

[Makinen & Wasserman, 2001, p.101]
1 Introduction

Understanding the political, economic and social context in which each suicide occurs is essential for public health efforts to reduce this major cause of death. Much of our knowledge of suicide comes from research conducted in the high-income and relatively stable countries of Europe, Scandinavia, North America, and in New Zealand and Australia. Many low- and middle-income countries have undergone or are currently experiencing extensive societal transformations, and little is understood of the suicide profiles in these countries and how macro-level changes affect these profiles.

South Africa, with the substantial socio-political changes that occurred with the dismantling of apartheid and their likely differential impact on the various socio-demographic groups within the country, is an interesting setting in which to examine the relationship between social and economic contextual circumstances and suicide. Patterns of suicide in the post-apartheid, democratic South Africa can be important indicators of the levels of adjustment to the changes across various segments of the population.

My public health approach to suicide originated from my involvement in developing the National Injury Mortality Surveillance System in South Africa. That experience highlighted for me the need for an increased focus on the problem of suicide in the country, starting with good quality data collection, leading into studies of underlying factors, with the ultimate aim of implementing and evaluating appropriately targeted prevention efforts.

It is hoped that the findings of this thesis have begun to address this need by providing a better understanding of the risk distribution across different socio-demographic groups, of the social and contextual aspects of suicide mortality, and of the potential of the medico-legal system to assess suicide deaths in a structured approach that takes not only medical, but also psychological factors into account. My wish is that this understanding will be used to inform prevention efforts so that unnecessary pain and loss can be avoided. To date, despite recent indications that suicide is a considerable public health issue for South Africa, no national suicide prevention programme exists.
2 Background

2.1 The public health burden of suicide in different countries

Suicide mortality is a major public health problem internationally. According to the World Health Organization (WHO), almost one million people worldwide died from suicide in 2000, representing one death every 40 seconds [1]. Estimates are that this will increase to 1.53 million in 2020 [2]. Suicide is the thirteenth leading cause of death globally, but among 15-44 year olds, it advances to fourth position. Such figures alone do not begin to reveal the psychological pain of the suicide victims themselves, nor the emotional and social impact that these deaths have on the family and friends left behind. In addition, huge economic costs are associated with suicidal behaviour [1].

2.1.1 Regional variations in data collected and knowledge produced

The availability of data and the consequent knowledge accumulated regarding suicide varies considerably across countries. The WHO plays a crucial role in maintaining a data bank on mortality based on the data provided by its Member States [3]. This data bank is the primary source of international suicide figures. Yet, the regularity of reporting by Member States has been varied, with some not reporting at all. For example, data are received mostly on a regular basis from countries in the European Region, but almost no data are available for the African Region [3]. Despite a few regional studies that provide some information [4], little is consequently known regarding the problem of suicidal behaviour in Africa.

Variations in the reliability of the data across countries (due to differing recording practices, degrees of misclassification, and/or underreporting) means that some caution should be exercised when making cross-national comparisons. However, it has been argued that the relative ranking of national suicide rates can be regarded as reasonably accurate [1,4].
2.1.2 Suicide in countries in transition

Of the 105 countries reporting on cause of death to the WHO since 1995 [5], the highest suicide rates (over 30/100 000 population) occur in Eastern European countries. This has led a number of authors to highlight the importance of rapid change in society in influencing cause-specific mortality [6-8]. A number of studies examining the relationship between societal transformations and suicide mortality have found the process of social, political and economic change to be paralleled by changes in suicide mortality [6-7,9-13]. Yet, similar transformations do not necessarily produce the same suicide mortality outcomes [10], nor are all social groups similarly affected by the transition [6-8,12-14]. These differences both across and within countries, point to the “within country” possible intermediate roles of culture or social integration in influencing the outcomes [10,15].

2.1.3 Suicide in the South African context

A lack of systematic data collection has meant that the full burden of suicide in South Africa cannot be assessed. Based on vital statistics data, Lester [16] presented national level figures for all race groups, with a suicide rate of 8.4/100 000 for males and of 2.2/100 000 for females during 1979-1981, while figures in a WHO report show a considerably higher overall suicide rate of 17.2/100 000 in 1990 [17]. Yet, these vital statistics from the apartheid years have been shown to be questionable given the reported poor quality of both mortality and population data for particular groups and regions during this time period [18,19]. Consequently, other researchers investigating data from the apartheid years have restricted their analyses to compilations of proportional mortality rather than rates for Blacks, and have excluded some regions [20,21].

Post-apartheid, the only national suicide figures are estimates for 2000 [22]. These give age-standardised rates of 24.6/100 000 for males and 6.9/100 000 for females. Regional figures that are available, mostly covering large urban centres, show rates ranging between 11/100 000 and 25/100 000 [23-26].

Research on suicide mortality in South Africa is in its infancy, particularly epidemiological research. Information comes from small-scale ad hoc studies and, more recently, a surveillance system (the National Injury Mortality Surveillance System, or NIMSS – see `Material
and Methods’ section below) that covers some parts of the country and produces annual reports on these data.

The studies cover different groups of the population, different time periods, and different regions, making comparisons across studies difficult. Some of this work has been presented at four southern African suicidology conferences that have been held in South Africa from 1988-2000, two before and two after the end of apartheid [27-30]. These conferences have been important in highlighting the differential patterning of suicidal behaviour across social groups and in proposing underlying social, economic and political factors such as the high rate of family break-up in society, substance abuse, unemployment, rapid urbanisation with inadequate housing, socio-economic and educational pressures and the changing socio-political circumstances with associated violence [31-34]. Such factors contribute to high levels of stress and produce a breeding ground for potential suicidality [35]. Work presented at the most recent conference [30] revealed increasingly high levels of stress and suicidal behaviour that cut across all age, sex and race groups.

Most of the research presented at these conferences, and the South African literature more generally, focuses on suicidal ideation, attempted suicide or parasuicide. In addition, despite the acknowledgement of broader contextual issues, South African suicidology research typically has an individual-level focus. While these are essential avenues of research, a focus on the fatal outcome of suicidal behaviour and the use of a public health approach are also important for improving our understanding and prevention of this significant health burden. It is on these grounds that the current work profiles the socio-demographic patterning and investigates the social and environmental circumstances underlying suicide mortality. The development of the National Injury Mortality Surveillance System (NIMSS) has been important in this regard, and with its recent full coverage of urban municipalities it has become possible, for the first time, to compare all socio-demographic groups for the same time period and same geographical level.

2.2 Socio-demographic suicide mortality profiles within countries

While country level figures are useful in estimating the burden of suicide mortality, it is also clear that these conceal great variations in the suicide profile within countries. International and South African research has
shown that socio-demographic groups are differentially affected by suicide, both in magnitude and in the methods of suicide used.

2.2.1 Socio-demographic differences outside of South Africa

Sex and age differences

Sex and age are important socio-demographic markers for health outcomes, including suicide mortality. In almost all countries, suicide rates are higher among males than females [1,5]. China is a notable exception, with very high rates recorded for females, particularly young women in rural areas [36-37]. It has been argued that the sex reversal seen in China is an extension of the lower male-to-female ratio of suicide rates seen in India and some other Asian countries compared to other regions [37-38].

Globally, suicide rates tend to increase with age, with rates among people aged 75 years or older approximately three times the rates among people aged 15-24 years [1,5]. While this is visible for both sexes, it is more marked in males. For females in some places, the rates peak instead in middle age or, particularly in low- and middle-income countries and among minority groups, among young adults [1].

However, there has been a shift in the profile across age over the last 50 years, with a rise of suicide in younger age groups. In the United States, Canada, Australia and a number of countries in Europe, this trend has been most pronounced in males and in some instances, a decline in female rates have been observed [21,39]. For example, in England and Wales, rates in males aged under 45 have doubled in the last 50 years, whilst they have declined substantially in females and older males. Attempts to explain these shifts remain exploratory but a range of social changes are likely to have played an important part, with varying impact for males and females of different age groups [40].

Racial/ethnic differences

International studies have found that rates of suicide differ substantially according to racial/ethnic group [1]. Studies examining suicide in indigenous groups – for example, in Australia [1,41-42], Canada [1,41], Greenland [43], and the United States [41] – report that their rates are frequently higher compared to the overall population, are typically concentrated among young men, and are increasing, particularly among young men.
A number of studies, typically from Australia, Canada, the United States and Sweden, have also examined suicide among immigrants [1,42,44-45]. In these countries, immigrants’ rate of suicide is typically higher than in their country of birth, and this rate may or may not exceed that of the non-immigrant population, depending on the groups and specific destination country examined. While factors in the destination country seem to influence the outcome, a strong correlation between the patterning of suicide across immigrant groups and that in their countries of origin has been observed, suggesting an important role for cultural factors in suicidal behaviour.

While these overall differences are important, a closer look at subgroups within racial/ethnic categories is also necessary. Patterns across racial/ethnic groups have been shown to vary depending on which sex or age group is examined. For example, in the United States, African Americans traditionally have substantially lower overall suicide rates than other racial/ethnic groups [46-48]. However, given dramatic increases in young African American male rates in recent decades, African American and Caucasian males under 35 years of age have become equally likely to commit suicide [49-51]. Additionally, Asian American females have the highest rates of all women aged over 65 years [52].

2.2.2 Socio-demographic differences within the South African context

Sex, race and age differences

South African research shows that suicide mortality profiles vary according to the sex, race and age combination examined. In addition, the time period and region covered is important. The only consistent finding across all race and age groups, time periods and regions is that, as for most countries globally, the suicide mortality rate is higher among men than women [16,20-21,26,53]. However, the size of the difference fluctuates. For every female death by suicide, there are usually approximately five male deaths, but this varies between three and nine depending on the race group, time period and region [16,20-21,23-26,53-59].

Since race has been one of the major bases of division of South African life, it has frequently been considered as a crucial socio-demographic variable, and regional studies almost invariably examine
the suicide outcome in race-specific groups. Although there are dangers of presenting the data according to race groups that have no anthropological or scientific validity [60-61], there remain important differences between racially-defined groups in the share of ill-health, mediated by social and economic factors. Statistics South Africa continues to classify people into race groups (based on self-classification, rather than legal definition) since moving away from past apartheid-based discrimination and monitoring progress in development over time involves measuring differences in life circumstances by race [62-63]. As mentioned above in the ‘Terminology’ section, four racial categories are used in South Africa, that is, Asian, Black, Coloured and White. Figure 1 shows the distribution of these race groups in the whole South African population, according the 2001 census [63]. Blacks constitute more than three-quarters of the entire population.

Figure 1. Distribution of the South African population by race group, 2001 (N=44,819,778)

The races differ from one another on several important variables. For example, the age structure [63] and life expectancy at birth [64] varies substantially across them. As shown in Figure 2, the age structure of the Black population in South Africa is typical of a low- and middle-income country with a large proportion being under 15 years of age, and a relatively low proportion being above 65 years. By contrast, relatively few of the White population are below 15 years and proportionally more are above 65 years. The age distributions for Coloureds and Asians fall between these two extremes. Life expectancy at birth is lowest for Blacks and highest for Whites, with that for Coloureds being more similar to Blacks, and that for Asians being more similar to Whites.
Figure 2. Race-specific distribution of the population by age group and sex, and life expectancy at birth, 2001

**Black population**
- Life expectancy at birth: 52.3 years

**White population**
- Life expectancy at birth: 64.9 years
Figure 2 cont.

**Coloured population**

Life expectancy at birth (years): 57.6

<table>
<thead>
<tr>
<th>Age category</th>
<th>Percentage Males (%)</th>
<th>Percentage Females (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>85+ yrs</td>
<td>0.1</td>
<td>0.1</td>
</tr>
<tr>
<td>80-84 yrs</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>75-79 yrs</td>
<td>0.3</td>
<td>0.4</td>
</tr>
<tr>
<td>70-74 yrs</td>
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<td>0.2</td>
</tr>
<tr>
<td>65-69 yrs</td>
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<td>60-64 yrs</td>
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<td>50-54 yrs</td>
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<td>1.3</td>
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<td>45-49 yrs</td>
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<tr>
<td>0-4 yrs</td>
<td>4.1</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Source: Statistics South Africa [63-64]

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**Asian population**

Life expectancy at birth (years): 63.8

<table>
<thead>
<tr>
<th>Age category</th>
<th>Percentage Males (%)</th>
<th>Percentage Females (%)</th>
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<tr>
<td>0-4 yrs</td>
<td>4.3</td>
<td>4.9</td>
</tr>
</tbody>
</table>

Source: Statistics South Africa [63-64]
Most available figures show the suicide proportions or rates for Blacks to be considerably lower than that of Whites or Asians [20-21,25,33,65]. However, some studies of suicide in particular regions of South Africa, even if covering similar time periods during apartheid, or soon after its demise, have found the suicide rate among Blacks to be nearly as high as in these other race groups overall, and even higher in particular age groups [26,59]. The researchers of these studies have consequently argued that the poor quality of national data regarding mortality among Blacks has severely underestimated the problem of suicide in this group. It has also been suggested that this increase be viewed as a genuine escalation of the problem, rather than simply as a reflection of improved recording practices over recent years in post-apartheid South Africa [30,35,59].

For Black males and females, younger age groups (usually 15-24, 25-34 years) have proportionally higher suicide [20-21,57,59,66] and higher rates [26], after which suicide generally decreases with increasing age. Suicides among Coloureds tend to be highest in middle age (25-54 years), although 15-24 year old females also have high numbers, and they typically decrease substantially after age 54 years [20-21,57]. Suicides among Whites tend to peak in older age groups, particularly for males [20-21,26,53,57,59]. All reviewed studies found that suicide among Asian females was highest in the 15-24 year age group, often substantially so, with very few recorded for the elderly. Results for males vary across studies with some reporting higher levels among 15-44 year olds [26,53] and others reporting higher levels among those older than 54 years [20-21].

The above findings reveal the difficulty in reporting on suicide mortality without simultaneous consideration of factors like sex, race and age. Examination of one socio-demographic variable at a time requires controlling for the others. A recent city-based study has examined the independent contributions of age, race and geographical location to the suicide risk for males and females, while adjusting for the other variables [67]. It found that compared to those aged 45+ years, males have increased odds of suicide in young to middle adulthood and females have an increased odds of suicide in all age groups, particularly if aged between 15-24 years. Compared to Coloureds, the likelihood of suicide is increased among males if Asian or particularly if White, and among females if White. The odds of suicide also varied across cities, differentially for males and females.
Changes across time
Findings that the suicide profiles across groups change across time highlights the need for continual monitoring of the phenomenon and for a greater understanding of social and contextual circumstances that may underlie the changes. Only longitudinal studies covering the apartheid years are currently available. A study concerned with trends in suicide from 1968-1990 found increases in the young, particularly for Whites and an increase for Whites older than 64 years [21]. These changes were more marked in males. From 1978-1984, Lester [16] found rates increased for Whites and Asians but remained stable for Coloureds and Blacks (although the questionable quality of these data for Blacks has already been raised). Mkize [59] reports an increase in suicide among Blacks from 2/100 000 to 11.6/100 000 over the period 1971-1990 in Umtata.

2.2.2 Socio-demographic differences in methods of suicide used
Outside of South Africa
The literature typically divides suicide methods into ‘violent’ methods such as hanging, firearms, or jumping from a height; and ‘nonviolent’ or ‘soft’ methods such as ingestion of medicines or poisons. Nearly everywhere, females tend to use softer methods, although the practice of self-immolation in India is a striking exception [1]. Older adults tend to use more violent methods [1,68]. Controlling for socio-economic status, marital status, age, region and urban residence, Stack and Wasserman [68] found that in the United States, African Americans are 2.24 times more likely than Caucasians to die using a violent method.

Within the South African context
With regards to the methods used for suicides, most studies report hanging to be most common (typically accounting for between 34-43% of suicides), followed by firearms (29-35%), poison ingestion (9-14%), gassing (6-7%) and burning (2-4%) or jumping (2-4%) [23-24,55-56]. However, where examined, these methods typically differ substantially across different combinations of sex, race and age groupings. Annual reports for the NIMSS [23-24,55-56] show that while the above pattern is typical among males, for females poison ingestion predominates followed by firearms or hanging. Across age, hanging predominates until middle age, after which firearms become the leading method. Blacks and Coloureds use hanging considerably more frequently than any other method. The results for Asians are mixed depending on what year of NIMSS data is examined, with similar numbers of firearm and hanging
suicides for 1999 and 2000, but hanging more than twice as likely as firearms to be used in 2001. Whites most often use firearms as the method of choice and are the only race for whom gassing suicides are noteworthy (accounting for approximately 15% of suicides among them).

A number of studies covering different regions have examined methods across race for males and females separately [20,53-54,57]. With few exceptions these studies found that the leading method was the same for both males and females for Blacks (i.e., hanging), Asians (i.e., hanging), and Whites (i.e., firearms). While for Coloured males the leading method was typically hanging, the most common method for Coloured females was always poison ingestion.

### 2.3 The importance of the social and environmental context for suicide mortality

Social epidemiology examines the social distribution and social determinants of ill-health so as to identify exposures that may be related to health outcomes [69]. Included among exposures are those relating to socio-economic and environmental factors, while among outcomes are those relating to mental health. Crucial to this approach is the emphasis on the social context, that is, an individual’s risk of ill-health cannot be considered in isolation from the disease risk in the population in which that individual is located [70]. For suicide, this approach mirrors Durkheim’s early insight that the rate of suicide in society is linked to collective social forces [71].

The social environment has important influences on behaviour by shaping norms, impacting on the availability of environmental opportunities to engage in certain behaviour, enforcing patterns of social control (which may be health-promoting or health-damaging), and affecting stress levels [69]. Each of these factors has important implications for the suicide outcome, and will be briefly discussed further. *Community norms* can play an important role in the likelihood that suicide will be chosen as an option or the degree to which an individual attempts to disguise the suicide. These norms may also influence, in combination with other regulations, the *environmental opportunities* available for engaging in suicidal behaviour. For example, firearm legislation and social norms may together influence the availability of firearms in society and likelihood of their being used in suicide. The presence of other people may provide an effective protective
form of social control, particularly if social support is available [72]. Research clearly points to the importance of the ties that attach individuals to peers and to the larger society, and to the likelihood of committing suicide. Social relationships can include familial, friendship, neighbourhood or occupational ties, and the number, duration, strength and quality of these relationships are reported to show a consistently inverse relationship to suicide risk [72]. At the ecological level, in recent years there has been an increased focus on social support and community connectedness, with social fragmentation being positively and strongly associated with suicide [73-74]. The availability or absence of social support, and the extent to which social ties are disrupted – be it through divorce, changes in labour status, or through geographical movement – can serve to produce or reduce stress, with important implications for the suicide outcome. For example, areas characterised by high levels of mobility often have high suicide rates [72].

Individuals in a society are partly defined by their relationship to the social context [75]. Individual socio-demographic and socio-economic characteristics can be used to describe one’s social status within the society in which one lives. Yet, the classification of status based on personal descriptors is limited by the fact that communities share status positions in ways not often reflected by individual characteristics [76]. In addition, reviews of studies [77-79] demonstrate that the community social and economic environment both impacts on population health and has effects independent of individual characteristics. These factors are discussed further below.

2.3.1 Social status

The link between social status and health has been realised throughout history and, in recent years, increasing attention has been paid to the role of social status in injury outcomes, including suicide. Typically, those belonging to the more advantaged groups or living in more advantaged areas, whether this is expressed in terms of income, education, social class or race/ethnicity, tend to have better health than the other members of their societies.

Positions in a social structure should be distinguished from the individuals occupying them [80]. Rather, these positions are indicators of location within the social structure, and are derived from, or generated by, a particular social context [75,81]. This means that classifications of social status will vary across countries with differing economic or
industrial structures [75]. In some countries, for example, sex (or gender), race, age or religion may play a major role in what social position a person occupies, while in others, the typical socio-economic measures of education, occupation and income (or wealth) [76,82] may be more appropriate indicators of social status.

In South Africa, apartheid meant that one’s social position was, first and foremost, defined by one’s race. Moreover, with persistent discrimination against women, sex has also been an important determinant of social status, with the worst-affected being Black women [83]. While important differences between racially-defined groups in health outcomes remain, an increasingly multiracial upper class has meant that while differences between races are on the decrease, differences within races have increased [83]. It becomes apparent that factors other than race, like socio-economic status, should also be used to define social status, as they are likely to be more precise measures of differences between groups. Unfortunately, at the individual level, such information is unavailable in South Africa. Consequently, in this thesis, race and sex are used as measures of social status. The term ‘socio-demographic groups’ is used to describe these dimensions as this most clearly defines what is being measured, with the link to social status implicit.

Comparisons between dimensions or positions are made on the basis of the difference between groups, not that between individuals. These comparisons can be, and it has been argued should be [84], made in both absolute and relative terms. Absolute differences provide an overall picture of the problem and are therefore useful in prioritising, while relative differences highlight the magnitude of the inequality and give some clues as to the possible underlying mechanisms [85-86].

Increased knowledge of the relationship between social status and health is important for a number of reasons [87]. First, the size of the gap between the mortality rates of the most and least advantaged groups gives some indication of the potential for improvement in a nation’s health and safety. Second, the identification of groups at greatest risk can make for the proper management of medical services and resources. Third, the magnitude and form of the relationship between injury and social status can suggest hypotheses concerning injury-mortality aetiology, all causes aggregated or by separate cause. Fourth, better understanding of the mechanisms of social variations in injury risk allows for appropriate
policy or intervention strategies by means of which they can be reduced. These policies or interventions should take into account not only the socio-economic characteristics of people but also of the places in which they live [75,88-89].

2.3.2 Socio-environmental circumstances
Studies finding that the community in which one lives confers health risks beyond an individual’s standing in that community suggest that characteristics of places represent more than the aggregation of characteristics of their residents [75-76,90]. Some risks for ill-health are not characteristics of individuals in a population and can only be measured for groups (e.g., aggregate measures like unemployment rates), or at the community or societal level (e.g., features of the environment such as the proportion of households receiving piped water) [75]. Community social and economic characteristics influence a wide range of health determinants such as the availability and accessibility of goods and services; the built environment; the level of residential stability; crime and social norms; and the ability for residents to maintain social controls over individual behaviour [77,88,91-92].

Ecological studies addressing contextual determinants of suicide are almost exclusively conducted in North America, the United Kingdom and Australia. They have included aggregated measures of education, income or wealth and poverty, occupation or employment status, marital status; or have used indices that attempt to capture the socio-economic context or deprivation level of an area (e.g., Townsend or Carstairs deprivation scores, social fragmentation score, Jarman under-privileged areas score, Mental Illness Needs Index). Most often, people living in low socio-economic status areas have shown an increased risk of suicide [88,93-101]. However, decreased risk [94,101-102] or no excess risk have also been observed [94,97,103]. Whether inconsistencies are related to differences in settings or measurement, or in both, is uncertain.

2.4 Reliability and validity of suicide statistics
Suicide mortality data are used to assess the magnitude and distribution of the problem, identify high-risk groups, and to generate and test hypotheses about suicide, while trends in the incidence of suicide are used to evaluate the effectiveness of suicide prevention measures and to influence health policy and the flow of resources [104-107]. Yet, the issue of the reliability and validity, and therefore the usefulness, of suicide
mortality data has been raised repeatedly in both international and local research. O’Carroll [104] has provided a good overview of the terms:

- **Reliability** is a measure of the precision or (conversely) the variability of the suicide determination process across different regions or in a single region over time.

- **Validity** is a measure of the accuracy or correctness of a particular assessment or judgement. The validity of the suicide determination made is a measure of the degree to which true suicides are recorded as suicides, and true non-suicides recorded as other than suicides.

When assessing the reliability and validity of suicide statistics it is important to consider: (1) if suicides are underreported/misclassified differentially across regions or time, (2) the degree of underreporting/misclassification, and (3) if the degree of underreporting/misclassification is sufficient to threaten the validity of research based on the suicide statistics [104].

The determination of a suicide usually depends on a chain of informants and can be concealed so as to avoid stigmatisation for the victim and his/her family, to benefit from insurance policies, for political reasons, or because it was deliberately masked as an accident by the person committing it [1]. Variability and error in suicide statistics can also be due to differences in medical examiner training, practice and work circumstances. It has been posed that decisions to certify deaths as suicides are frequently marked by a lack of consistency and clarity; that without specific criteria to aid this decision-making, medical examiners may be more susceptible to pressures from families and communities not to certify specific deaths as suicide [105,108]. The misclassification of suicide as other causes of death, particularly as accidental death categories like poisoning and drowning, or as included in the ‘undetermined death’ category is well known [104,109-111].

Underreporting and misclassification of suicide deaths implies that the prevalence of suicide in a population is usually underestimated. Yet, the actual extent and impact of potential inaccuracies continue to be debated. Estimates of underreporting have ranged from 25% to 50% [112], and substantial differences across different socio-demographic groups [106,111,113-114] and across methods used in committing suicide [112-116] have been noted. This means that absolute and relative differences across groups are potentially uncertain.
The inconsistencies across studies regarding the degree of suicide mortality underestimation is largely due to the lack of a ‘gold standard’ against which the verdicts of any given death certification process can be measured [104]. Intensive reanalysis of death reports to determine how many would be reclassified as suicides may be used as the gold standard. However, disguised suicides may still not be picked up, and samples are typically small and often geographically unrepresentative [111]. Additional data on cases can be gathered through psychological autopsies [104] but tracking relatives or friends of the deceased may be practically impossible in many low- and middle-income countries where populations can be fairly mobile.

In South Africa, although death registration has improved considerably since the end of apartheid in 1994, deaths continue to be underreported and misclassified [117]. The only source of epidemiological suicide mortality data currently available in the country (the National Injury Mortality Surveillance System) is increasingly being used to profile suicide mortality in the country [4,34,118], but has not been subject to rigorous testing of its accuracy. The determination of suicide in the NIMSS is based on the decision of the medical practitioner performing the post-mortem. Yet, little is known of the decisional processes lying behind this determination and the accuracy of this determination has not yet been assessed.

Furthermore, given the historical differential treatment of social groups and the well-documented poor quality of apartheid-era mortality and population data for Blacks [18-20,119-121], examining the validity of the data across different groups is important in the South African context.

2.5 Summary of knowledge and relevance of the research

Following its transition to democracy since 1994, South Africa has undergone massive socio-economic changes, that are not uniform across regions and that are likely to affect socio-demographic groups differently. The South African setting offers a good opportunity to examine health outcomes of the changes, the measurement of which can be important for understanding mortality aetiology and highlighting prevention possibilities, both within South Africa and in other low- and middle-income countries, particularly those in transition. An outcome measure of community health
(or distress) is the suicide rate. However, the ability to perform studies in this area has been severely hampered by epidemiological data that have been incomplete or of a poor quality.

Available South African research shows that suicide deaths vary according to age, sex and race, but the lack of national data and difficulties in comparing across regional studies means that a great deal of uncertainty remains regarding the patterning across these socio-demographic groups. Furthermore, research has focused on individual-level explanations of suicide with the influence of area-level factors yet to be explored.

Although the urgent need for accurate data has been stressed by a number of writers for many years, it is only recently that progress in the development of a system to collect data has been made [122] (see ‘Materials and Methods’ section below). Assessment of the quality of this data is of utmost importance for accurate conclusions to be drawn from it.
3 Aims and Objectives

Within the overall goal of contributing to a deeper understanding of the role of social status and environmental circumstances in suicide mortality, the general aims of this thesis are:

- To highlight the socio-demographic patterning of suicide mortality
- To determine the role of contextual exposures on suicide mortality, and whether this differs by socio-demographic group
- To assess the reliability and validity of available suicide mortality data

Studies are conducted in the South African urban context, with a focus on six cities, City of Tshwane in particular. Sex and race are used as the primary indicators of social status, given the importance of these factors historically, and their continued impact on a range of health determinants and outcomes. The studies have pursued the following specific objectives:

Regarding the socio-demographic patterning

- To determine the socio-demographic distribution of suicide deaths as compared to other injury deaths in South Africa (Study I).
- To determine the distribution of suicide across different socio-demographic groups across cities (Study II) and in one particular city, Tshwane (Study III).

Regarding the role of contextual factors

- To assess the importance of city on sex- and race-specific suicide rates (Study II)
- To measure the importance of living area circumstances for suicide mortality across race and sex groups in a South African city, Tshwane (Study III).
Regarding the reliability and validity of currently available suicide data

- To assess the decisional processes regarding suicide deaths of those medical practitioners who determine the apparent manner of death of each injury case (Study IV).

- To assess the accuracy of available suicide mortality data as recorded in the NIMSS (Study V).
4 Materials and Methods

As mentioned above, on a national level in South Africa, the apartheid era is characterised by incomplete and poor quality mortality and population data for some socio-demographic groups and some regions of the country. During the period of transition to the new government and beyond, the manner of death (i.e., whether suicide, homicide, accident, or undetermined) is no longer specified for injury deaths (following a change to the Births and Deaths Registration Act), nor is race specified in death statistics (repeal of the Population Registration Act). There are no indications that such reporting will be reinstated in the foreseeable future.

Consequently, information is obtained from different sources and the design of each study in the thesis is based on the data that were available at the time of conducting the study. Given the difficulties with historical suicide mortality data, all studies are conducted in post-apartheid South Africa. As regional suicide mortality surveillance data have become available only recently, all studies are cross-sectional. Furthermore, improved availability of data across time has meant, for instance, that while no denominator data could be used to calculate rates for Study I, this became possible in later studies.

Figure 3 summarises the material for each specific study. The thesis is built around five studies, based on three different sets of material – the National Injury Mortality Surveillance System (NIMSS), census data for 1996 and 2001, and medico-legal system data. The NIMSS is the basic source of data for all studies. Studies II and III use census data as denominators and/or the source for contextual information. Medico-legal system records provide residential areas of injury victims in Study III. In addition, information gathered from experts and from victim files are used in Studies IV and V, respectively. These are described in greater detail under the headings ‘Data sources’ and ‘Individual study design and data analysis’ (see pages 23 and 31).
Figure 3. Data sources for individual studies

<table>
<thead>
<tr>
<th>Data sources</th>
<th>Individual Studies</th>
</tr>
</thead>
</table>
| Population Census (StatsSA) | Study I  
The share of suicide in injury deaths in the South African context: socio-demographic distribution |
| 10 mortuaries 1999-2000 | Study II  
Suicide mortality in South Africa: A city-level comparison across socio-demographic groups |
| 6 cities 2001-2003 | Study III  
Living circumstances of suicide mortality in a South African city: An ecological study of differences across race groups and sexes |
| Census 2001 | Study IV  
Determination of suicide in South Africa: Medical practitioner perspectives |
| Census 1996 | Study V  
Assessment of accuracy of suicide mortality surveillance data in South Africa: Investigation in an urban setting |
| Tshwane 2000-2001 | |
| Population Census (StatsSA) | |
| 6 cities 2001-2003 | |
| Census 2001 | |
| Census 1996 | |
| Tshwane 2000-2001 | |
| National Injury Mortality Surveillance System (Victim surveillance) | |
| 5 cities 2004 | |
| Expert data 2004 | |
| Victim data 2000 | |
| Tshwane 2000 | |
| National Injury Mortality Surveillance System (Victim surveillance) | |
| 5 cities 2004 | |
| Expert data 2004 | |
| Victim data 2000 | |
| Tshwane 2000 | |
4.1 Data sources

4.1.1 National Injury Mortality Surveillance System (NIMSS)

The National Injury Mortality Surveillance System (NIMSS) was developed in response to the lack of detailed epidemiological data on injury mortality [122]. By law, all injury deaths in South Africa are subject to medico-legal investigation and the NIMSS collates information that arises from these existing investigative procedures at mortuaries and state forensic chemistry laboratories, as a collaborative effort between different research groups and government bodies in South Africa. The NIMSS form (see Appendix I) is a one-page document typically completed soon after the post-mortem, while the body is still in the mortuary. Demographic variables of the deceased, spatial and temporal details of the injury event, the manner and external cause of death, and the involvement of alcohol are recorded. The ‘manner’ of death describes the intention prior to the injury that resulted in the death, and is divided into four categories: homicide (intentional interpersonal injury), suicide (intentional self-directed injury), accident (unintentional injury), and undetermined. The ‘external cause’ of death refers to the mechanism or circumstance of the event that preceded the event [23]. For suicide mortality, the external cause refers to the method used to commit suicide and examples include hanging, firearm, poison ingestion, gassing, burn and jumping from a height.

Since medical practitioners are not required by law to determine the manner of death, on the NIMSS forms it is recorded as the apparent manner and is for research purposes only. All deaths due to external causes are included for all races, allowing an overview of how the different manners of death contribute to the profile of non-natural mortality in men and women, in the different race groups and across age.

Presently, the NIMSS does not have national coverage. The system began formally at the beginning of 1999 at ten study sites across the country, selected on the basis of size, accessibility and available resources. For each successive year, the number of participating mortuaries has increased. At the time of writing, the most recent data available are for 2003. The number of mortuaries included, their caseloads and estimated coverage of national injury deaths across time are shown in Table 1. Coverage is estimated using current approximations for the national number of injury deaths of between 65 000 and 80 000 per annum [23].
Table 1. Annual caseload and estimated coverage of the NIMSS

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of mortuaries</td>
<td>10</td>
<td>15</td>
<td>32</td>
<td>34</td>
<td>36</td>
</tr>
<tr>
<td>Caseload</td>
<td>14 897</td>
<td>18 876</td>
<td>25 361</td>
<td>32 890</td>
<td>24 600</td>
</tr>
<tr>
<td>Estimated coverage</td>
<td>19-21%</td>
<td>24-27%</td>
<td>32-36%</td>
<td>41-47%</td>
<td>31-35%</td>
</tr>
</tbody>
</table>

Although the NIMSS includes some mortuaries that cover rural areas, it is strongly biased to urban areas. Individual mortuaries generally do not have clearly defined catchment areas. Yet, as more mortuaries were included in the system, a combination of mortuaries in a region provided full coverage at the municipality level. The municipalities where full coverage by the NIMSS has been achieved across time is shown in Table 2.

Table 2. Municipalities with full coverage by NIMSS across time

<table>
<thead>
<tr>
<th></th>
<th>1999</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cape Town</td>
<td>Cape Town</td>
<td>Cape Town</td>
<td>Cape Town</td>
<td>Cape Town</td>
<td>Cape Town</td>
</tr>
<tr>
<td>Tshwane</td>
<td>Tshwane</td>
<td>Tshwane</td>
<td>Tshwane</td>
<td>Tshwane</td>
<td>Tshwane</td>
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<tr>
<td>Johannesburg</td>
<td>Johannesburg</td>
<td>Johannesburg</td>
<td>Johannesburg</td>
<td>Johannesburg</td>
<td>Johannesburg</td>
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<tr>
<td>eThekwini</td>
<td>eThekwini</td>
<td>eThekwini</td>
<td>eThekwini</td>
<td>eThekwini</td>
<td>eThekwini</td>
</tr>
<tr>
<td>Buffalo City</td>
<td>Buffalo City</td>
<td>Buffalo City</td>
<td>Buffalo City</td>
<td>Buffalo City</td>
<td>Buffalo City</td>
</tr>
<tr>
<td></td>
<td>Stellenbosch</td>
<td>Stellenbosch</td>
<td>Stellenbosch</td>
<td>Stellenbosch</td>
<td>Stellenbosch</td>
</tr>
</tbody>
</table>

4.1.2 Medico-legal system data

Currently, the Department of Health and the South African Police Service run mortuaries in South Africa jointly. The Inquests Act (Act 58 of 1959) requires all injury deaths to be reported to the police and subject to medico-legal investigation. When an injury death occurs, the closest police station is responsible for the case, which is referenced using the police station name and a number. The police are responsible for the scene investigation and the history-taking. The body is taken to the mortuary in whose catchment area the death occurred, and a medical practitioner is responsible for conducting the post-mortem and ensuring special investigations are undertaken. Medical practitioners performing
post-mortems can be forensic pathologists (i.e., specialists in forensic medicine), registrars (i.e., specialists in training) or medical officers (i.e., general practitioners or district surgeons with or without a diploma in forensic medicine). The flow of data through the medico-legal system as compared to the NIMSS is shown in Figure 4.

**Figure 4. Flow of suicide mortality data through the NIMSS and medico-legal systems**

As mentioned above, medical practitioners performing post-mortems are not required to determine the manner of death (i.e., whether suicide, homicide, accident, or undetermined). Only the primary medical cause and probable mechanism of death are recorded on the death certificate, which is used as the basis for cause of death statistics. However, from the forensic investigative procedures, a medico-legal docket is produced, containing documentation such as witness statements, photographs of the scene, suicide notes (if any), and the results of medical and police investigations. This report is sent to the inquests court for a decision when the criminality of a case is not clear, or
to the Director of Public Prosecutions office if there is a suspect or a person who is criminally liable for the death. An inquests magistrate makes a final decision based on an exclusionary rule that specifies nobody is criminally responsible for the death. This implies that the death could be accidental or suicidal, and only in a few cases is it specified as a suicide. Police stations keep some record of all cases registered at the station. For an inquest case, the original docket is filed at the inquests court, while a copy is kept at the police station.

In other words, the docket kept at the court and/or police station is the culmination of all medico-legal investigations. In contrast to the completed NIMSS forms that are sent to a local and then the national centre relatively soon after the injury event, the medico-legal procedure can take several years to complete.

4.1.3 Census data
South Africans were counted for the first time as citizens of a democracy in October 1996, and for the second time in October 2001. The population of South Africa increased by 4.2 million people between 1996 and 2001. The distribution across sex and race for the two years is shown in Table 3.

<table>
<thead>
<tr>
<th></th>
<th>October 1996</th>
<th>October 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (millions)</td>
<td>%</td>
</tr>
<tr>
<td>Male</td>
<td>19.5</td>
<td>48.0</td>
</tr>
<tr>
<td>Female</td>
<td>21.1</td>
<td>52.0</td>
</tr>
<tr>
<td>Black</td>
<td>31.1</td>
<td>76.7</td>
</tr>
<tr>
<td>White</td>
<td>4.4</td>
<td>10.9</td>
</tr>
<tr>
<td>Coloured</td>
<td>3.6</td>
<td>8.9</td>
</tr>
<tr>
<td>Asian</td>
<td>1.0</td>
<td>2.6</td>
</tr>
<tr>
<td>Other or unspecified*</td>
<td>0.4</td>
<td>0.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>40.6</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>

Note: *In 2001, logical and dynamic imputation was used to reclassify the few people who did not indicate their population group or who described themselves as ‘other’ [63]

For both years, the census data were statistically adjusted for undercount on the basis of a nationwide post enumeration survey,
described in detail in Statistics South Africa publications [123-125]. The methodology used for each year differed in some aspects. The undercount was found to have been 10.7% in 1996 and 17.6% in 2001 [125], and varied by age, sex, race and geographic location. No estimates are provided for areas smaller than provinces, but the effects of undercount are less likely to be a concern in urban areas, the focus of the current work, where the enumeration process is considerably easier.

The census data were used for between cities (Study II) and within city (Study III) analyses. For Study II, 2001 census data [126] were used as denominators, while in Study III, 1996 census data [127] were used as denominators and as area level descriptors.

### 4.2 Setting

South Africa’s economy is essentially urban and is becoming increasingly so. Currently, 58% of the South African population is urbanised and this is projected to rise to 64% in 2030 [128].

Apartheid policies left their mark on the size and shape of urban populations by restricting non-White residence to particular areas and forcing millions of people to exist in dual households with constant movement between rural and urban areas. In an attempt to mend the extensive wrongs enacted upon the country’s communities by decades of these discriminatory policies, South Africa’s Constitution (1996) formed a vision for local government to provide equitable and efficient services, build local democracy, promote social and economic development, collect revenue, ensure safe and healthy environments, and create a generally viable and sustainable system of local government [129]. The drawing of new municipal boundaries was one of the first steps that aimed to give substance to the Constitution’s vision, by setting the structural conditions within which the other processes of transforming and developing local government could occur [129]. The process began in 1998 and has resulted in some substantial shifts in the position of boundaries of residential areas within municipalities. These changes have important implications for comparisons of areas across time, for example, from the 1996 census to that in 2001. This has necessitated reformulating the 1996 boundaries to fit those of 2001, an ongoing process only in Tshwane.

While much progress has been made in ensuring more equitable access to the benefits of living in cities, the little more than a decade since
the dismantling of apartheid has been insufficient to correct all historical inequalities across socio-demographic groups. Furthermore, across regions, social, economic and health development has not been uniform and is likely to have affected diverse social groups differently.

The good coverage of urban areas by the NIMSS, expanding across time, facilitates an increased urban focus that is clearly necessary. It also coincides with the launching of the South African Cities Network (SACN) in 2002 that aims to encourage the exchange of information, experiences and best practices on urban development and city management among a network of nine city municipalities and partners (the South African Local Government Association, national and provincial government departments). Six of the nine SACN cities have full coverage by the NIMSS and have been included in at least one study of the thesis. With the names of their historical urban centres, these cities are: City of Tshwane Metropolitan Municipality (Pretoria); City of Johannesburg Metropolitan Municipality (Johannesburg); eThekwini Metropolitan Municipality (Durban); City of Cape Town Metropolitan Municipality (Cape Town); Nelson Mandela Metropolitan Municipality (Port Elizabeth) and Buffalo City Local Municipality (East London).

All of these cities are metropolitan municipalities, except Buffalo City which is a local one. A municipal area is designated metropolitan on the basis of criteria set out in the Municipal Structures Act, such as having high population density; extensive development; and a centre of economic activity. Despite not meeting all the criteria for a metropolitan municipality, Buffalo City is an important population and economic centre in its own right [128]. Kimberley, included in Study I, is not a municipal area but is located in Sol Plaatjie Local Municipality. The location of these cities in South Africa and the studies they have been included in are shown in Figure 5. In addition, for the six municipalities covered by the NIMSS, the size of the population aged over 15 years, and the distribution of race groups is provided using 2001 census data.
Figure 5. Map of South Africa showing location of study sites, and the size and race distribution (aged 15+ years) of municipalities covered by the NIMSS, 2001
The cities differ in size and in the distribution of race groups. Together the cities have a lower proportion of Blacks than nationally. Of all cities, Johannesburg has the highest proportion of Blacks, Tshwane the highest proportion of Whites, Cape Town the highest proportion of Coloureds, and eThekwini the highest proportion of Asians.

The City of Tshwane was selected as the focus area for two studies in the thesis (Studies III and IV), being among the first cities to have full coverage by the NIMSS, and centred around the capital of South Africa, Pretoria. The municipality was established in December 2000 when various municipalities and councils that had previously served the greater Pretoria and surrounding areas were integrated. The name Tshwane comes from Chief Mushi, who moved from Zululand to settle in the Pretoria area about 100 years before the arrival of the Voortrekkers in the early 1800s. The word tshwane means "we are the same" or "we are one because we live together", and was the name of Chief Mushi’s son [130]. Its total area is 2 199 km², and at the time of the 2001 census it was inhabited by approximately 2 million people.

Tshwane is currently the fourth largest city in South Africa. Johannesburg is the largest, having regained this status from eThekwini after very fast growth in the late 1990s. It has the smallest land area of the six metropoles, yet the largest population, making it the most densely populated and most urbanised municipality. eThekwini is centred on the major port city of Durban. It has grown rapidly to become the second largest city in the country, now growing at a moderate 2.4% annually. The City of Cape Town is the legislative capital of South Africa and is now the third largest city in the country. A number of indicators suggest it is the most advantaged of the six cities with the lowest percentage of people without formal housing, of households without water, of unemployed people, and with the highest per capita municipal budget [128]. Nelson Mandela is a new metropolitan municipality centred on Port Elizabeth. The city saw the second lowest growth rate between 1996 and 2001 (0.7% per annum). The boundaries of Buffalo City extend to encompass both an historical large urban centre (East London) and outlying former Bantustan areas. Between 1996 and 2001 the city grew hardly at all (0.6%).
4.3 Individual study design and data analysis

For Studies I, II, III, injury cases aged under 15 years were removed given the small number of these deaths, especially suicide, at such ages relative to other age categories.

Study I

Socio-demographic distribution of suicide deaths as compared to other injury deaths

Study I examines the share of suicide in injury deaths as compared to other manners. At the time of conducting the study, few areas had achieved full coverage by the NIMSS. Ten mortuaries were included when the system started in 1999 and this was increased to 15 in 2000. To increase data reliability, Study I used the data from the 10 mortuaries which registered cases for both 1999 and 2000. As the catchment areas of each mortuary were not clearly defined it was not possible to use census data as denominators and consequently, to calculate rates.

To assess whether the share of suicide as a cause of death was comparable for males and females, male over female risk ratios (95% CIs) were calculated, one manner at a time, for all races and within each race. Differences in proportions (95% CIs) were used to assess if suicide was randomly distributed across sex-specific race groups and race-specific age groups, by comparing the proportion of suicide with the proportion of other injury deaths.

In addition, the differential involvement of alcohol in manners of death by sex and race was assessed using differences in proportions (95% CIs) of alcohol-positive cases across suicide, homicide and unintentional injury deaths.

Study II

Socio-demographic distribution of suicide mortality across cities

Study II compares the socio-demographic profile of suicide across large urban centres in South Africa. By 2001, the NIMSS had achieved full coverage in five municipalities additional to Tshwane; namely City of Johannesburg, eThekwini, City of Cape Town, Nelson Mandela and Buffalo City. Data on suicide mortality cases for all cities were extracted from the NIMSS from the beginning of 2001 until the end of 2003, the date of
the latest available data. Selected cases included definite suicides only, based on the decision made by the medical practitioner performing the post-mortem.

For each of the six cities, age-standardised sex- and race-specific suicide rates were calculated. Suicide mortality data were directly age-standardised to the South African 2001 population in 10-year age groups.

For each city separately, differences in the risk of suicide between males and females of each race group were measured using rate ratios (95% CIs). Across cities, sex- and race-specific suicide rates were ranked and Spearman’s rank order correlation coefficients were calculated to assess differences in the distributions. Methods used for suicide were also considered. The association between city and the leading methods (i.e., hanging, firearms, poison ingestion) was assessed using Chi-squared.

**Study III**

*Living area circumstances of suicide mortality across sex and race groups within the City of Tshwane*

Study III is a cross-sectional ecological study within the City of Tshwane. When work began on the study, only census data for 1996 and suicide data for 2000-2001 were available. Tshwane was divided into 276 residential areas and 19 variables describing the compositional and socio-environmental characteristics of those areas were extracted from the census. Area effects were considered based on aggregates or clusters of variables since it is likely that, as proposed by Blane [87], advantages and disadvantages can be expected to cluster cross-sectionally. Furthermore, as it would be expected that several dimensions could reflect this living context, these were sought for through an exploratory factor analysis where several compositional and socio-environmental attributes could be considered simultaneously. For each factor, the residential areas were ranked according to the factor score and divided into three levels based on cut-off points derived from the distribution of residential areas.

Since identifiers such as the victim’s area of residence are not collected by the NIMSS, for each injury case this had to be extracted from police records in the mortuary. Cases were located via the post-mortem number that appears both in the NIMSS and police records. Only Black and White suicide deaths were considered, given the small number of cases in the other race groups. Sex- and race-specific rates per 100 000 for
Tshwane residents were compiled, before assessing the impact of the contextual dimensions on them. Then, injury deaths and the factor scores were linked by residential area and for each factor, the impact of each exposure level on the injury mortality outcome was measured by calculating age-adjusted odds ratios, with 95% confidence intervals, for each sex and race separately.

**Study IV**

*Medical practitioners’ decisional processes in determining suicide for the NIMSS*

Study IV is one of two studies that assesses the level of accuracy of the NIMSS as the currently only available source of epidemiological data on suicide mortality. In this study, the decisional processes of those medical practitioners determining the manner of death on the NIMSS forms were examined. In particular, the study assessed whether operational and empirical criteria developed in the United States to aid decision-making for the determination of suicide are important and/or difficult to apply to the South African context.

Because of the urban bias of NIMSS, this study focused on the medical practitioners working in the urban centres. Face-to-face semi-structured interviews were held with 32 practitioners in the five metropolitan municipalities covered by the NIMSS. To appreciate the applicability of the U.S.-developed criteria in guiding the decisional processes of medical practitioners, it was first necessary to gain an understanding of the context and issues arising from the medico-legal process in South Africa. Consequently, the questionnaire used in the study consisted both of closed- and open-ended questions (see Appendix II). The former comprised the Operational Criteria for the Determination of Suicide (OCDS) as defined by Rosenberg *et al.* [105] and the Empirical Criteria for the Determination of Suicide (ECDS) as defined by Jobes *et al.* [109] (all 22 items of the OCDS and the additional four items from the ECDS). Medical practitioners were asked if they thought a criterion was important when assessing a suicide death (yes/no), and secondly, whether the criterion was difficult to assess in the South African situation (yes/no). Although they were constructed as closed-ended questions, respondents were encouraged to elaborate where necessary. The open-ended questions asked about the current practice in South Africa with
regards to suicide deaths, and the applicability of the specified criteria to the South African situation.

After data collection, all questionnaires were captured electronically and attention was paid first to all open-ended questions, split into questions relating to the South African context and those relating to the applicability of each of the operational and empirical criteria to that context. At that stage, common themes or discrepancies across participants were highlighted to form the basis of the findings.

For the closed-ended questions, the operational and empirical criteria were grouped into those relating to self-infliction and those relating to intention. For each criterion, the proportion of practitioners who thought it important and/or difficult to assess was compiled. For those participants who provided explanations for their responses, common themes or discrepancies were also highlighted to provide greater understanding of the findings.

Study V

Accuracy of the NIMSS' suicide mortality data

Study V assesses the accuracy of suicide mortality data as recorded in the NIMSS using the docket produced from standard medico-legal investigation procedures as the gold standard. It is the second study to assess the accuracy of the NIMSS data, this time in comparison with victim data at the end point of the medico-legal process – finalised dockets - rather than expert data at the starting point of the process – medical practitioner determinations.

The study is based on data from Tshwane and, given that cases take several years to be finalised in court, NIMSS data from 2000 were selected. In addition to suicide cases, deaths with ‘undetermined’ manner were included so that the final outcome for these deaths also could be assessed. A 50% random sample of all suicide and undetermined death cases was selected.

A pilot study revealed that, in order to track these cases in the court system, not only is the police station name and case number required, but also the name of deceased. All of these details were obtained from the death register in the relevant mortuaries. These details were for the
exclusive use of tracking cases following which they were removed from
the dataset so as to ensure anonymity.

Three inquests courts and 25 police stations served Tshwane in 2000. The
courts were approached first and permission to access cases was
obtained from the relevant personnel. For cases not found at the inquests
courts, appropriate police stations were approached after obtaining
permission from the relevant police officials.

Cases were assigned a manner of death based on the docket analysis
and these medico-legal system classifications were compared with those
of the NIMSS. The sensitivity, specificity and predictive values were
calculated for each sex and race group. The definitions and calculations of
each of these measures are shown in Table 4 below.

<table>
<thead>
<tr>
<th>Measure</th>
<th>Definition*</th>
<th>Calculation†</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity</td>
<td>Degree to which true suicides are correctly identified as suicides</td>
<td>I/(I + II)</td>
</tr>
<tr>
<td>Specificity</td>
<td>Degree to which true nonsuicides are correctly classified as other than suicides</td>
<td>IV/(III + IV)</td>
</tr>
<tr>
<td>Predictive value positive</td>
<td>Proportion of positive suicides that the data can predict</td>
<td>I/(I + III)</td>
</tr>
<tr>
<td>Predictive value negative</td>
<td>Proportion of negative suicides that the data can predict</td>
<td>IV/(II + IV)</td>
</tr>
</tbody>
</table>

* From O’Carroll [104]
† From Jobes et al. [109] where I = suicides classified as suicides that are suicides (true positives); II = suicides classified as nonsuicides that are suicides (false negatives); III = deaths classified as suicides that are nonsuicides (false positives); IV = deaths classified as nonsuicides that are nonsuicides (true negatives).

Cases classified as suicides in the medico-legal system were
examined in greater detail to explore possible sources of any misclassification by the NIMSS, such as the method of suicide used,
specifically in different sex or race groups.
5 Results

5.1 Study I

*What is the share of suicide as a cause of injury death for different socio-demographic groups compared to other causes?*

According to the NIMSS data for 1999-2000, the share of suicide as a cause of death is similar for males and females for all race groups. By contrast, homicides contribute significantly more to male than female deaths for all race groups except Asians, while the share of unintentional injury deaths is significantly lower for Black and Coloured males. For all races, the proportion of undetermined deaths is significantly lower among males.

For males and females, the share of suicide as a cause of death is not randomly distributed in the different races. For Asians, Blacks and Coloureds, suicide follows homicide and unintentional deaths as the major contributors to injury mortality, while for Whites, suicide is the second leading contributor after unintentional deaths.

The proportion of suicide deaths is significantly greater than that of homicide deaths for Blacks aged 55 years and older and for Whites aged 15-24 years; and is significantly lower than that of homicide deaths for Blacks aged 35-44 years and Whites aged 55 years and older. In comparison to unintentional injury deaths, the proportion of suicide deaths is significantly greater for Blacks and Coloureds aged 15-34 years and for Whites aged 35-54 years; and is significantly lower for Coloureds aged 45 years and older and Whites aged 15-24 years. For other race-age combinations, the proportion of suicide deaths is not significantly different to that for homicide or unintentional deaths.

For Blacks and Coloureds, the proportion of alcohol positive cases is significantly higher in homicide and unintentional deaths compared to suicide deaths, for both sexes. By contrast, for Whites the proportion of alcohol positive cases is significantly higher in suicide cases than in homicide cases; with no difference in proportions between unintentional and suicide cases.
5.2 Study II

*Does the distribution of suicide across different socio-demographic groups, and across methods, vary over South African cities?*

White suicide rates are higher than for the other race groups in Tshwane, Johannesburg, eThekwini and Cape Town for both sexes, and Nelson Mandela for females, whereas male suicides in Nelson Mandela and male and female suicides in Buffalo City are highest among Asians.

Sex-specific suicide rates for Coloureds in Tshwane show one of the rare instances where the suicide rate for males is not significantly higher than that for females. However, the small suicide numbers may make this result unreliable. For all cities, male/female rate ratios are greatest for Blacks. Across cities, the relative differences between the sexes vary for each race group. The greatest sex difference for Blacks is found in Cape Town, for Whites in Buffalo City, for Coloureds in Johannesburg, and for Asians in eThekwini; while male and female rates are most similar for Blacks in eThekwini, for Whites in Nelson Mandela, for Coloureds in Nelson Mandela, and for Asians in Johannesburg.

Suicide rates for Black, Coloured and Asian males, and Black and Asian females are highest in Buffalo City. Johannesburg has the highest suicide rates for White males and females, while Nelson Mandela has the highest rates for Coloured females. Despite this, rank order correlations show no significant relationships (p>.05) between males and females of each race, nor between any combination of race-specific city distributions for either sex.

For all cities combined, hanging is the method most often used, accounting for 43% of all suicides. This is followed by firearm (29%), poison ingestion (13%), gassing (8%), jumping (4%) and burning (2%) suicides. There is a highly significant association between city and method of suicide used ($\chi^2=241.14; p<.001$). Firearm suicides are more frequent than expected in Tshwane and Johannesburg (42.0 and 32.0, respectively, compared to 28.9 all cities aggregated). Hanging suicides are more frequent in Buffalo City, eThekwini and Nelson Mandela (55.1, 54.4 and 47.1, respectively, compared to 43.2 all cities aggregated) while poisoning suicides are over-represented in Nelson Mandela and Cape Town (21.4 and 15.9, respectively, compared with 12.6).
5.3 Study III

*Do socio-environmental characteristics of the living area influence the suicide mortality risk for different socio-demographic groups in the City of Tshwane?*

The suicide rate varies considerably across different social groups in the City of Tshwane. Rates are higher for males and for Whites. White males and Black females consistently have the highest and lowest rates, respectively, for all age groups. Black males exceed the rate for White females in all except the 35-44 and 45-55 year age groups. For Black males, suicide rates tend to be higher in younger age groups, peaking between 35-44 years. For White males, suicide rates steadily increase with age, peaking between ages 45-54 years. Rates peak between ages 45-54 years for Black females, with no suicides recorded for those older than 54 years. Rates for White females are highest among those aged 35-44 years.

Factor analysis shows that socio-economic circumstances, economic need and matrimony are three distinct contextual aspects of residential areas in Tshwane. For the two race groups, contextual exposures impact minimally and differently on the suicide risk. For Blacks, only in areas with an intermediate level of matrimony is there a significantly decreased risk. For Whites, there is a protective effect of low socio-economic circumstances on the risk of suicide.

By contrast, for male and female suicides the contextual factors play a significant role, particularly for the latter. There is evidence of a gradient of decreasing risk with decreasing socio-economic circumstances and increasing economic need for both sexes. For males, there is also a protective effect in areas with low and moderate levels of matrimony, but no gradient. Only areas with moderate levels of matrimony have an effect on the suicide risk for females, and this is protective.
5.4 Study IV

What decisional processes lie behind the determination of an injury death as a suicide in the NIMSS, and could criteria developed by experts elsewhere be applied in the South African context?

Medical practitioners agree that while post-mortem results may strongly suggest suicide, the determination of suicide requires additional information. Given the current structure of the South African medico-legal system, this may not always be available at the time of the post-mortem, with the result that practitioners may depend on different criteria at different times to aid their decision-making.

Most respondents agree that having a list of criteria, as put forward by experts in the United States, would assist in formulating the manner of death by adding structure to and streamlining the investigative process, so that informed decisions, based on standard information, could be reached. However, many argue that they are not relevant for medical practitioners in the current system because their role concerns the examination and collection of physical post-mortem data. In addition, a clear history with motives and psychological aspects is not available at the time of the post-mortem, and even if it was, practitioners are not legally responsible for determining a suicide death and have no interest in psychological aspects.

Given the divergent views expressed above, it is not surprising that responses vary considerably across criteria related to self-infliction and intention to die. Some criteria show considerable consensus among practitioners. For example, they agree that self-infliction is a necessary criterion for suicide deaths, and that pathological evidence, investigational evidence, and statements by witnesses should indicate self-infliction, or at least be supportive of/not exclude it. In addition, it is generally felt that psychological and toxicological evidence are difficult to assess. On the other hand, for other criteria there is much disagreement across practitioners. For example, there is little agreement regarding the importance or difficulty in assessing statements of the deceased, recent interpersonal conflict, instability in the immediate family, and inappropriate preparations for death by the victim. In many instances, criteria are viewed as important and/or difficult to assess only to some extent or in particular cases. Responses regarding the importance of the
criteria, particularly for those indicating self-infliction, generally show greater consensus than those regarding the difficulty in assessment.

5.5 Study V

Are available suicide mortality data accurate for different socio-demographic groups, in the case of Tshwane?

In the medico-legal system, for all socio-demographic groups aggregated, one-third of cases could not be tracked, have not been finalised, or have unclear outcomes. For the remaining cases, the sensitivity of suicide determination in the NIMSS is 88.4%, and the specificity is 88.8%. The predictive value of a positive suicide determination is 93.0% and the predictive value of a determination of a nonsuicide manner of death is 82.1%. These figures vary across sex and race groups. Sensitivity and the negative predictive value are lower, and the specificity and the positive predictive value higher, for females compared to males. Sensitivity, specificity and the positive predictive value are lower for Blacks as compared to Whites, while the negative predictive value is higher. For Coloureds and Asians, for whom only four cases are recorded for each, all measures are 100%.

Almost all firearm and hanging suicides are correctly classified in the NIMSS, whereas this is true for less than two-thirds of poisoning and ‘other’ causes. The ‘other’ category consists of gassing, jumping, drowning, railway and burn suicides for those cases correctly classified by the NIMSS, and jumping and railway suicides for those cases misclassified by the NIMSS. Suicides using the methods that are more likely to be misclassified are more common among females and Whites.
6 Discussion

South Africa has undergone dramatic socio-economic changes since the dismantling of apartheid in 1994. While all South Africans have been affected by this transition, it is likely that the transformations have impacted on health determinants and outcomes to varying degrees for the different socio-demographic groups. Suicide mortality can be a sensitive indicator of the quality of life in a country or area [131], and other countries in transition have linked societal transformations and suicide mortality [6-7,9-13]. Since 1999, with the development of the National Injury Mortality Surveillance System (NIMSS), suicide mortality data have for the first time been available for all socio-demographic groups for the same time period and same geographic level of the country. Within this framework, it has been possible to investigate the socio-demographic patterning of suicide mortality and to examine the role of contextual exposures in this patterning. With the reliability and validity of suicide data being a concern both internationally and locally, it has also been important to assess the accuracy of the data used in these investigations.

6.1 Main findings

What follows is a discussion of the findings relating to each of these three main study questions.

6.1.1 Socio-demographic patterning of suicide mortality

Across the years that the thesis work has been undertaken, data availability has improved substantially, both with the NIMSS increasingly covering clearly defined areas and the release of recent census data corresponding to those areas. It has thus been possible to move beyond the calculation of proportional mortality in Study I to the calculation of rates in later studies.

Yet irrespective of whether proportional mortality or rates are calculated, the unequal distribution of suicide across socio-demographic groups is clearly evident. Moreover, the specific form of the distribution across socio-demographic groups varies across different urban locations.
Despite these city-level differences, however, some common trends across socio-demographic groups are observed. Firstly, while the share of suicide as a cause of injury death is comparable for males and females, suicide rates are higher among males. This is true for all race groups where case numbers are large enough to be reliable, and where tested, for all age groups. The size of the difference between male and female rates is typically greatest for Blacks. Secondly, the proportional mortality and rates for Whites are often substantially higher than those of other races for both males and females, and where tested, for most age groups. Although rates are useful measures for comparing across groups, given that population size is taken into account, absolute numbers of deaths are important when considering management and treatment strategies. Absolute numbers of suicides are most often highest for Blacks. Thirdly, suicides among Whites tend to peak in older age groups unlike the other race groups.

The differential suicide mortality outcomes across socio-demographic groups and geographic locations suggest that influences underlying them vary, or that in the face of common adverse influences, the different groups have varying expressions of protective factors [40,132]. Investigation of the possible mechanisms that contribute to increased risk or protective factors is urgently needed to understand what drives the differences in outcome. Prevention efforts are likely then to be better designed and have greater effects. In the discussion that follows, possible factors underlying the thesis findings are explored, recognising that they may be better understood in light of the socio-political transition in South Africa.

The legacy of apartheid
Apartheid laws meant that the various socio-demographic groups were differentially treated and non-White residence was restricted to particular areas. The little more than a decade since the dismantling of apartheid has been insufficient to correct all historical inequalities across both socio-demographic groups and regions. South Africa is still in a process of transformation.

Chronic and acute stress [133-134] are critical co-morbid aetiological considerations in suicidal behaviour, and are of particular importance in the South African society. Decades of discriminatory apartheid policies
have not only severely traumatised citizens through gross human rights violations [135] but have left a heritage of stress-related psychological problems [136] with potential suicidal implications. Extremely high prevalence rates of violence and trauma [137-138]; first world influences in an internationally, less isolated post-apartheid South Africa; high expectations which are not always realised following political and other transformation; acculturation; socio-economic difficulties including high unemployment levels; and economic pressures which (if not timeously addressed) all combine to further produce a breeding ground for potential suicidality [35].

The finding that the suicide rate or proportional mortality is typically highest for Whites, followed by Asians, then Coloureds or Blacks, is consistent with outcomes reported for years during apartheid [16,20-21,57], although as noted earlier, national apartheid era data should be viewed with some caution. If the findings reported for the apartheid years do in fact reflect the socio-demographic patterning accurately, then it would appear that the ongoing transition has not affected the patterning of suicide deaths across the different races, perhaps reflecting a gap in time between the political decision which initiates change, and the individual and collective adjustments to the change. Yet, it is not known if the mechanisms behind the possibly enduring patterns are the same at all historical time periods. Henry and Short proposed that when people have an outside source to blame for their misery (e.g., non-Whites, as the oppressed groups), they are more likely to direct violence outwards, resulting in assault or homicide; while those with no external source of blame (e.g., Whites, as the oppressors) are likely to regard their problems as internal and resort to suicide [16,21,139]. This process may persist post-apartheid since, as shown by Study III and as is evident in the census data [126], Whites largely continue to have better socio-economic and living circumstances than the other race groups.

The lower proportion of suicide among White youth relative to other races may reflect differences in socio-economic opportunities. It is likely that in the younger age groups a higher proportion of Whites are attending secondary or tertiary educational institutions, or are employed, than of the other races, and therefore may be less inclined to commit suicide [26]. This is similar to research by Hawton and colleagues [140] that found youth of working class backgrounds with limited employment opportunities to be at high risk for suicide.
As we progress in a democratic South Africa, Henry and Short’s understanding of suicidal behaviour could have perturbing implications for future suicide mortality in non-White groups. Race, together with sex, are important factors in the determination of the expectations that individuals have of themselves and from society – expectations that, if not met, may contribute to suicide risk [13]. Indeed, the size of the interracial gap has been shown to be narrowing for socio-economic status [83], and the findings in Study II and other research [26,59] suggest that the same may also be occurring for suicide mortality.

Cultural influences
The apparent consistency in patterning during and post-apartheid may be due to cultural differences across groups. It has been suggested that compared to Whites, suicide mortality may be lower among Asians and Coloureds because they tend to adhere to religions proscribing suicide [21]. The importance of moral and religious attitudes in influencing suicidal behaviour was first noted by Durkheim [71] who found that suicide rates in countries adhering to orthodox teachings tended to be low. The typically lower rates among Blacks may be because, in addition to close family ties, they have cultural taboos against suicide.

In contrast to Whites, who have fewer suicides among those aged 15-24 years compared to older groups, the other races tend to have a concentration of suicide cases in those aged 15-34 years with few among the elderly. Wassenaar and colleagues [26] have put forward a number of cultural factors to explain this patterning. First, in traditional Black and Asian cultures the elderly are respected and remain an integral part of the family and community and this is thought to be an important protective factor against self-destructive acts. Second, young people from traditional backgrounds in a multicultural South Africa, stressed by the conflict between traditional social roles and new roles offered by a more western-orientated culture, could be more likely to engage in suicidal behaviour.

Stress is also more likely to result in substance abuse, and the high proportion of alcohol positive cases (40.2%) among those tested in Study I may reflect high levels of societal tension. This is in line with, but towards the upper limit of, other retrospective studies that indicate alcohol abuse and dependence characterise 15-50% of suicides, depending on where the study was conducted and the population groups examined [141]. Study I suggests that associations between alcohol consumption and manner of
death differ across races, with alcohol use in Blacks and Coloureds associated more with homicides, and alcohol use in Whites associated more with suicides. Although these results do point to differential patterns across races, they should be viewed with caution, as only 43% of cases are tested for BAC levels, and sex and racial differences exist in the likelihood of being tested. Yet, cultural differences in drinking patterns may be important to consider, since suicide risk may not necessarily occur as a result of severe dependence, but on occasions of high consumption when impulsivity increases and the capacity for constructive thought decreases [141].

**The importance of suicide method chosen**

The method of suicide chosen is a major factor in determining whether suicidal behaviour will be fatal or not [1]. The choice of method can be influenced by factors such as the availability and socio-cultural acceptability of the means, media portrayals of suicides, and the degree of suicidal intent [36, 68, 142]. The extent to which such factors influence different socio-demographic groups may account for some of the variations in method used across these groups, and consequently, the variations in fatal outcome.

The consistently higher suicide rate among males compared to females found in the current work is typical of other South African studies [20-21, 25-26, 53] and most countries globally [2], and may reflect the male tendency to use more violent methods of suicide compared to females [67, 143]. Possible explanations for the excess of violent suicide in males include greater suicidal intent, aggression, knowledge regarding violent methods and less concern about bodily disfigurement [36]. Even in rural areas of China, where females have higher suicide rates than males, it is suggested that death may not be their intention. Rather, it may be that – since attempted suicide is much more common among females than males – females impulsively ingest the easily available potent pesticides that, in the absence of well trained medical personnel to manage the poisoning, result in high levels of mortality, even if they did not intend to die [37]. Prompt and adequate medical care, although unlikely to be lacking in the urban setting of this thesis, may be less accessible in the relatively small Buffalo City with poorer infrastructure, and could have contributed to the higher suicide rates there.
In addition to possible variations in medical care across cities, there is a highly significant association between city and method of suicide used (Study II). Particular methods of suicide seem to be over-represented in some cities, and it is plausible that these outcomes are related to the local environment. Yet, the method used is also known to vary across socio-demographic groups [23-24,55-56], and this may influence, perhaps through interaction with contextual factors, the city-level outcomes. For example, while Whites typically tend to use firearms, they may be more inclined to do so in cities where they are more easily available and socially acceptable.

**Box 1. Socio-demographic patterning of suicide mortality**

<table>
<thead>
<tr>
<th>Main findings</th>
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</thead>
<tbody>
<tr>
<td>• Suicide rates higher among males than females</td>
</tr>
<tr>
<td>• Proportional mortality and rates usually highest for Whites</td>
</tr>
<tr>
<td>• Blacks typically have highest absolute numbers of suicides</td>
</tr>
<tr>
<td>• Different age profile across race groups</td>
</tr>
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<thead>
<tr>
<th>Remaining challenges</th>
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</thead>
<tbody>
<tr>
<td>• A longitudinal assessment of the impact of transition</td>
</tr>
<tr>
<td>• A clarification of the mechanisms underlying the differences</td>
</tr>
<tr>
<td>• Use of other measures of social status beyond race and sex</td>
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</table>

**6.1.2 Role of contextual factors for group-specific suicide mortality**

The above discussion regarding methods highlights the important role context can play in the distribution of suicide mortality across socio-demographic groups. A report by the Centers for Disease Control in the United States found that, even after adjustments for certain demographic variables, regional differences persisted [144]. As discussed in the 'Background' section, contextual factors affect health outcomes, both directly and by modifying a wide range of other health determinants [75-77,88,90-92]. In addition, these factors are likely to differentially affect various social groups.

While city-level analyses are important in providing a comparative profile across regions, the within city differences found in Study II suggest that understanding the factors underlying suicide mortality in different groups may require local investigations in smaller
communities. Study III consequently assesses the impact of social and environmental factors at the living area level on suicide mortality.

Apartheid meant that Whites were the privileged race group, and people with better socio-economic circumstances have the resources to move to more desirable locations [145]. In Study III, the strong positive correlation between the White/Black ratio and other indicators of high socio-economic circumstances (formal dwellings with services available, high educational and occupational levels, high household expenditure) and the near absence of Whites in areas with high economic need (densely populated areas with high unemployment and many dependents) suggest that, at the end of the nineties, they largely continued to have better living conditions compared to Blacks. These Whites are those who have stayed following the dismantling of apartheid, but without their politically-defined privileged social position. Adapting to this change may increase the risk of suicide [7-8], and have lead to the unexpected finding that those in more advantaged areas actually have higher suicide risks.

Living in areas with high unemployment that are densely populated with many children and elderly people (called high economic need in Study III) may contribute to decreased suicide risk by providing some degree of social support, and creating a sense of community [146-147]. Relationships and family may be more important for women than are external factors [13], and this could underlie the greater benefit of such circumstances for females than for males. In contrast, areas with good socio-economic circumstances have high proportions of divorcees, together with formal dwellings that are likely to be surrounded by dividing barriers, given South Africa’s high crime levels. This context can be expected to increase one’s sense of loneliness and isolation, and consequently, the likelihood of suicide. Indeed, social fragmentation has been more strongly associated with suicide than is deprivation [73-74]; and in areas with lower than expected suicide rates, given their high deprivation levels, some kind of social cohesion has been proposed as a protective factor [95,98].

It has been suggested that an undermining of social cohesion, or social capital, is associated with increased crime [78,92,148-149]. In Study III, citizen homicide rate is hypothesized to impact on suicide because of the social tension it may engender. Although it does not appear as a component feature of the three dimensions observed, as a single variable
it correlates significantly and positively with overall suicide rate at the area level ($r=0.19, p<0.01$).

An unexpected result in areas with a high number of married individuals and older male household heads (labelled Matrimony in Study III) is the higher risk for suicide for both males and females, despite the apparent emphasis on family values suggested by these factors. This is in contrast not only to individual level studies, but also to some ecological studies (for example, [94]) that report suicide is lower in areas where more people are married. A number of variables constitute this factor and the role of each is unclear. Also, it is not known if the suicide victim comes from a household with such a family structure or not.

Indicators that are useful in describing characteristics of places only (dwelling type, services received, White/Black ratio, population density, citizen homicide rate) are, except for the latter, strongly associated with aggregated individual and household level socio-economic indicators. Each contextual dimension comprises a blend of these sets of characteristics, suggesting that such health promoting or health damaging features of areas need to be more fully investigated and perhaps targeted by mental health and social policies, together with individually focused health promotion activities [92,145]. In addition, multi-level studies will be important to differentiate between individual and the broader societal sources of risk [88].

Box 2. Role of contextual factors in suicide mortality

<table>
<thead>
<tr>
<th>Main findings</th>
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<tbody>
<tr>
<td>• The magnitude and distribution of suicide mortality across race and sex groups, and for the method of suicide used, differs across cities</td>
</tr>
<tr>
<td>• Less favourable clusters of living area circumstances have a protective effect on age-adjusted suicide rates, more so for both sexes than for race groups</td>
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<table>
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<tr>
<th>Remaining challenges</th>
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<tbody>
<tr>
<td>• The impact of social fragmentation deserves attention in the South African context</td>
</tr>
<tr>
<td>• Longitudinal assessment of the impact of contextual changes on the suicide outcome at various observation levels (i.e., city, suburb or smaller neighbourhood)</td>
</tr>
</tbody>
</table>
6.1.3 Reliability and validity of available suicide mortality data in the NIMSS

In examining the accuracy and variability of the NIMSS, studies in this thesis have additionally provided useful insights into the workings of the national medico-legal system as they relate to injury deaths. The peculiarities of the South African medico-legal system, in which medical practitioners are not required to determine the manner of death, have meant that national suicide statistics are not possible through this avenue.

The development of the NIMSS has made it possible to discuss the issues arising from, and the future needs related to, the determination of a suicide death by medical practitioners. Studies in the thesis have shed light on the factors influencing medical practitioner determinations of suicide in the NIMSS and whether these determinations are in fact accurate when compared to the medico-legal system outcomes.

As mentioned earlier, the issue of the reliability and validity of suicide mortality data is particularly pertinent for South Africa given its poor historical record for statistics keeping, at least for some socio-demographic groups. Any discussion regarding the accuracy of the NIMSS needs to be informed by an understanding of relevant issues in the broader South African context and of the current organisation of the national medico-legal system with which the NIMSS is intricately linked.

A manner of death with low priority

Important in this regard are the excessively high injury and violence rates that plague South Africa and overburden the medico-legal system. It is estimated that the age-standardised homicide rate is more than five times higher, and the age-standardised road traffic collision mortality rate approximately double, the global average [150]. A primary purpose of medico-legal investigations of injury deaths is to establish criminal responsibility for the death and, given the high numbers of homicides in particular, requiring suspects to be apprehended, it is obvious that elements important to a criminal investigation are the focus and interest of this work. The existing arrangement of dual responsibility for the mortuaries by the police service, in addition to the Department of Health, also promotes such a focus. The consequence of these factors is that suicide deaths receive relatively low priority in the medico-legal system.
Discussion

Possible threats to accuracy
In addition to their low priority, the determination of suicide deaths is subject to the same possible inaccuracies that impact on all injury deaths in the system. As noted by the medical practitioners themselves, these include poor training on the part of both police officers and medical practitioners, and a poor flow of data and weak chain of command throughout the investigative process. Such issues may have contributed to the high numbers of dockets missing in the courts and police stations in Tshwane.

As medical practitioners are not required by law to determine a suicide death, no explicit standard criteria exist to aid them in their decision-making. Many of those proposed by experts in the United States [105,109] are difficult, or even impossible, to assess in the current South African medico-legal system. Although detailed information on suicide deaths is collected in the course of the standard investigations, many factors highly relevant to the assessment of suicidal behaviour are not considered. This is particularly true for factors relating to the intention to die, such as the psychological state of the deceased prior to death. The legal requirements to determine the cause of, and responsibility for, the death favours assessments of self-infliction over those of intention.

Applicability of the criteria to South Africa
The investigations required to obtain the information for the U.S.-developed criteria [105,109] would be time-consuming and costly, increasing the workload and paperwork in an already overburdened system. However, if South Africa had a more inclusive forensic investigation (like the medical examiner or coroner systems), more importance would be attached to the criteria because it would be possible to acquire the information needed to answer them. A move towards this approach may be possible when the Department of Health assumes exclusive running of the mortuaries, a process that has already begun, with implementation intended to begin in April 2006 (personal communication, Richard Matzopoulos, Medical Research Council of South Africa).

Yet, Donoghue and Lifschultz [151] have argued against the strict use of the criteria. They believe that forcing a 'yes' or 'no' decision regarding suicide to represent the decision maker’s best judgement after collecting and reviewing all the evidence required by the criteria, is
Discussion

Main findings

• Medical practitioners have differing opinions both regarding the quality of the data currently available for suicide determinations, and the applicability of the U.S.-developed criteria in South Africa

• High levels of accuracy of the NIMSS data for Tshwane

• Variations in accuracy across sex, race, and method unlikely to be sufficient to invalidate conclusions drawn

Remaining challenges

• Disguised suicides may never be uncovered

• Assessment of reliability and validity of suicide data needs to include other regions and requires longitudinal data

Box 3. Reliability and validity of currently available surveillance-based suicide data in South Africa

<table>
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</table>

Level of accuracy

In the absence of explicit standard criteria for guidance, medical practitioners must base their decisions on the typically fluctuating and limited amount of evidence available at the post-mortem. Yet, this lack of a standard approach does not seem to threaten the validity of the NIMSS suicide statistics, at least when studying data from Tshwane. Using the
medico-legal system classifications as the gold standard, the sensitivity, specificity, and predictive values are generally high. Variations in accuracy across sex, race and method used are largely in line with international research [106,111,113-114], and are unlikely to be sufficient to invalidate the conclusions drawn from the data in the other studies of this thesis. However, suicides may still be underestimated in this process given the challenge of tracing disguised suicides and without the careful examination of potential misclassifications of true suicides as unintentional deaths.

6.2 Limitations of the studies

6.2.1 Misclassification

Systematic differences in the way data on exposure and outcome are obtained can lead to information bias. Misclassification of the exposure (or outcome) can be dependent on (differential misclassification), or independent of (non-differential misclassification), the values of outcome (or exposure) [152]. Differential misclassification can result in an exaggeration or underestimation of an effect. Non-differential misclassification can occur when an exposure or disease classification is incorrect for equal proportions of cases in the compared groups.

The widespread concern regarding possible misclassification of suicide deaths was the reason for Studies IV and V. This would be a concern in Studies I, II and III if suicide statistics are more accurate for particular socio-demographic groups or if the bias is unevenly distributed across cities. While data appear to be fairly accurate for Tshwane, even across socio-demographic groups (Study V), misclassification could be a problem in the other cities where accuracy has not been evaluated, particularly if it varies across groups within them.

In addition, although the use of the ‘undetermined’ manner of death category was evaluated in Study V, other categories also likely to contain suicide cases were not checked in Tshwane or elsewhere. For example, suicide might be missed in those cases classified as unintentional, particularly equivocal cases or those where there may be a low index of suspicion on the part of the police officers or medical practitioners (such as poisonings, drownings, single vehicle driver crashes or pedestrian deaths) [111]. In such cases, a thorough investigation of the inquests dockets may not be helpful in uncovering evidence of suicide if the
relevant information regarding suicidal intent was not available to begin with. Also, as the proportion of true suicides among all unintentional deaths is likely to be very low, a considerable number of cases need to be reviewed to find any cases. Such efforts are very labour intensive and time-consuming, producing few results. This is a concern in the South African context as well as elsewhere, and is important for conclusions drawn across groups since the extent to which suicides are ‘disguised’ as other deaths may be strongly influenced by socio-cultural factors.

In Study III, contextual data are taken from the 1996 census fitted to the 1998 change in municipal boundaries, while injury data are from 2000-2001. It is difficult to estimate how the 1998 change in boundaries, and other changes occurring in the areas over four years, may have influenced the outcome. Population data will have changed through births, deaths, or mobility, and this is problematic if there is differential change across area types. It is likely that these factors would affect people living in poorer areas to a greater extent. For example, high numbers of (other than suicide) deaths in an area, resulting in a smaller than expected population, would underestimate the suicide outcome; while the opposite would be true in areas with an unanticipated influx of people into them. Additionally, mobility affects individuals’ length of exposure to contextual conditions. It also disrupts social ties and the availability of social support systems [97].

**6.2.2 Selection bias**

Selection biases are systematic distortion errors resulting from the procedures to select subjects and from factors that influence study participation [152]. In the current work, as all cases of non-natural death are legally required to undergo medico-legal investigation, it is unlikely that deaths are missed, particularly in urban areas. However, across mortuaries there are varying degrees of missing data for race, sex, age, method of suicide used and suburb. Cases with missing values may more often come from particular socio-demographic groups, or live in particular areas. The problem of missing information also applies to the exposure data in Study III, as taken from the census in 1996. The extent of this bias is difficult to assess at the small area level, but as mentioned in the ‘Material and Methods’ section, census data are adjusted for undercount and are likely to be more complete in urban areas.

In Study III, suicide rates exclude deaths of residents occurring outside the geographical area served by the mortuaries, and with the
current lack of data from some of the surrounding areas it is impossible to assess the extent of these exclusions. If a similar number of Tshwane residents enter surrounding mortuaries as residents of elsewhere enter the Tshwane mortuaries, then the figures for all cases seen at Tshwane mortuaries are a better estimation than that for residents only. It is unclear how this would affect the relationships examined – people in wealthy areas are more likely to afford the possibility of travelling to other geographical areas to commit suicide, but some people living in poor areas may travel back to rural homelands to do so.

The selection of mortuaries and cities is limited to those that record data for the NIMSS. It is difficult to assess the representivity of the sample with respect to the rest of the urban population of the country. It is possible, and even likely given the inter-city differences in Study II, that the outcomes in other urban settings not covered by the NIMSS may differ from those reported here. Local research is clearly required. Yet, the areas covered are composed of the full range of social groupings that constitute South African society thereby supporting the ambition of the studies to examine the relative importance of suicide across different socio-demographic groups.

6.2.3 Confounding
Confounding occurs when the apparent effect of the studied exposure is distorted because the effect of an extraneous factor is mistaken for, or mixed with, the actual exposure effect [152]. Confounding by socio-demographic variables was not possible in the current work as results are stratified by sex and race, and adjusted for age (Studies II and III). In Study III, adjusting for age was essential as studies have found that younger age groups are influenced more strongly than older groups by contextual factors [74,95].

However, other potential confounders are not adjusted for. In Study III, it is impossible to determine if individuals who commit suicide share the characteristics of the population from which they are drawn. The results may be confounded by, for example, individual socio-economic status. For instance, a person committing suicide in an advantaged area may in fact have low individual socio-economic status, and it may be this contrast that is suicide-promoting [78,145]. However, the only available multilevel study that to my knowledge includes suicide [88], found little or no attenuation of neighbourhood effects with the introduction of individual socio-economic status.
6.2.4 Additional limitations

Other known risk factors for suicide

Many other known risk factors for suicide have not been included in the studies in the thesis, and of particular significance in South Africa is the influence of other health problems. While these could also be considered as possible confounders, they are dealt with separately given their importance.

South Africa is experiencing the quadruple burden of disease from the pre-transitional diseases (including communicable diseases, maternal causes, perinatal conditions and nutritional deficiencies), the emerging chronic diseases, injuries and HIV/AIDS [22]. These outcomes are not equally distributed across all groups and regions. For example, HIV prevalence is higher for females than males for ages 15-34, with young females aged 15-24 years in particular contributing many new infections, but is higher for males in older ages [153]. Adjusting for race and urban location, a study using the NIMSS data found similar patterns across age for suicide and suggested that HIV/AIDS could be an important underlying influence on this distribution [67]. A substantially increased likelihood of suicidal behaviour in HIV/AIDS patients compared to the general population has been found [154-155]. Evidence from a study examining mortality between 1996 and 2000 in a general hospital in Transkei, a former Black homeland area, suggests that suicide rates have risen parallel to the rise in mortality due to HIV/AIDS [156]. Critical psychosocial stressors of HIV/AIDS include social stigma, discrimination, isolation, lack of support from family and friends, and social devaluation, all of which contribute to an increased risk of suicidal behaviour.

More research on suicide mortality in people with other life-threatening diseases, such as cancer, is also needed [157], given the fact that one in four South Africans will develop cancer and one in two is likely to know someone who has cancer [158]. Even internationally, the role of physical illness in suicide has received little attention in research and education [159].

Feelings of helplessness and hopelessness are two signs of depression that occur in people with life-threatening illnesses [156]. Both international [46,160-161] and local [28-30,35,162] research has identified various, often co-morbid, psychopathological conditions as critical factors in the aetiology of suicidal behaviour. Affective disorder, particularly depression, is the single psychiatric diagnosis most strongly linked with
suicide. A recent review article, with most cases coming from North America and Europe, found that 98% of suicide deaths had a diagnosis of at least one mental disorder: mood disorders (30.2%), substance-use related disorders (17.6%), schizophrenia (14.1%), and personality disorders (13.0%) [163]. While the majority of depressed patients do not commit suicide, recent studies show that the estimated rate for lifetime suicide mortality from major depressive disorder is 10-15% [161]. In South Africa, similarly high levels of depression in all race groups have been reported [4]. However, there is some evidence that cultural factors modify the expression of depressive symptomatology in some groups, resulting in an under-diagnosis of the condition. For example, in some traditional beliefs typical symptoms of depression may rather be viewed as the result of the influences of ancestors or supernatural means [4].

**Cross-sectional study limitations**

Possible limitations related to cross-sectional studies are time lag and reverse causation [164]. In addition, as the time period of available data is short and particularly since suicide is a rare event, an additional concern is that small caseloads for some groups reduce the robustness of the results.

With regards to time lag, it is plausible that contextual factors take time to have an effect. In most cross-sectional studies, both the exposure and outcome are usually measured at the same point in time. In Study III, however, limited data availability meant that 1996 census data adjusted to 1998 boundaries was used for the exposure variables, while suicide data as the outcome was from 2000-2001. Although the optimal time lag to study is unclear, it may be that this study more accurately captured the effects of contextual factors on the suicide outcome than in typical cross-sectional studies. However, as mentioned above, this design opens itself up to the risk of other factors confounding the results.

In terms of reverse causation, it is possible that ill-health leads to reduced status, instead of the usually hypothesized reverse. This may have affected the finding in Study III, where more favourable contextual factors were linked with higher suicide. People at high risk of suicide may choose to live in more favourable areas because they contain better mental health clinics or to avoid the intensity of areas with high economic need.
6.3 Implications for future research and prevention

The calculation of both absolute and relative measures means studies in the thesis have been useful in portraying both the magnitude of the suicide problem in the population as a whole or in different socio-demographic groups, and the relative importance of suicide as a cause of death for different socio-demographic groups. This has significant implications for treatment and prevention. Absolute differences between groups are useful for identifying priorities, while relative differences reveal the size of the inequalities and suggest possible underlying mechanisms.

Future research needs

As raised in the limitations, future research needs to increasingly cover rural areas. The NIMSS provides only limited coverage of rural areas in one province (Mpumalanga), and only a few rural studies, covering the Transkei region [59,66,165], to my knowledge exist. Without comparisons across several rural areas, we do not have a clear understanding of how the magnitude or distribution of suicide rates in rural areas compares with that of urban areas. Studies that have segregated national suicide data by urban versus rural residence show no clear pattern, with some countries having higher suicide rates in urban areas and others having higher rates in rural areas, but these differences often vary by age group and sex [37]. Indeed, in South Africa both the distribution of the population, and the socio-environmental exposures, are vastly different across the two levels, and it would be of interest to know their effects on the suicide outcome. This will not only assist in uncovering possible underlying mechanisms, but the inclusion of rural data are important to fully assess the relationship between socio-political changes and the suicide outcome.

As more suicide data become available across time, longitudinal studies will be possible. These are essential for examining concomitant changes in both the independent and dependent variables so that the link between social changes and the suicide outcome can be more fully understood. The absence of longitudinal data means that we do not know if the results seen are the products of change since the demise of apartheid or if they are constant over time. A better understanding of the processes occurring in South Africa will be useful not only locally, but also for other countries in transition. Studies in this thesis provide a basis
from which to estimate some health impacts of city development in the future.

Further research is required to understand the mechanisms behind the socio-demographic and socio-environmental differences for suicide mortality found in the studies in this thesis. Although there are ongoing deliberations regarding the relative importance of various risk and protective factors in suicidal behaviour, it is likely that a range of factors are associated with increased suicide risk for an individual [42]. Recognition of risk factors at all levels – societal, community and individual/family – is an essential feature in planning intervention and prevention programmes. Although many South African studies have examined risk factors on each of these levels, in-depth research on the underlying mechanisms of suicidal behaviour is lacking.

The importance of particular cities, and even suburbs, for group-specific suicide outcomes is difficult without detailed information for each the cities or suburbs, on for example, the number and utilisation (by the different groups) of mental health facilities. The launching in 2002 of the South African Cities Network [128] that aims to encourage the exchange of information, experiences and best practices on urban development and city management among a network of municipalities, including those examined in the thesis, will hopefully generate much needed knowledge of city-level factors likely to influence health outcomes. Suburb-level information is likely to be more difficult to obtain and may have to rely on individual studies to be gathered.

**Surveillance, treatment, and prevention**

The problem of suicide mortality has not been high on the South African policy agenda in the past, being largely overshadowed by other numerous, and indeed pressing, health problems. Yet, the results of this thesis show that suicide deaths are a cause for concern, outnumbering other injury deaths for several sex-, race- and age-specific groups, and with rates indicative of a substantial public health burden.

At the government level, there has been increasing awareness across time of the need for suicide prevention strategies to be developed. In 2002, the mental health legislation was amended by enacting the Mental Health Care Act. The Act provides for the care, treatment and rehabilitation of persons who are mentally ill, and ensures their dignity and rights [166]. The passing of the Act is important in highlighting the
needs of the mentally ill, and the notion that mental illness can indeed be treated. Other initiatives tend to focus on youth and include the launching of policy guidelines on child and youth mental health, the Health Promoting Schools Initiative, Life Skill programmes, and a school-based suicide prevention programme in the Free State. These initiatives are intended to draw together other departments such as Education and Social Development as well as to equip children and youth to deal with life’s challenges [166].

In addition, a significant step forward was taken at the latest Congress of the International Association for Suicide Prevention held in Durban 13-16 September 2005. Department of Health officials committed government to dealing with the problem of suicide, including the development of adequate recording systems and well-designed research. Findings from the thesis can be helpful in this regard. Studies IV and V provide encouraging results for the use of the NIMSS, using medical practitioner determinations, in providing epidemiological information on suicide mortality statistics. In addition to the high accuracy, the NIMSS ensures completeness of caseloads in the regions it covers, not only for suicides but all injury deaths; the data are relatively easily obtained; and are available within 12 months of death. In contrast, Study V found that medico-legal system cases can take between five and 57 months (mean = 23 months) to be finalised in court. Furthermore, three to five years after the injury death occurred, a court finding of suicide or not suicide could not be made in one-third of cases, because cases were missing, had not yet been finalised, or it was unclear from the docket information if they were suicides or not. With government backing, it may be possible to increase the coverage of the NIMSS to national level and to conduct further studies regarding its accuracy. The latter will be particularly important if death registration procedures are changed when the Department of Health assumes exclusive running of the mortuaries.

Examination of the methods used to commit suicide is important for informing prevention efforts. Controlling the environment to decrease the incidence of suicidal behaviour has shown clear preventive effects [142]. This approach includes reducing the availability of and access to means of suicide, through detoxification of domestic gas, detoxification of car emission, toning down reports in the media, legislation to reduce access to firearms, and controlling the availability of toxic substances, including pharmaceutical drugs. The latter two are of particular significance in South Africa, given the high numbers of firearm and poisoning ingestion
suicides. At the time of writing, a new Firearms Control Act is currently being implemented. It remains to be seen whether regulations specified in the Act can be effectively enforced. In addition to national approaches such as this, the findings in this thesis and elsewhere, showing that methods used for suicide vary both across groups and regions, suggest that local prevention efforts need to be considered. For example, cities with an over-representation of firearm suicides could introduce firearm-free zones in high risk places.

A number of countries have developed national programmes and strategies, for example, Australia, New Zealand, Sweden, Norway, Finland, Britain, the United States, France, and Estonia [167]. Also, the WHO has drafted strategy proposals for suicide preventive work and published a series of documents on how to prevent suicide in psychiatric and general practice settings, in schools, prisons and in survivors of suicide, and how to report on suicides in the media [168]. Although South Africa does have some regional prevention activities, a national programme is yet to be developed. It is important that South African efforts to create a national strategy build on the knowledge and experience gained from other national programmes while taking into account our own South African research data. The regional strategies and programmes have covered many aspects of the prevention of suicidal behaviour and have been fairly widespread in their efforts. They include helplines, survivor support groups, school-based initiatives, public awareness and education, and research-based efforts (for example, LifeLine Southern Africa, South African Depression and Anxiety Group, Samaritans/Befrienders Worldwide, Survivors of Loved Ones of Suicide, Mental Health Information Centre, Durban Parasuicide Study).

These groups and organisations are valuable partners in prevention and treatment strategies, and should be supported. However, the effectiveness of the strategies in reducing suicidal behaviour or promoting mental health has not been evaluated and greater collaboration between the different groups is required. A fully integrated national strategy that is research-based and outcome-focused, with evaluation as an integral part, would be an important goal. Results from the thesis emphasize the need for such a strategy to include local communities and specific population subgroups as targets, and to be appropriate and responsive to the social and cultural needs of the groups or populations they serve. Initial efforts to create the framework of such a strategy have been undertaken [169].
7 Conclusions

To contribute to better understanding of the role of social status and environmental circumstances in suicide mortality, the aims of this thesis are to highlight the socio-demographic patterning of suicide mortality, determine the role of contextual exposures on suicide mortality for different socio-demographic groups, and to assess the reliability and validity of available suicide mortality data.

The results show that in a post-apartheid urban South African setting, there are considerable differences in the distribution of suicide mortality across socio-demographic groups. Suicides among Blacks usually outnumber those of other races substantially, but males and Whites typically have the greatest risks when rates are calculated. Contextual factors are important in the suicide outcome, with the magnitude and distribution of suicide across sex and race groups varying both across and within cities.

The National Injury Mortality Surveillance System (NIMSS), using medical practitioner determinations of suicide, plays an essential role in providing epidemiological information on suicide mortality for all population groups in South Africa. As the only source of such data currently available in the country, the importance of this information cannot be overstressed. High accuracy levels of the data for one city provide encouraging initial results for using the data to appropriately inform future research, prevention initiatives and policy making.

With data available, it now becomes possible to gain a better understanding of what appears to be an increasingly significant public health problem, suicide, in a part of the world where very little is known about the epidemiology of the phenomenon. In South Africa, high levels of suicide mortality in several socio-demographic groups suggest that suicide no longer be given low priority in the health system. The findings highlight the importance of locally based suicide research. An increased understanding of what drives the differences across socio-demographic groups is the challenge for (preferably longitudinal) future research. Such understanding is essential for the development of appropriately targeted public health interventions aiming at improving health conditions for all. Crucial in that work is likely to be a better understanding of the effects of the macro-social transition South Africa has undertaken since 1994.


8  Acknowledgements

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