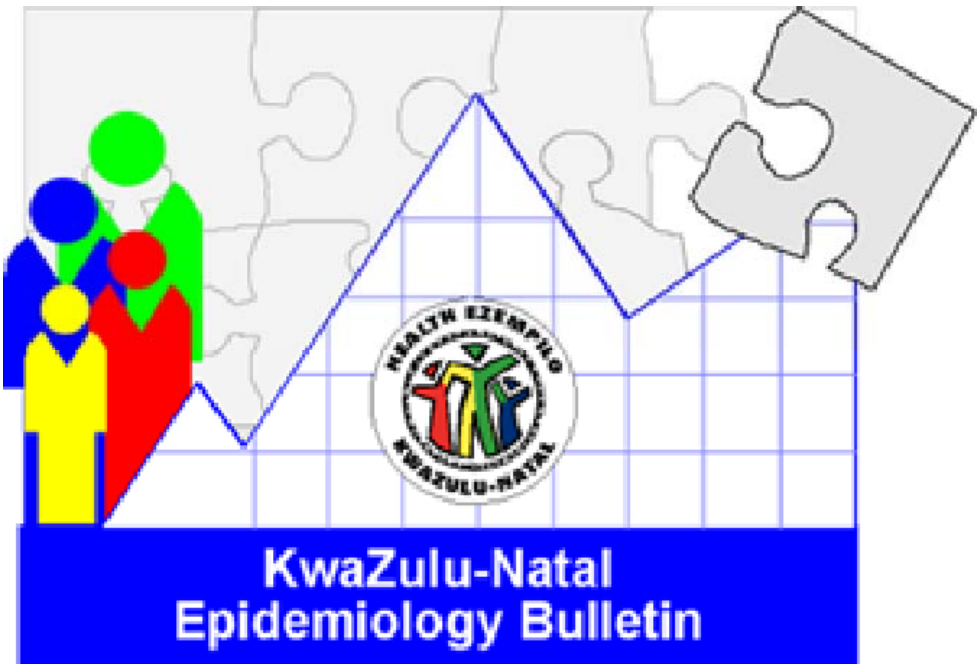

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Epidemiology of injuries in KwaZulu-Natal

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Editorial

The new democracy in South Africa brought with it many challenges, not least of all the need to improve the Vital Registration system. The registration of births and deaths while a very fundamental part of a country was in disarray due to the multitude of systems, which existed due to artificial separation on the basis of race and geography. This was further compounded by the under-reporting of vital events in the absence of societal incentives associated with citizenship such as education, healthcare and social welfare to name a few.

Against this backdrop, the quality of death registration was questionable. This can be seen in the large number of deaths (19,2%) classified as either ill defined or unspecified and unnatural for the period 1997- 2001. Further analysis of this group shows both a distinct age and gender pattern. Men between the ages of 15-49 had the highest mortality due to unspecified unnatural causes and were three times more likely to die of this cause than females.

At a societal level this is an area for concern indicating the need to intervene to mitigate the epidemic of trauma, which can be broadly categorized into interpersonal violence, and motor vehicle accidents. In both instances the confounders of alcohol and possibly stress are implicated in the lead-up to the fatal event- with the former allowing for a more objective measure.

The naturalist Dr Charles Darwin in his publications supporting the theory of Evolution coined the phrase, “Adapt or Die” which becomes quite apt in a society undergoing rapid change in all spheres of functioning. Understanding the associated risk factors and instituting public health programmes addressing pervasive issues such as conflict resolution, drug abuse and political tolerance while maintaining high levels of policing and legislative reform to act as deterrents must be implemented to decrease the burden of disease attributed to trauma in KwaZulu Natal.

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Acronyms & Definitions of Terms

BOD	Burden of Disease
DHS	1998 Demographic and Health Survey.
KZN	Kwazulu-Natal
ICD10	10th International Classification of Diseases.
Intention	Intentions include accidents (unintentional), suicides and homicides (intentional).
Modality	Modalities include traffic accidents, falls, struck by objects, contact with machinery and other means listed in Table 1.
NIMSS	National Injury Mortality Surveillance System.
Undetermined	Non natural deaths with no clear modality and intention
WHO	World Health Organization.

Acknowledgement

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Abstract

This issue deals with the epidemiology of injuries. The mortality estimates are based on the analysis of the data coming from Statistics SA, which consists of a 12% sample of the death notifications that occurred between 1997 and 2001. Deaths from injuries, have stabilized in the last few years, although at a high level, and their contribution to the total mortality has slightly declined from 13% to 9% between 1997 and 2003, mainly because other causes of death have increased.

Males have a higher non natural mortality than females and are more frequently dying from firearms. Males contributed to about 80% of deaths from injuries and they die more more frequently from homicides and suicides compared with females who die more frequently from accidents.

Injuries occurr in the economically active age group. Mortality from injuries rises sharply after 15 years of age and reaches the highest level between 15 and 44 years of age, which is the age group where 70% of all non natural deaths occur. The first cause of non natural mortality are burns and drowning among children, traffic accidents between 5 and 14 years of age and firearms among adults. Because the deaths from injuries are concentrated in the economically active age group and because the non-fatal injuries are frequently associated with disabilities, there is a substantial burden in terms of years of life lost because of premature mortality and disability.

Preventive actions can decrease this burden by identifying the most cost effective and feasible interventions. Reducing the circulation of firearms, enforcing traffic regulations and limiting the consumption of alcohol are some examples on how risk factors could be reduced. Because some actions are more easily implementable than others, interventions should be prioritized according to cost effectiveness and feasibility. Unfortunately most interpersonal violence is not easy to control without an inter-sectoral and integrated approach that takes into account socioeconomic and cultural factors that are at the root of the problem.

Introduction

Injuries fall under the definition of external causes and non natural deaths, and are divided according to modality and intention. Examples of modality include firearms, falls, poisoning and drowning; while intentions include accidents, homicides and suicides. There are deaths in which the modality is known (i.e. poisoning) but the intention is unknown. Finally, there are non natural deaths that are categorized as undetermined injuries because both the modality and the intention are unclear. This issue describes the most recent statistics on injuries and it is divided into methodology, results and discussion.

Methodology

The statistics presented in this Bulletin is based on an analysis of the data coming from Statistics SA and on the information presented in several reports and scientific articles. The mortality for Kwazulu-Natal (KZN) was estimated by analysing the files related to the deaths certificates sampled by Statistics SA. These are based on a sample of 12% of the recorded deaths that occurred between 1997 and 2001. The analysis carried out on this data source was already described in Issue number 4, which focused on non communicable diseases. In this issue, the analysis on the deaths from injuries were categorized according to the 10th International Classification of Diseases (ICD10). The causes were divided into known modality and intention, known modality but unknown intention and undetermined causes, as shown in Table 1.

The deaths which were categorized as known modality and unknown intent were reassigned according to the age and gender proportional distribution of the relative modality. If for example, among males of a certain age group, there were a certain number of deaths from firearms (modality) but the intent was unknown, these were re-assined according to the proportional distribution of (a) accidental discharges from firearms, (b) suicides by firearm and (c) homicides by firearm, which occurred in males of that age group.

Undetermined causes of unkown modality and unknown intent were not reassigned. The trends in undetermined causes, had an influence on the distribution on the known causes of death. The proportion of undetermined deaths declined during the late 1990s, when the quality of reporting improved, producing changes in the distribution of the number of deaths from specific causes. The probability of a non natural death being correctly categorized varies across accidents, suicides and homicides. For example, somebody dying from suicide is more likely to be assigned to the category "undetermined" compared with somebody dying from traffic accidents. Therefore, whenever the quality of recording improves, there is an increase in the number of deaths recorded as due to homicides and suicides because these causes were previously more assigned to undetermined causes. Because it is not possible from these data to estimate the probabilities relating undetermined cause with the known causes of injurioes, the undetermined causes were not reassigned but their contribution was taken into account in the presentation of the results.

Table 1 Categories of injuries according to intent and modality

Intent	Modality	ICD10
Accidents	Traffic accidents (including pedestrians)	V03-V98
	Falls	W10-W19, Y31
	Struck by object	W20
	Contact with machinery	W31
	Firearm accidental discharge	W32-W34
	Mechanical Force	W49
	Attacked by any type of animal	W54-W58, X20
	Drawning	W69-W74
	Accidental Hanging	W76
	Suffocation due to inhalation of gastrict content, food, objects, and any unspecified threat to breathing	W78-W84
	Electricity	W87
	Fire/smoke, contact with hot water/vapour/heating devices	X00-X17
	Exposure to extreme natural heat/ cold	X30-X31
	Lightning	X33
	Mine accidents, landslide, floods, other forces of nature	Y37, X36-X39
	Accidental poisoning	X46-X49
	Modern medicine	Y45, Y70, Y83
	Traditional medicine	Y67-Y68
	Other accidents	X53-X59
Suicide	Poisoning	X61-X64
	Hanging	X70
	Drawning	X71
	Firearms	X74
	Fire/smoke	X76
	Other suicides	X84
Homicides	Hanging/strangulation/suffocation	X91
	Drawning	X92
	Firearms	X93-X94
	Sharp Objects	X99
	Blunt Objects	Y00
	Other homicides	Y06-Y09
Determined modality but undetermin ed intent	Poisoning of undetermined intent	Y14-Y19
	Hanging, strangulation, suffocation of undetermined intent	Y20
	Drawning of undetermined intent	Y21
	Firearms of undetermined intent	Y23-Y24
	Smoke, fire, hot vapour, heating devides, undetermined intent	Y26-Y27
	Sharp objects of undetermined intent	Y28
	Blunt objects of undetermined intent	Y29
	Falls undetermined intent	Y30
	Other undetermined intent	Y33
Undetermined modality & undetermined intent		Y34

Another source of information were the reports from the National Injury Mortality Surveillance System (NIMSS). The vital statistics stopped reporting the causes of deaths from injuries between 1990 and 1996, and the NIMMS was implemented to fill this gap. Since 1999, the NIMSS has been collecting the information on fatal injuries through a sentinel system based on a sample of mortuaries distributed in five

provinces, mainly in urban areas. It is estimated that in 2001, the NIMSS captured more than one third of deaths from injuries nationwide.

Other sources included the 1998 DHS, the SA BOD study, other reports and scientific articles from the literature.

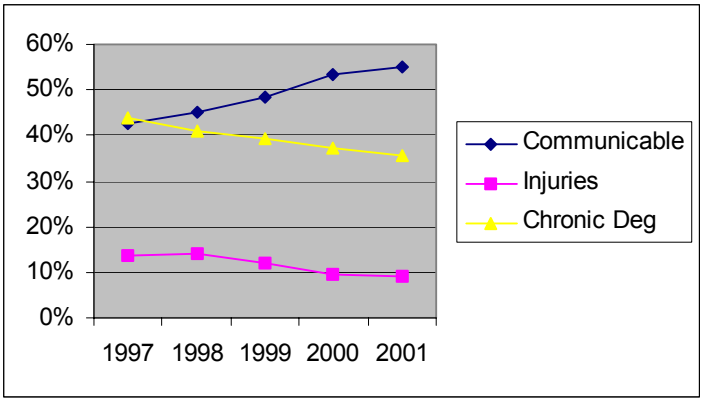
Results

The results are presented as mortality from vital statistics, mortality from NIMMS, mortality from other data sources, morbidity due to injuries and burden of injuries.

Mortality from Vital Statistics

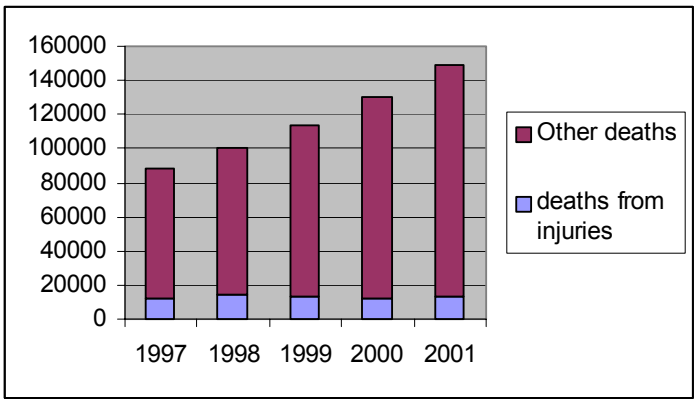
During the late 1990s, the number of deaths from injuries in KZN has stabilized, while mortality from other causes, especially HIV/AIDS, has increased. Therefore, even if the number of deaths from injuries have not changed substantially, the proportion of total mortality caused by injuries has declined between 1997 and 2001 (Figure 1). In other words, the proportion of deaths caused by injuries has declined from about 13% to about 9% between 1997 and 2001. This is due to the fact that while the numbers of deaths from injuries stabilized, the annual mortality from other causes increased (Figure 2).

Figure 1 Proportional mortality due to injuries v.s. other causes



Source: analysis of vital statistics

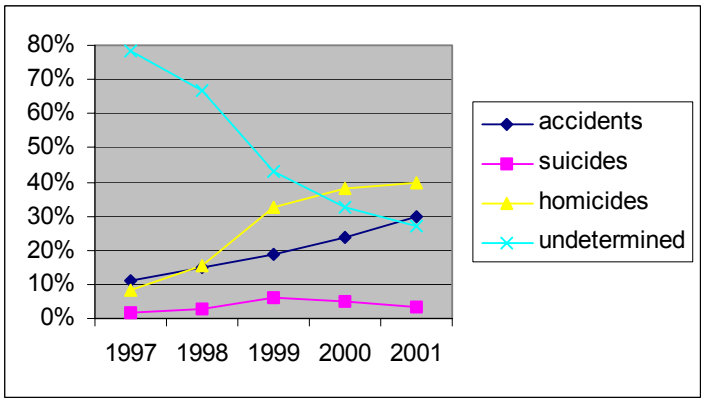
Figure 2 Annual deaths from injuries vs. total mortality in KZN



Source: analysis of vital statistics

Trends are affected by the proportion of deaths which are undetermined. Figure 3 shows that in 1997, out of 100 deaths from injuries, 80 did not have a determined cause, and the remaining 20 were almost equally assigned between accidents and homicides, with a minority being assigned to suicides. As the proportion of undetermined deaths declined steadily between 1997 and 2001, the proportion of homicides and suicides increased. This suggests that as the quality of recording improved, a higher proportion of deaths, which were previously undetermined, were assigned to homicides and to a less extent to suicide and accidents. This brought an increase in the proportion of known deaths due to homicides and to a less extent due to suicides, while the proportion of deaths from accidents increased at a lower pace.

Figure 3 Proportional mortality by cause among non natural deaths in KZN



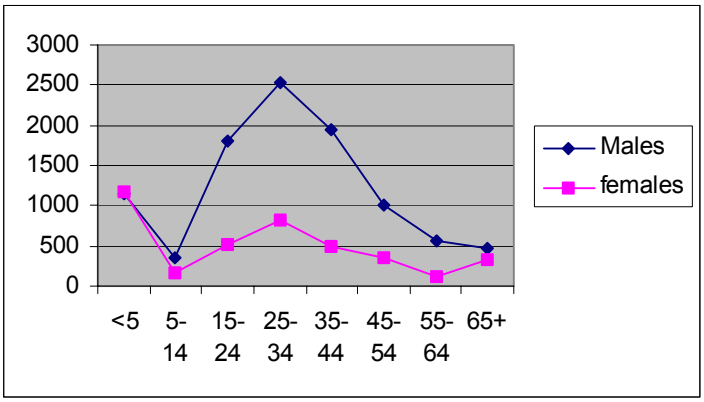
Source: analysis of vital statistics

The above findings should be kept in mind when interpreting the trends in the number of deaths due to accidents, homicides and suicides. As undetermined deaths decreased, the number of non natural deaths attributed to suicides and homicides increased in the late 1990s. This pattern suggests that deaths from accidents were more frequently classified under a known cause compared with deaths from suicide or homicide. This is in line with the common knowledge that those dying from suicides and to a less extent from homicides have a higher chance of being assigned to undetermined causes compared with those dying from accidents such as from falls or traffic accidents. The fact that the proportion assigned to suicides (3%) is about 3 times lower than what is expected for KZN, confirms that suicides have the highest chance of being assigned to undetermined causes.

Therefore, any trend of known causes should be interpreted with caution because many changes are the result of reassignment of undetermined causes. For example, looking only at the number of known causes, there was a sharp increase in homicides between 1997 and 2000, because most of these causes where previously undetermined. For the above reason, it is not possible to utilize these data to check how the accidents, homicides and suicides increased or decreased between 1997 and 2001. However, other data suggest that the proportion of non natural deaths due to accidents, suicides and homicides has not changed substantially in the last few years.

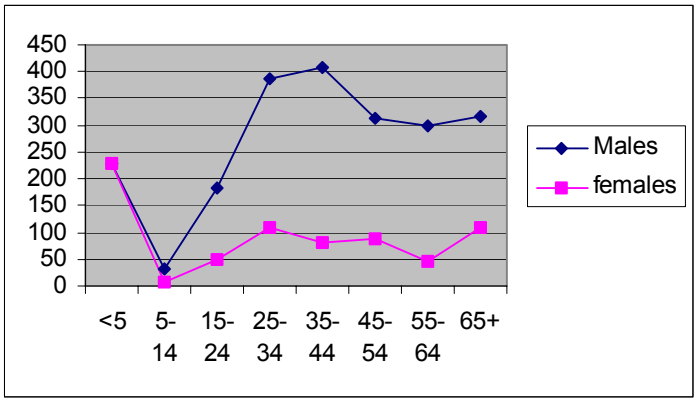
Because the proportion of undetermined causes has reached its lowest point in 2001, only this year has been taken into account to describe the causes of deaths. Mortality from non natural causes are concentrated among males in the active age groups. Figure 4 shows the expected number of non natural deaths which occurred in 2001 among males and females of different age groups. Figure 5 shows the non natural death rate per 100,000 by age and gender in KZN in 2001, and Figure 6 shows the proportion of total mortality due to injuries by age and gender in KZN in 2001. While under 15 years of age, males and females experienced a similar pattern of mortality from injuries, after 15 years of age there was a sharp increase in the non natural mortality among males, which peacked between the age of 25 and 34. Deaths among females increased with a similar age pattern but at a much lower rate.

Figure 4 Number of non natural deaths, KZN, 2001



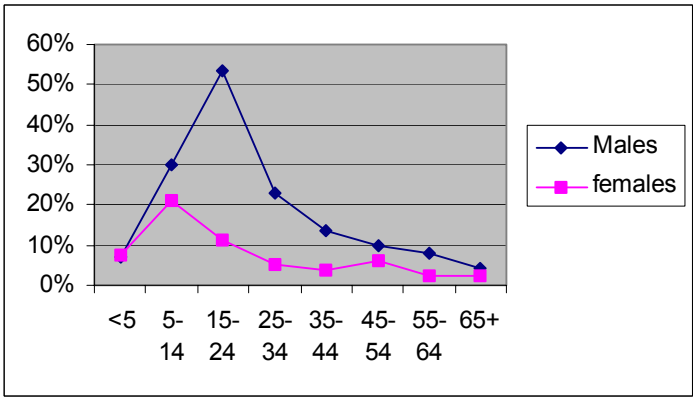
Source : analysis of vital statistics

Figure 5 Mortality rates from injuries per 100,000, KZN, 2001



Source : analysis of vital statistics

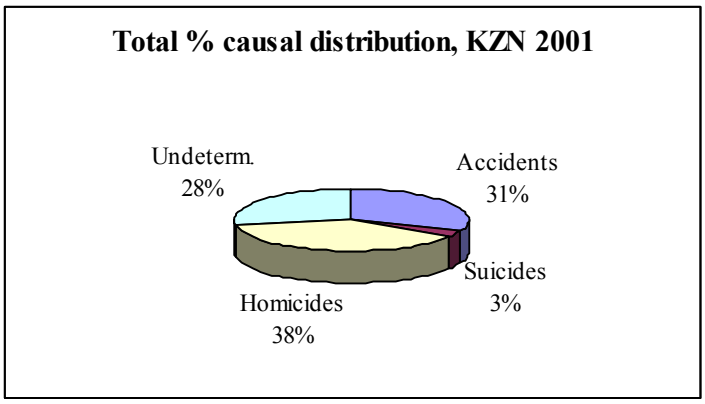
Figure 6 Proportional mortality due to injuries, KZN, 2001

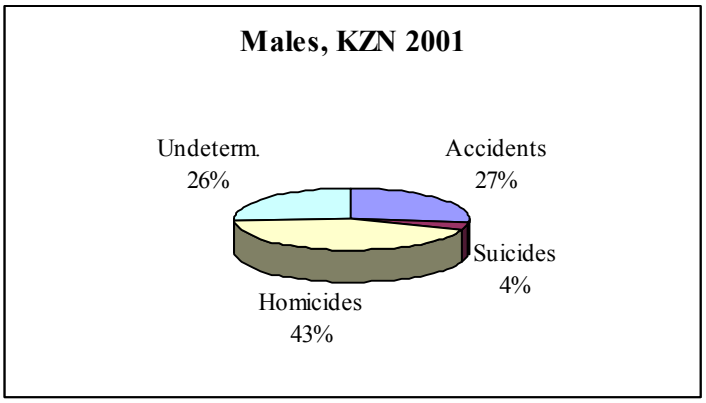


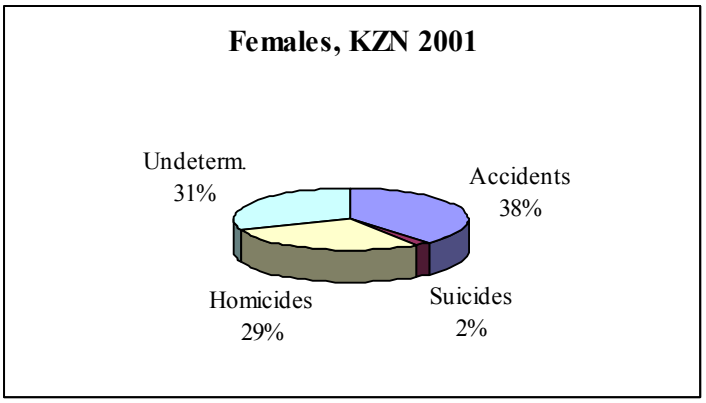
Source : analysis of vital statistics

Homicides were the first cause of non natural deaths, especially among males. Figures 7 through 9 show that the first cause of non natural mortality was homicide, followed by accidents, undetermined causes and suicides. Among males, there was a higher proportion of non natural deaths due to homicides and suicides, while females had a higher proportion of non natural deaths due to accidents. If all undetermined deaths were correctly assigned, the likely proportion for accidents, suicides and homicide will probably be in the order of 40%, 10% and 50% respectively. Figure 10 shows that the proportion of deaths from accidents was high under the age of 5, it declined between 15 and 59 years of age and it rose again afterwards. The proportion of deaths from homicides exceeded that due to accidents between the age of 15 and 59 and declined afterwards. Suicides were more common between 15 and 44 years of age.

Figures 7-9 Mortality by cause according to death certificates, KZN, 2001

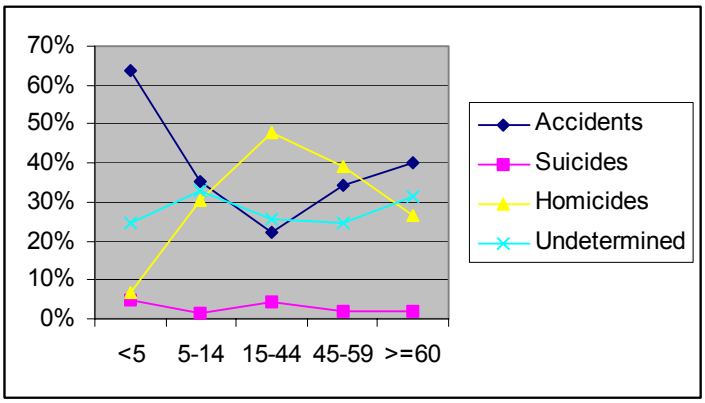






Source: Analysis based on death certificates

Figure 10 Mortality by age, according to death certificates, KZN, 2001

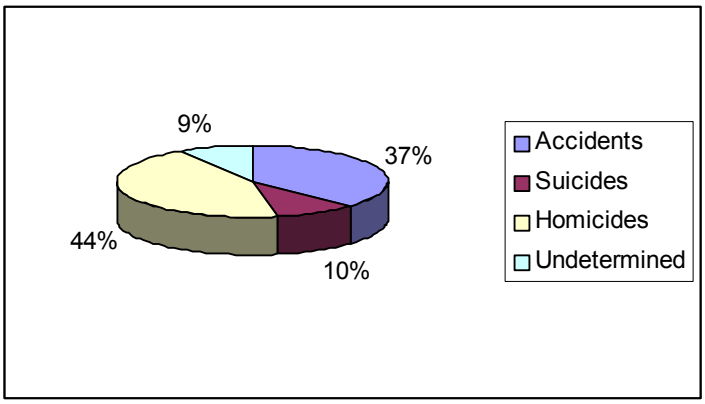


Source: Analysis based on death certificates

Mortality from NIMMS

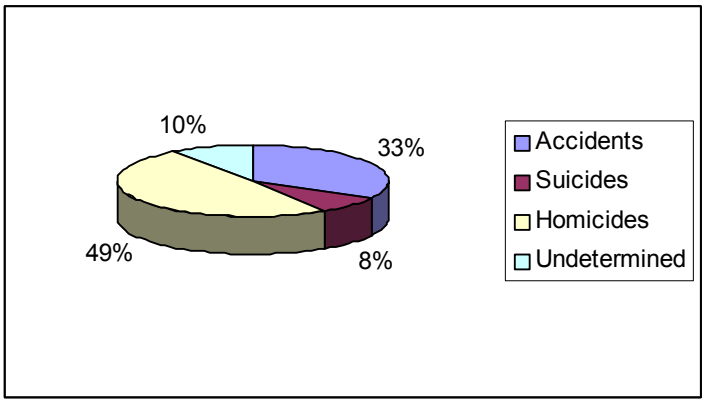
NIMMS reported a similar pattern of non natural mortality for 2001. It has to be noted that the statistics from NIMMS is not completely comparable with the mortality from vital statistics. The data from NIMMS cover about one third of non natural deaths and they are more representative of the urban areas. Nevertheless, because of its higher accuracy, NIMMS provides critical information on the distribution of injuries by cause. Because, the proportion of undetermined deaths in NIMMS was lower, the proportion of accidents, suicides and homicides was higher (Figure 11) compared with the data from Statistics SA. In KZN the proportion of non natural mortality due to homicides was higher and that due to accidents and suicides was lower compared with the national level, while the undetermined causes were around 10% (Figure 12).

Figure 11 Mortality by cause according to NIMMS, South Africa, 2001



Source: NIMMS 2001

Figure 12 Mortality by cause according to NIMMS, KZN, 2001



Source: NIMMS 2001

The main causes of non natural deaths reported by NIMMS for 2001 varied across age, gender and population groups. Firearms caused most non natural deaths, followed by sharp objects, traffic accidents, blunt objects, burns, hanging, poisoning, drowning, falls, railway accidents, strangulation, medical procedures and other accidents. Males accounted for 80% of non natural deaths and were more frequently dying from firearms, sharp and blunt objects, hanging, drivers' and railways' accidents. Females were more frequently dying as a consequence of pedestrians' accidents and burns. Africans and Coloured were dying proportionately more from homicides, while transport related accidents were the first cause of non natural death among Whites and Asians. KZN and Western Cape, had the highest proportion of non natural deaths due to homicide.

More than 70% of non natural deaths was concentrated between 15 and 44 years of age. In terms of causes of death by age, burns and drowning were more frequent under 5 years of age, pedestrians' accidents were the most common non natural deaths between 5 and 14 years of age, firearms and sharp objects caused most of the non natural deaths that occurred after the age of 15, suicides were more frequent between 20 and 34 years of age and accidents increased again after the age of 65.

The means of homicides had a certain variation. The first modality was firearms, which caused half of the homicides and was mainly concentrated between the age of 20 and 24. Sharp and blunt objects caused about 40% of homicides, while a minority was caused by strangulation and other means, which were concentrated among women and older people. Most homicides occurred within the home, with a higher frequency on weekends and with a peack between 8 pm and 11 pm.

Traffic accidents were higher in certain time periods. The most frequent victims of traffic accidents were pedestrians followed by passengers and drivers. Traffic accidents were more frequent in March, June, October and November; during weekends and between 5 pm and 10 pm. Blood alcohol concentration, which was available for only about one third of cases, was higher among victims of motor vehicle accidents.

The means of suicides varied across age, gender and ethnic group. Hanging was the most common modality of suicide among men while poisoning was the first cause of suicide among women. Hanging was higher among Africans, Coloured and Asians than among Whites who were using firearms more frequently. In terms of age, hanging was more frequent under 55 years and firearms predominated afterwards.

Mortality from other data sources

In South Africa, as in other countries, suicides follow a seasonal pattern. Seasonal trends in suicides are related to bioclimatic and sociodemographic factors, with the first ones being related to annual variation in biochemical processes influencing vulnerability to stress. The sociodemographic factors are related to seasonal changes in social activities such as the beginning of the academic year and the holiday season. These periods are associated with higher levels of stress and social pressure especially in some population groups and in individulas who are more isolated.

Flisher et al. found that the incidence of suicides in South Africa peacks in September, October and January, especially for groups which are less urbanized and have a lower standard of living. The peak recorded in South Africa in January is a reverse of the peak recorded in the northern hemisphere in September. Both peaks correspond to the beginning of the academic year, which starts in January in South Africa and in September in the northern hemisphere. The higher frequency of suicides during this period has been explained by a higher level of social interacion and stress. There was also a peack in December, mainly affecting Coloured and Africans, which was interpreted as related to the Christmas season. It has been suggested that during the holiday season less affluent socioeconomic groups experience more financial hardship and are more conscious of their poorer socio economic status relative to Whites and Indians.

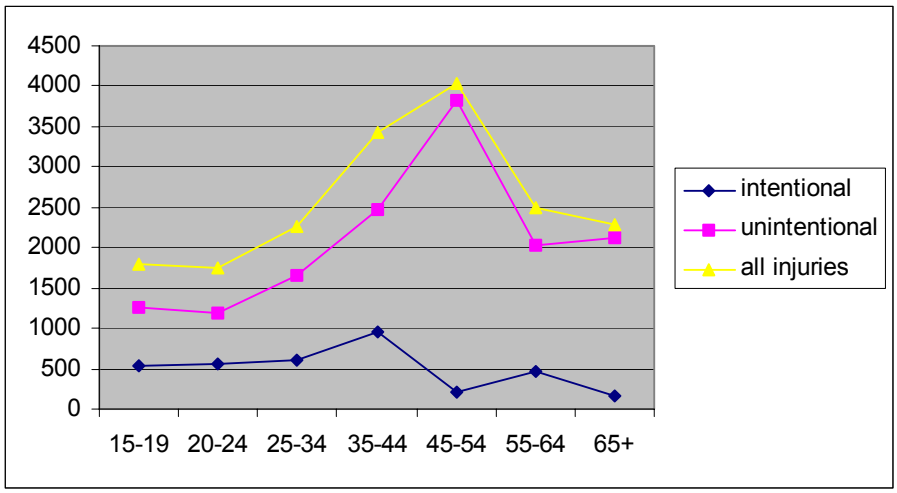
Suicides are more frequent among males. Wassenaar D.R. et al. carried out a study based on the non natural deaths reported in the Magisterial Inquest Register in Pietermaritzburg. They estimated that the annual suicide rates between 1982 and 1996 was about 14 per 100,000 and the highest rates was between 25-34 years of age. The rates were similar across ethnic groups with Whites having slightly higher rates. The rates among males were almost six times higher than among females in all ethnic groups.

The ratio between attempted suicides and deaths from suicides may be in the order of 30-40. The 1998 DHS estimated for South Africa an annual rate of 492 per 100,000 for attempted suicides. If these national rates of attempted suicides and the Pietermaritzburg rates of suicides mentioned above were extrapolated to the whole KZN, the rates of attempted suicides could be about 30-40 times higher than the suicide rates. Although this generalization is an oversimplification, these rates are not very far from what estimated by WHO, according to which there are between 10-40 attempted suicides per each death from suicide world wide.

Morbidity due to injuries

Figure 13 shows the national monthly incidence per 100,000 population for non fatal injuries, measured by the 1998 DHS in South Africa. The annual incidence of non intentional injuries increased with age, peacking at 45-54 years of age, and declining afterwards. The incidence of intentional injuries peacked between 35 and 44 years of age and declined afterwards. Most injuries among children were due to burns, falls, traffic accidents; but about 19% were due to violence. Seventy percent of accidents among adolescents were the result of burns, falls and motor vehicle accidents; while 30% of injuries were due to assault or attempted suicides. Among adults, about one third of *non fatal* injuries were due to violence and attempted suicide. The annual incidence for ***all*** *non fatal* injuries for adults 15 years and older in South Africa was 14,796 per 100,000 per year, equivalent to about one every seven adults per year requiring medical attention for an injury. The annual incidence for *non fatal* **accidents** among adults was 11,592 per 100,000; or about one every nine adults, with the highest single most frequent cause being accident at work, followed by traffic and sport injuries. The annual incidence for *non fatal* **intentional injuries** was 3,204 per 100,000; equivalent to one every 31 adults having an assault or attempting suicide each year.

Figure 13 Incidence of injuries per 100,000 in South Africa in 1998



Source: 1998 DHS

The 1998 DHS collected information on the work related injuries. By interviewing the household members who had worked in the previous 12 months, the 1998 DHS estimated that in KZN 7.6% of male workers and 2.3% of female workers had a work related injury in the previous 12 months. Work related injuries included falls, motor vehicle accidents, contact with machines, cutting by sharp objects, poisoning, fire and drowning. Most injuries occured between 45 and 54 years of age and were related to sprains, dislocations, fractures and lacerations. These rates suggest a high burden of temporary or permanent disabilities and absenteism from work, most of which could be prevented. These rates may be overestimated because the people interviewed at home were more likely to have had an injury compared with the general workforce.

Burden of injuries

According to the South Africa (SA) Burden of Disease (BOD) study, intentional and unintentional injuries are respectively the fifth and the sixth cause of death, with a predominance of male deaths. Because deaths from injuries are more frequent among the younger age groups, the number of years of life lost because of premature mortality is substantial. According to the SA BOD, in the year 2000, injuries accounted for 22% and 8% of the total number of years of life lost due to premature mortality respectively among men and women. The high proportion of disabilities among survivers contributed further to this burden. The SA BOD study estimated that when the years of life lost because of premature mortality are added to the years lost because of disability, unintentional and intentional injuries rank respectively as third and fourth in number of Disability Adjusted Life Years (DALY). This suggests that mortality alone is insufficient to capture the burden of injuries.

Discussion

The reliability of the mortality statistics on injuries improved considerably between 1997 and 2001 when there was a steady decline in the proportion of undetermined causes. The major change between 1997 and 2001 was an improvement in the accuracy of reporting, with a subsequent increase in the proportion of deaths correctly assigned to homicides and suicides. The increase in the number of homicides and suicides that were recorded between 1997 and 2001 were the result of a reassignment of cases that were previously classified as undetermined causes. If the quality of recording will continue to improve, the number of non natural deaths that will be assigned to homicides and suicides will increase further. Although any trends in the numbers of accidents, suicides and homicides between 1997 and 2001 should be interpreted with caution, there is substantial evidence to suggest that the distribution of various causes did not change substantially between 1997 and 2001.

Deaths are concentrated among males in the economically active age group and the first cause is homicide. The most likely proportional distribution of deaths from injuries by cause in KZN are 50% homicides, 40% accidents and 10% suicides. In 2001, firearms were the first cause of non natural deaths, followed by sharp objects, pedestrians' accidents, blunt objects, other traffic accidents, burns, hanging, poisoning, drowning, falls, railway accidents, asfixiation by gas, strangulation and other accidents. Transport accidents caused most of the deaths from injuries between 5 and 14 years of age, while homicides increased after the age 15 to reach a peak between 25 and 34 years of age, when it caused nearly half of all deaths from injuries. The holiday season, the weekends and the evening hours are critical periods for homicides and the consumption of alcohol is partially related to the occurrence of crimes and accidents.

The above statistics can provide suggestions on preventive strategies, some of which are more cost effective or easier to implement than others. For example, one of the most frequent preventable injuries among infants is accidental paraffin poisoning. This could be partially prevented through the provision of 'child resistant' containers, which have specially designed cups which are difficult to open. In a study carried out in the early 1990s in the area of the Cape Peninsula, Blanche de Wet et al. estimated that the cost of treating children between 12 and 36 months who ingested paraffin was equivalent to the cost of providing almost all households in the area of residence of these children with 'child resistant' paraffin containers. A law enforcing the adoption of such containers could reduce morbidity and mortality due to paraffin ingestion. In another study conducted in the early 1990s, Krug A. et al. found that the distribution of 'child resistant' containers reduced the incidence of paraffin ingestion among children by more than half. A certain proportion of children can still remain victims of accidental poisoning even if 'child resistant conntainers' are adopted by the companies selling paraffin. In fact, 'child resistant' containers can be left opened in the households and paraffin can continue to be sold by the informal sector in other types of containers. This is an example of how even the most potentially cost-effective interventions depend on many variables including public education and enforcement of regulations.

Traffic accidents play an important role in the burden of non natural deaths and preventive strategies include the control of alcohol consumption, the enforcement of

speed limits and other safety measures. The fact that the most frequent victims were pedestrians suggests that there is insufficient enforcement of traffic regulations. The reports from NIMMS have suggested several recommendations including: increasing the separation between pedestrian walking areas and traffic lanes, improving the visibility of pedestrians and traffic signs, strengthening the restriction of alcohol consumption, widening the use of traffic calming measures (i.e. road bumps) for areas with a high concentration of children, such as around schools and playgrounds; and enforcing the compliance with safe driving and vehicle standards.

Suicide prevention should be based on the identification of risk factors and on the implementation of intervention strategies to prevent them. Primary prevention includes education of health providers in identifying events that are more associated with life crisis and in targeting people who are more sensitive to responde with a suicidal behaviour. However, the scientific knowledge on the efficacy and cost effectiveness of interventions to prevent suicides is scarce.

Other strategies require a conserted effort on multiple factors such as in the case of homicides which are the major contributor of non natural deaths. Besides a stricter control of firearms, homicides need to be tackled by acting on socioeconomc, cultural and other intersectoral factors that are at the roots of interpersonal violence. These are not easy to tackle and take a long time to change because they are deeply rooted in hystorical and cultural factors.

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