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**A DESCRIPTIVE ANALYSIS OF PATIENT MORTALITY IN**  
**THE EMERGENCY CENTRE OF A REGIONAL HOSPITAL IN**  
**THE WESTERN CAPE**

**MMed Emergency Medicine**  
**University of Cape Town**  
**2010**

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**DECLARATION**

I confirm that the dissertation *A Descriptive Analysis of Patient Mortality in the Emergency Centre of a Regional Hospital in the Western Cape* is entirely my own work.

I confirm that I hold the degree MBChB from the University of Cape Town.

This dissertation is being submitted for the degree of Master of Medicine (Emergency Medicine).

I confirm that I have not submitted this dissertation for any other degree, diploma or professional qualification.

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Date: 6 MAY 2010.....

University of Cape Town

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University of Cape Town

## INDEX

GLOSSARY	Page i
LIST OF FIGURES	Page ii
LIST OF TABLES	Page iii
ABSTRACT	Page iv
CONTENTS:	
○ <u>CHAPTER 1</u> : INTRODUCTION	Page 1
○ <u>CHAPTER 2</u> : AIM	Page 14
○ <u>CHAPTER 3</u> : LITERATURE REVIEW	Page 15
○ <u>CHAPTER 4</u> : METHODOLOGY	Page 16
DATABASE	
DATA ANALYSIS	
ETHICAL APPROVAL	
OUTCOMES	
○ <u>CHAPTER 5</u> : RESULTS	Page 20
○ <u>CHAPTER 6</u> : DISCUSSION	Page 36
STUDY LIMITATIONS	
STRENGTHS	
○ <u>CHAPTER 7</u> : CONCLUSION	Page 48

○ CHAPTER 8: RECOMMENDATIONS

Page 49

REFERENCES

Page 51

University of Cape Town

## GLOSSARY

<b>BoD</b>	Burden of Disease
<b>BMI</b>	Body Mass Index
<b>CANSA</b>	Cancer Association South Africa
<b>CoD</b>	Cause of Death
<b>DOA</b>	Dead on Arrival
<b>EC</b>	Emergency Centre
<b>GIT</b>	Gastrointestinal
<b>HIV</b>	Human Immunodeficiency Virus
<b>MRC</b>	Medical Research Council
<b>NIMMS</b>	National Injury Mortality Surveillance System
<b>PMTCT</b>	Prevention of Mother-to-Child Transmission
<b>SA CRA</b>	South African Comparative Risk Assessment Study
<b>SATS</b>	South African Triage Scale
<b>STATS SA</b>	Statistics South Africa
<b>STI</b>	Sexually Transmitted Infections
<b>TEWS</b>	Triage Early Warning Score
<b>TB</b>	Tuberculosis
<b>UCT</b>	University of Cape Town
<b>WHO</b>	World Health Organisation

## LIST OF FIGURES

- Figure 1:** SATS Triage Early Warning Score
- Figure 2:** SATS Discriminator List
- Figure 3:** Distribution of Deaths by Age and Gender
- Figure 4:** Time of Presentation
- Figure 5:** Distribution of Deaths by Main Causes
- Figure 6:** Underlying Cause of Death
- Figure 7:** Underlying Natural Causes of Death in Males and Females
- Figure 8:** Underlying Non-Natural Causes of Death by Gender
- Figure 9:** Underlying Non-Natural Causes of Death
- Figure 10:** STATS SA Leading Underlying Causes of Death in 2007

## LIST OF TABLES

- Table 1:** Number of Deaths by Age
- Table 2:** Distribution of Deaths by Age and Gender
- Table 3:** Description of Under-Triaged Patients
- Table 4:** Time to See the Emergency Physician
- Table 5:** Number of Reported Cause of Deaths
- Table 6:** Broad Cause of Death Groups
- Table 7:** The 10 Leading Causes of Death
- Table 8:** Broad Cause of Death Groups by Gender
- Table 9:** Leading Causes of Death in Males and Females
- Table 10:** Causes of Death by Age Groups

## **ABSTRACT**

**Objectives:** To describe the demographics and underlying causes of death in patients presenting to a rural regional hospital Emergency Centre (EC) in the Western Cape. The secondary aim is to collate information regarding the triage of this sample of patients.

**Design:** A retrospective cross-sectional descriptive study of patients presenting to Paarl Provincial Hospital EC from 1<sup>st</sup> January to 31<sup>st</sup> May 2008.

**Setting:** Paarl Provincial Hospital Emergency Centre, Paarl, South Africa.

**Sample:** All patients who died in the EC or who were declared dead on arrival were included.

**Results:** Data on 108 patients showed the leading causes of death to reflect the quadruple burden of disease. The causes of death include the pre-transitional diseases and conditions related to poverty, the emerging chronic diseases, injuries, and HIV/AIDS. The pre-transitional conditions encompass lower respiratory infections, tuberculosis (TB) and diarrhoea. For the non-communicable diseases, strokes and cardiac disease are the main contributors.

**Conclusions:** Analysis of the data points to emerging health issues and vulnerable groups who can be identified and targeted for interventions. In addition, it has highlighted the need for more reliable and accurate cause-of-death statistics, and for improving completeness and quality of death certification. The study has also provided information regarding triage practices, identifying the need for continued training of doctors and nurses using the South African Triage Scale.

## **CHAPTER 1: INTRODUCTION**

*"Mortality data are some of the best sources of information about the health of living communities. They provide a snapshot of current health problems, suggest persistent patterns of risk in specific communities, and show trends in specific causes of death over time. Many causes of death are preventable or treatable and, therefore, warrant the attention of public health prevention efforts. Furthermore, because mortality data allow us to identify leading causes of premature death, they provide a valuable benchmark for evaluating progress in increasing years of healthy life. As such, they are important indicators of where state and local prevention efforts should be placed in building healthy communities".<sup>1</sup>*

Mortality statistics are of crucial importance to epidemiological research, being used in both epidemiology and public health as an indicator of health status. They provide a tool to evaluate health programmes, and in population studies help to define trends and spatial differences, comparing social, economic and health conditions in different population groups. They provide a baseline indicator from which health profiles can be constructed and health policies formulated.

Mortality statistics are indicative of the level of human development, and as such, are included in human development indices and in the multi-dimensional approach to poverty. In South Africa reducing poverty is critical in reducing risk factors for poor health such as undernutrition, unsafe water and lack of sanitation.<sup>2</sup> Poverty reduction strategies are complex and need careful monitoring and evaluation, inclusive of their impact on health.

Longevity depends on the physical and social conditions in which we live, many of which are influenced by economic policy - for example, the availability and accessibility of health care, and the provision of social services such as basic education and sanitation. The statistics on mortality draw our attention to all of these policy issues, guiding not only prioritisation of health services, health and community programmes and research, but also guiding the priorities in other sectors. In particular, sub-population data are necessary to identify and monitor inequalities in health status. South African health policy is directed from a national level, yet it is

the provincial and local government that has to respond to the specific needs of their communities. An essential element for public health planning at these levels is reliable mortality statistics.

In ECs, understanding local mortality statistics helps to gain insight into the health status of the community: such data provide a valuable tool to evaluate and monitor the health status of a whole community and respond to their health needs. Mortality data may aid in strategic planning, monitoring, and implementation of health programmes with the objective of improving public health. Adequately utilised, the potential benefit is to increase life expectancy, prevent or reduce premature mortality, and improve the overall quality of life of the community served.

In addition, in the absence of resources for disease surveillance and health surveys, mortality statistics can also be used as a proxy for morbidity statistics. Statistics are typically used to measure the level of mortality, the burden of disease, and to assess the quality of health and medical care.<sup>3</sup>

In the context of ECs, the quality of medical care delivered will ultimately influence morbidity and mortality. Quality of care in general is dependant on many factors, including accessibility of emergency services to patients, infrastructure, resources of the facility, staffing numbers, and level of staff expertise and training.<sup>4, 5</sup> Specific to Emergency care, and impacting on patient morbidity and mortality, is the importance of a functional patient triage system. Triage is the process of sorting patients according to the type and seriousness of their injury or problem. The aim is to render timely emergency care to those in the most need by maximizing the efficient use of available resources. Triage systems aim to minimize the risk to the patient, and reduce patient morbidity and mortality. This is particularly relevant in the South African environment with limited resources, understaffed facilities, long waiting times and a high burden of disease<sup>6, 7</sup>

In South Africa, the objective to reduce mortality is reflected in the Government Programme of Action.<sup>8</sup> This programme identifies key areas of intervention and focuses on research and programmes to reduce mortality from HIV, malaria, TB,

non-communicable diseases such as diabetes, asthma and hypertension, and unnatural causes of death.

South Africa is undergoing significant changes in health and it is important to monitor this for planning purposes. Inequalities are still of particular importance given the legacy of the South African Apartheid history. This is of particular relevance to rural communities, where poverty and unemployment are high and access to medical care limited.

In common with most developing countries, cause of death statistics in South Africa suffer from misclassification of causes and under-registration of deaths:<sup>9, 10</sup>

- misclassification of causes of death as a result of both system problems and poor certification practice, resulting in
  - incorrect cause of death reported
  - ill-defined causes noted
  - other content omissions
- under- registration of deaths, particularly in rural areas and amongst children, with subsequent under-estimation of overall mortality statistics and certain causes of death.

In addition, the system does not yet routinely provide cause of death statistics that can be used by provinces. A recent review of the quality of national cause of death statistics identified the need for improvement in a large proportion of countries that submit data to WHO, as well as the high number of countries in sub-Saharan Africa that do not submit any data.<sup>11</sup> The general lack of interest in routine health information systems and statistics was recently identified, including the under-researched and under-funded nature of cause of death statistics.<sup>12</sup>

It must be acknowledged that efforts to improve cause of death statistics in South Africa have been under way since 1994. Prior to this, data on the number and the underlying cause of deaths was of limited usefulness. This was mainly because many South Africans lived in the so-called independent homelands or in poorly serviced rural areas where the infrastructure to register deaths was not in place.<sup>13</sup> However, current health information systems are still evolving and not yet able to

provide timeous, accurate, comprehensive information on the trends in health status and the determinants.<sup>14</sup>

There is a growing recognition of the importance of health information systems and the integral role mortality statistics plays in the need for monitoring public health, allocating resources and developing public health policy.<sup>15,16</sup> A sentinel Human Immunodeficiency Virus (HIV) surveillance system,<sup>17</sup> the National Injury Mortality Surveillance System (NIMSS),<sup>18</sup> the Perinatal Mortality Surveillance,<sup>19</sup> the Confidential Maternal Mortality Surveillance<sup>20</sup> and the National Cancer Registry<sup>21</sup> have been established to complement the routine disease notification system and provide detailed information for specific conditions.

### SOUTH AFRICAN MORTALITY STATISTICS

The systematic collection of mortality data in South Africa is a recent phenomenon. The shortage of data on adult mortality largely reflected the inadequacy of vital registration systems,<sup>9</sup> combined with the technical limitations of methods used to investigate the subject retrospectively.<sup>22</sup> The importance of mortality and cause of death statistics was realised by the post-apartheid government, and the collection of reliable mortality data prioritised. Initiatives taken to improve the collection and quality of data resulted in a noted improvement of the death registration system in the country over the last decade.<sup>23,24</sup> However, despite dramatic improvements, under-registration and the misclassification of causes still make it difficult to accurately interpret official death statistics.<sup>25, 26</sup> Information that is available on mortality and health is often fragmentary and sometimes inconsistent.

Various studies have reported on mortality and cause of death statistics in South Africa.<sup>27-29</sup> The national statistical office, Statistics South Africa (Stats SA) is the government body that has the legal mandate to collect, process and publish official statistics based on deaths reported to the Department of Home Affairs.

In 2001, Stats SA published the *Advance release of recorded causes of death, 1997–2000*.<sup>30</sup> These statistics were based on information accessed from the population register. In 2002, Stats SA published *Causes of death in South Africa 1997–2001: Advance release of recorded causes of death*,<sup>31</sup> based on a 12%

sample of death notification forms for the period 1997 to 2001. This statistical release highlighted a changing trend of mortality in the country.

Stats SA continued to address the backlog in collection of statistics from death notification forms received from the Department of Home Affairs with the subsequent release of *Mortality and causes of death in South Africa 1997 – 2003*.<sup>32</sup>

Approximately 3 million death notification forms were coded in this study and death rates were analysed by age, sex, year of death and cause of death. It was reported that the annual number of deaths in South Africa increased by 57%, from 318 287 in 1997 to 499 268 in 2003. This was partly due to population growth (which accounted for about 10%) and increased notification.

In 2009 Stats SA released *Mortality and causes of death in South Africa: Findings from Death Notifications*.<sup>33</sup> This release presented information on mortality and causes of death in South Africa, based on all death notification forms received from the Department of Home Affairs for deaths that occurred in 2007. It outlined trends and differentials in mortality from 1997 to 2007 and provided patterns of causes of death in South Africa.

It was noted that despite improvements in death registrations in South Africa, especially with the introduction of the new death notification form in 1998, the quality of information collected and overall coverage was incomplete, with underestimation of figures. South Africa's Statistician General, Pali Lehola, stated that "*despite these limitations, the captured data represented significant progression in understanding mortality trends and developing accurate mortality statistics needed for the implementation of health programmes*".

Key findings from the study were:

- the majority of deaths were due to natural causes, and specifically, most deaths were due to certain infectious and parasitic diseases.
- age patterns at death had remained steady between 2003 and 2007, with most deaths observed at ages 30–34. Overall, there were slightly more male than female deaths

- death rates rose for every 5 year age group for each sex (except for males aged 15-19), more than trebling for females aged 20-39 and more than doubling for males aged 30-44
- the leading causes of death were TB, influenza, pneumonia, intestinal infectious diseases and cerebrovascular disease
- HIV disease was the ninth leading cause of death, accounting for about 2.2% of all deaths in 2007
- intestinal infectious diseases were the leading causes of death for those aged younger than fifteen years; TB leading among those aged 15–64 and cerebrovascular diseases in those 65 years and older
- for children under 4 years of age, malnutrition was among the leading causes of death, with numbers increasing steadily over the period assessed. Other causes of death included gastrointestinal infectious diseases, influenza and pneumonia
- there had been a decline in the number and percentage of deaths due to unnatural causes, with the number of homicides declining, but still remaining very high, especially for males 35-39

The release of this data provided, for the first time, mortality information and cause of death detail for district municipalities. The five leading causes of natural death in the Western Cape were: TB, ischaemic heart disease, diabetes mellitus, cerebrovascular disease and chronic lower respiratory disease. Males aged 15–19 years had the highest percentage of deaths due to non-natural causes. The majority of these deaths were associated with transport accidents and assault.

Statistics SA has reported national vital statistics up to 2007<sup>33</sup> and has provided information on the distribution of deaths by province. However, information at district and sub-district levels has not been readily available, making it difficult for local government and health authorities to identify local health problems, plan health service priorities and identify the specific health needs of their community.

## SOUTH AFRICAN BURDEN OF DISEASE

Burden of Disease (BoD) analysis provides a comprehensive and comparable assessment of mortality and loss of health due to diseases, injuries and risk factors. It is a specialised area of research that quantifies ill-health by measuring and analysing the extent and causes of health problems. This research has contributed to BoD information for South Africa and assisted policy makers in responding to the health needs of the nation. The initial SA Burden of Disease Study 2000<sup>34</sup> applied the burden of disease approach developed by the WHO<sup>35</sup>, using available information and providing initial estimates of disease burden as well as provincial mortality estimates.

The SA BoD study measured the number of deaths due to injury and various diseases. It also looked at disability due to HIV /AIDS, other infectious, childhood and maternal diseases, non-communicable diseases and injuries. It provided interventions to promote health; as well as interventions to prevent, treat or ameliorate disease. The report reflected the changing pattern of mortality in South Africa. It confirmed the health transition pattern reflecting no longer a triple burden of disease, but rather a quadruple burden of disease, specifically poverty-related diseases, emerging chronic diseases, injuries and HIV/AIDS.

Following on the BoD project, further research was performed at local levels. The Western Cape BOD Reduction Project identified strengthening mortality surveillance at a sub-provincial level as essential for building the district health system.<sup>36</sup> In an effort to provide timely statistics for use by the health districts of the province, the local mortality system used in Cape Town was extended to the Boland Overberg Region, and then later to the rest of the province. A mortality report for the Boland Overberg Region for 2004 was produced in 2005,<sup>37</sup> and for 2004 – 2005 in 2006.<sup>38</sup> Thus, for the first time, a profile of the causes of death experienced in the health sub districts of the Boland Overberg health region was available. Similar to national experience,<sup>34</sup> a substantial impact of HIV/AIDS was observed, as well as a combination of degenerative chronic diseases, infectious diseases, and child mortality. A marked injury burden was also observed in these districts.

As part of the Western Cape provincial project to reduce the BoD, efforts were made to make the information more useful for monitoring local health programmes, as well as identifying new priorities for public health planning.<sup>39</sup>

### SOUTH AFRICAN COMPARITIVE RISK ASSESSMENT STUDY

The World Health Report of 2002 presented findings from a global review of risk factors and identified 10 risk factors that accounted for more than a third of all the deaths worldwide.<sup>40</sup> It urged governments, especially health policy makers, to formulate risk-prevention policies, including more support for scientific research, improved surveillance systems and access to global information.

Using WHO methodology from the 2002 World Health Report: Reducing Risk, Promoting Healthy Life, and local data on the prevalence of risk factors, the Medical Research Council (MRC) Burden of Disease Research Unit and its collaborators published the first South African Comparative Risk Factor Assessment (SA CRA) in 2007.<sup>2</sup> It identified the underlying causes of premature mortality and morbidity experienced in South Africa, quantifying the contribution of major risk factors to the burden of disease. It suggested interventions that could impact upon these risk factors, thereby mitigating the BoD they cause.

Unsafe sex, interpersonal violence and alcohol misuse are the three leading risk factor causes of BoD in South Africa. Others among the ten leading causes of death are high blood pressure, excess body weight (high BMI), under nutrition, high cholesterol and tobacco smoking.

The risk factor profile overall highlighted two distinct types of risk factors: those usually associated with more affluent lifestyles, such as tobacco consumption, diabetes, high BMI and high cholesterol, as well as those related to poverty and under-development, such as unsafe water; sanitation and hygiene; undernutrition and indoor air pollution from solid fuels. The high ranking of interpersonal violence and alcohol misuse as risk factors are also likely to be associated with the extreme inequalities in South African society.<sup>41, 42</sup>

From this report we can recognise that many of our health problems are socially and culturally rooted, that health is significantly influenced by socio-economic status, cultural roots, education, gender, and physical infrastructure. Poverty, complex social factors and behaviours, crime, violence, and gender inequalities play a major role in exacerbating the health problems experienced. Given the quadruple burden of disease experienced in South Africa, these risk factors are clearly all contributing to the ill health of the nation and need to be reduced in order to improve health.

### THE SOUTH AFRICAN TRIAGE SCALE (SATS)

The Cape Triage Score, (now the South African Triage Scale), was launched in the Western Cape in January 2006.<sup>43,44</sup> It is a triage system that was derived by the Cape Triage Group (CTG) for use in ECs throughout South Africa. As discussed previously, in the South African environment with limited resources, there was a definite need for implementation of a triage system.

The triage tool was designed to be locally and nationally applicable allowing effective, rapid and efficient triaging of patients in the EC setting. Its derivation has involved both expert opinion and in-hospital prospective studies.<sup>43, 45</sup>

Three versions have been developed (for the adult, child and infant) based on a prospective study of 22 500 patients in the public health sector, and 2 000 patients in private hospitals.<sup>46,47</sup> It has been shown to be a reliable triage tool,<sup>48</sup> to dramatically improve waiting times, identify the most ill patients, reduce mortality, predict death and aid in resource usage.<sup>45,49</sup>

There are two components to the triage tool – a physiological scoring system and a series of discriminators. The physiological scoring system, the Triage Early Warning System (TEWS), forms the core aspect of the triage. **Figure 1** shows the adult TEWS.

over 12 years / taller than 150cm		ADULT TRIAGE SCORE						© South African Triage Group 2008	
	3	2	1	0	1	2	3		
Mobility				Walking	With Help	Stretcher / Immobile		Mobility	
RR		less than 9		9-14	15-20	21-29	more than 29	RR	
HR		less than 41	41-50	51-100	101-110	111-129	more than 129	HR	
SBP	less than 71	71-80	81-100	101-199		more than 199		SBP	
Temp		Feels cold OR Less than 35		Feels normal OR 35-38.4		Feels hot OR More than 38.4		Temp	
AVPU		Con fused		<u>A</u> lert	Reacts to <u>V</u> oice	Reacts to <u>P</u> ain	<u>U</u> nresponsive	AVPU	
Trauma				No	Yes			Trauma	

**Figure 1** SATS Triage Early Warning Score (TEWS) (RR = respiratory rate, HR = heart rate, SBP = systolic blood pressure, AVPU = **A**lert, **V**erbal, **P**ain, **U**nconscious)

The parameters of the TEWS are a basic physiological score (respiratory rate, heart rate, systolic blood pressure, temperature), and a simplified score measuring level of consciousness and mobility. It is a user-friendly system, requiring minimal equipment, enabling early accurate assessment of the emergency patient.

The second part of the triage tool is the discriminator list, as shown in **figure 2**.

Colour	RED	ORANGE	YELLOW	GREEN	BLUE	
<b>TEWS</b>	<b>7 or more</b>	<b>5-6</b>	<b>3-4</b>	<b>0-2</b>	<b>DEAD</b>	
Target time to treat	Immediate	less than 10 mins	less than 60 mins	less than 240 mins		
Mechanism of injury		High energy transfer				
Presentation		Shortness of breath - acute			ALL OTHER PATIENTS	
		Coughing blood				
		Chest pain				
		Haemorrhage - uncontrolled	Haemorrhage - controlled			
	Seizure - current	Seizure - post ictal				
		Focal neurology - acute				
		Level of consciousness reduced				
		Psychosis / Aggression				
		Threatened limb				
		Dislocation - other joint	Dislocation - finger or toe			
		Fracture - compound	Fracture - closed			
	Burn - face / inhalation		Burn over 20%	Burn - other		
			Burn - electrical			
			Burn - circumferential			
			Burn - chemical			
	Poisoning / Overdose	Abdominal pain				
Hypoglycaemia - glucose less than 3	Diabetic - glucose over 11 & ketonuria	Diabetic - glucose over 17 (no ketonuria)				
	Vomiting - fresh blood	Vomiting - persistent				
	Pregnancy & abdominal trauma or pain	Pregnancy & trauma				
		Pregnancy & PV bleed				
Pain		Severe	Moderate	Mild		
<b>Senior Healthcare Professional's Discretion</b>						

**Figure 2** The SATS discriminator list (adult version)

The TEWS score alone will only appropriately triage a patient if their physiology is altered. The discriminator list identifies patients who have pathology requiring more urgent intervention, but whose physiological parameters according to the TEWS do not generate an appropriate urgency. It is the part of the triage tool that generates the actual triage colour (red, orange, yellow, green) which will determine patient severity level and also when the patient should be attended to.

Discriminators used are:

- mechanism of injury: limited to a high energy transfer injury
- presentation: such as chest pain, acute shortness of breath
- pain: regarded as mild, moderate, severe
- senior health care professional's opinion (altering the triage code, either upgrading or downgrading the triage status according to the discretion of the professional)

When triaging a patient the TEWS score is first calculated by measuring the physiological parameters. The discriminators are then assessed, and a triage colour category is allocated

- red = immediate priority; refer patient to the resuscitation room for emergency management
- orange = very urgent priority; refer patient to the anteroom for emergent treatment
- yellow = urgent priority; refer patient for routine management
- green = delayed priority; refer for streaming
- blue = dead; patient for certification

If the discriminators (mechanism of injury, presentation, pain) categorise a patient in a higher triage category than the TEWS score, then this higher category is regarded as the correct category.

Current recommendations are that all red patients be prioritised and seen immediately; orange patients should be seen within 10 minutes, yellow patients within 60 minutes and green patients within 4 hours.

## SUMMARY

While considerable progress has recently been made in the cause of death statistics by the South African vital registration system, there is a paucity of data especially at a district and sub-district level. Similarly, BoD data are lacking at a local level. This study was therefore undertaken to gain information on mortality and BoD at a local

level (and thereby gain insight into the health status of the community served), and assess whether the SATS is being used appropriately in local hospitals.

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## **CHAPTER 2: AIM**

The aim of this study is to identify the leading causes of death in the EC of a rural regional hospital.

In order to achieve this aim, the following objectives are identified:

- To describe the demographics of patients dying in the study site
- To identify the underlying causes of death in the study population
- To compare the data to current mortality statistics

The secondary aim is to collate information regarding the triage of this sample of patients:

- To determine whether patients are being triaged on presentation
- To determine whether the triage is performed correctly
- To determine whether the delivery of time-critical treatment for patients with life-threatening conditions is being met (as per policy,<sup>50</sup> according to their triage priority)

### **CHAPTER 3: LITERATURE REVIEW**

The following databases were searched:

- Pre-pubmed
- Medline1966 - present
- Embase 1982 - present

In addition, searches were performed on Google and Google scholar.

The followings search terms were used:

Mortality statistics

Morbidity

Statistics South Africa

South African mortality

Mortality in the developing world

Causes of death

Burden of disease

South African Demographics

South African Triage Scale

All retrieved items were assessed for suitability, by a review of the abstract.

All articles that were included had their reference lists checked for more articles of interest.

An attempt was made to obtain previously unpublished materials, including dissertations, via internet registries.

A total of 160 articles were retrieved, of which 79 were deemed useful, further articles were identified through the methods detailed above.

## **CHAPTER 4: METHODOLOGY**

We undertook a retrospective, cross-sectional descriptive study of patients presenting to Paarl Provincial Hospital Emergency Centre, Paarl, South Africa.

### **STUDY LOCATION**

Paarl General Hospital operates in the Paarl Health District, a rural peri-urban area. It is the largest town in the Cape Winelands, situated about 60 kilometres northeast of Cape Town. Paarl is the third oldest European settlement in the Republic of South Africa (after Cape Town and Stellenbosch) and forms part of the Western Cape Province.

Paarl Hospital is a level two (Regional) hospital with a 254 bed capacity. It services an estimated 600,000 population, encompassing a predominantly rural regional group. It covers a geographical area of approximately 22,500 square kilometers. The hospital drainage area includes: Paarl and its suburbs, Mbekweni, Wellington, Simondium and Groot Drakenstein.

The hospital consists of eight wards and a two bed high care unit. The EC consists of a treatment room, medical and surgical resuscitation rooms with a total of four resuscitation beds, and a six-bed short stay ward. The EC has a total of 28 beds with the capacity for more stretchers if needed. The average number of patients seen is 3,400 per month. During the day time there are three doctors per shift and the night shift is covered by one duty doctor. Weekend shifts have two doctors on duty per shift, with additional on call doctors available if needed. There is an onsite laboratory service, emergency blood available in the EC and a blood bank located in the town. X-ray and ultrasound scan facilities are available during working hours and an on- call afterhour radiographer is available for urgent requests.

According to census 2001 Paarl has a population of 312,119 people.<sup>51</sup> The age distribution of the population is as follows: 28.5% under the age of 15, 19.7% from 15 to 24, 32.7% from 25 to 44, 14.7% from 45 to 64, and 4.4% who are 65 years of age or older. The median population age is 26 years. The sex distribution is almost equal. In terms of gender and age, the largest recent demographic growth has been

among women in the age group 35 to 64. The population pyramid reflects a youthful, majority female and rapidly growing population, shaped by in-migration into the Cape Winelands.

The Paarl Municipality primarily comprises four racial groups. Based on the most recent national statistics 64% of the population is Coloured, 21% African, 14.8% White and 0.2% Indian.

Unemployment and poverty affects a large number of people within the municipal area. An estimated 23% of residents are unemployed, although this fluctuates seasonally.<sup>52</sup> High levels of illiteracy and generally low education levels contribute to the high proportion of unskilled labour employed in the district. 5.7% of the population aged 20 years or older has had no formal school education.

There are a significant number of relatively low-income families, with 86.3% of all residents in the Cape Winelands District earning less than R1600 per month. The implication is that approximately 550 000 people are living in relative, often seasonal poverty, and are in need of survival mechanisms to cope financially. The poorer communities, many on the outskirts of Paarl, suffer from massive unemployment, high levels of alcohol abuse, high rates of HIV/AIDS and AIDS orphans.

While it is still difficult to monitor the actual prevalence of HIV/AIDS in the District, the trend of the epidemic can be described as follows:

- In the West Coast/Winelands region Paarl had the highest HIV seroprevalence rate.
- Estimated prevalence rates were 10-15% in a 2005 burden of disease study<sup>37</sup>
- The estimated HIV scenario for 2015 is 9750 cases<sup>53</sup>
- The highest rates are within the district area in Mbekweni (54%), and Farming areas (14%).<sup>54</sup>

### *Living conditions*

About 78.4% of all households live in formal dwellings, and 16.2% and 2.2% respectively in informal and traditional structures. On average 3.6 persons shared a household. Piped water, either in the dwelling, on site, or from a communal tap is available in 98.3% of households. About 7.7% of households do not have access to a toilet facility. In 78.8% of households electricity is used as the main source of energy for cooking, wood in 2.9% and paraffin in 10.9%.<sup>53</sup>

### STUDY DESIGN

This was a cross sectional, retrospective study of all patients who died in the Paarl Hospital EC from 1<sup>st</sup> January to 31<sup>st</sup> May 2008. Patients who died in the EC were identified using the patient register and cross referenced with folders in the deceased registry.

The medical folders of all patients who died in the EC during the study period were analysed. Only patients who died in the EC or who were declared dead on arrival were included. Patients who were admitted to the wards under specialist care and subsequently died were excluded from the study.

### DATA COLLECTION

A data collection tool in the form of a questionnaire was designed to collect information from the patient folders. Information was entered by the principal investigators directly into the SPSS data capture programme.

Information gathered included:

- patient demographics
  - age
  - sex
  - race
  
- referral patterns
  - self-referred
  - referred from community health centre

- referred from general practitioner
- referred from specialist
- time evaluations
  - time of arrival in the EC
  - time of seeing attending physician
  - time to laboratory tests and special investigations
  - time of death
- initial patient observations
  - heart rate
  - blood pressure
  - respiratory rate
- triage category
- disease characteristics
  - patient presenting complaint
  - EC diagnosis - nursing staff and EC physician
- diagnostics and treatment

### STATISTICAL ANALYSIS

Descriptive statistics were calculated using a computer-based data analysis tool, SPSS (version 17). Assistance in statistical methods was provided by the Faculty of Health Sciences at UCT.

### ETHICAL APPROVAL

Ethical approval for this study was obtained from the Ethics Committee, UCT. REC REF 313 / 2008.

Consent to access medical records was obtained from Paarl Hospital. All data were transferred directly to the SPSS datasheet. Security was maintained via password access.

## CHAPTER 5: RESULTS

### SAMPLE CHARACTERISTICS

There were 108 deaths in the EC within the study period.

#### *Demographics*

There were 63 male deaths (58.3%). **Table 1** shows deaths within the study population by 10-year age categories.

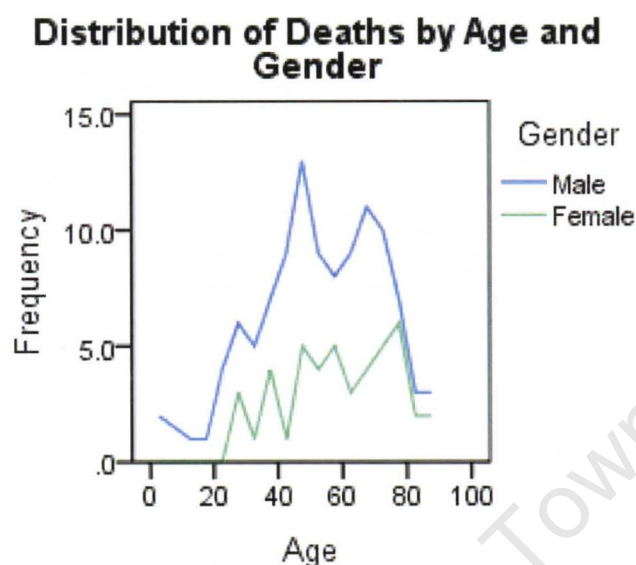
**Table 1:** Number of Deaths by Age

<b>Age at Death</b>	<b>n</b>	<b>%</b>
0 - 9	2	1.8
10 - 19	2	1.8
20 - 29	10	9.2
30 - 39	12	11.1
40 - 49	22	20.3
50 - 59	17	15.7
60 - 69	20	18.5
70 - 79	16	14.8
80 - 89	7	6.4

The mean age of death was 53 years. Peak incidence of deaths occurred in the 40 - 49 year age group (20.3%), followed by the 60 - 69 year group (18.5%). The 40 – 59 year age group accounted for 36% of all deaths and the over 60 year group, 40% of all deaths. Only two childhood deaths were recorded.

The age pattern of deaths for males and females is shown in **figure 3** and **table 2**.

**Figure 3**



**Table 2:** Distribution of Deaths by Age and Gender

Distribution of Deaths by Age	Males	Females
< 15	4.5%	-
15-29	11%	6%
30-49	36.5%	22%
50-65	24%	31%
>65	24%	40%

The mean age of death in the male population was 48 years of age (Standard deviation (SD) 19.4, CI = 8.01). Peak age group of death incidence was in the 30-49 year age group (36.5%), with a second peak in the 50-65 and over 65 year group (24% each).

The mean age of death in females was 59 years of age, eleven years older than that for males (SD 16.6, CI = 11.21). Peak incidence also occurred later: 40% in the over

65 year age group, followed by 31% in those aged 50 - 65. Only three of the fourteen deaths in the under 30 year age group were female (6%).

#### *Population group Differences in Mortality*

Numerous patient folders and documents did not record the population group, therefore this information could not be accurately assessed.

#### *Referral Patterns*

Referral information was retrieved from 84 patient folders; it was not specified in 24. The majority of these patients were self-referred (67.5%). Other patients were referred from the local day hospital (5.5%), specialist (2.7%) and general practitioner (2%).

#### *Method of Transport to Hospital*

Most patients were transported to hospital via Emergency Medical Services (61%); 23% of patients used their own transport and 1% came by police.

#### *Triage Categories*

The triage score was not calculated in 30 patients (28%). Patients were coded:

- 27 red (25%)
- 19 orange (17.6%)
- 19 yellow (17.6%)
- 2 green (1.85%)
- 11 blue (DOA) (10%).

#### *Triage Process*

Of the 78 patients who were triaged, 68 were done correctly. Of these, 11 were placed in a higher category than the TEWS score and up-triaged. It was not always evident from the notes whether this decision was valid.

The incorrectly triaged patients were all undertriaged. These cases are presented in **Table 3**.

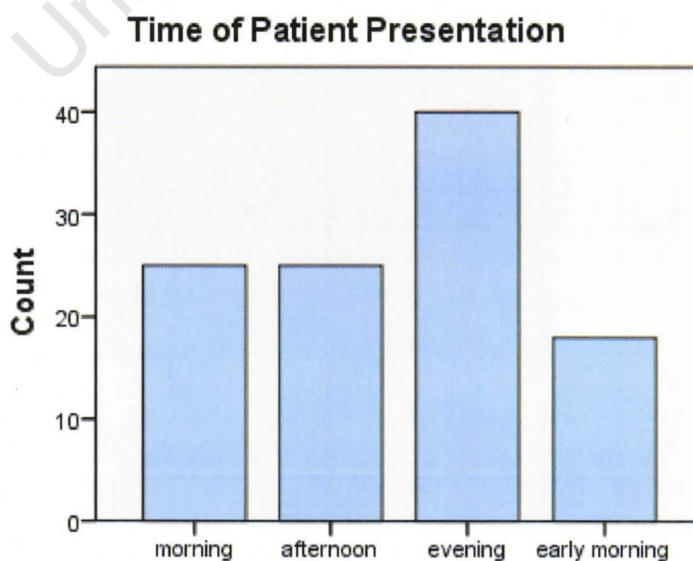
**Table 3:** Description of Under-Triaged Patients

Allocated Triage Category	Actual Triage Category	Nursing Problem	Cause of Death	Time to be seen (min)
Green	Orange	Haemoptysis	TB	90
Green	Orange	TB, neck stiffness	TB / CVA	–
Yellow	Orange	Generalised weakness	Acute MI	90
Yellow	Orange	Chest Pain	Acute MI	25
Yellow	Orange	Generalised weakness	TB, Pneumonia	145
Orange	Red	Shortness of breath	Renal failure, COPD	90
Orange	Red	Generalised weakness	TB / HIV	75
Orange	Red	Generalised weakness	Lung Cancer	35
Orange	Red	Collapse	Renal Failure	–
Orange	Red	Multiple Stabs	Assault	10

*Time of Patient Presentation*

The time of initial patient presentation to the EC was noted (**figure 4**). From this information trends and peak visiting times could be calculated. The day was divided into four time periods: morning (06.00 - 12.00), afternoon (12.00 – 18.00), evening (18.00 – 24.00) and early morning (00.00- 06.00).

**Figure 4:**



Most patients presented to hospital during the day time (46%), evenly distributed over the morning and afternoon. 37% of patients were seen during the evening and 18% of patients presented in the early morning.

The more ill patients (higher SATS score) presented during the evening (44% of the Red patients), and the afternoon (30%), compared to the morning and early morning (13%) each.

#### *Time to see Emergency Physician (EP)*

The time period from initial patient presentation to being attended to by the duty physician was calculated. On average, red patients were seen within 44 minutes (0-185min), orange patients within 61 minutes (0-310min), yellow (10-320min) and green patients both within 90 minutes.

**Table 4:** Time to see Emergency Physician

Triage Category	Number of Patients	Time to see emergency physician (min)	
		Mean	Range
Red	27	44	0, 185
Orange	19	61	0, 310
Yellow	19	90	10, 320
Green	2	90	n/a
Blue	11	11	5, 45

### **CAUSE OF DEATH**

Overall mortality is divided into three broad groups of causes of death according to the BoD classification. Each group is divided into several major categories of causes of death, such as respiratory infections, cardiovascular diseases and injuries. These categories are further disaggregated into more specific causes of death (specific diseases or disease clusters). Cause of death calculations were based on the sample group (n=108) – DOA's (n=11).

An age and gender breakdown of the proportion of deaths due to natural and non-natural causes is then presented. Due to concerns in South Africa about levels of violence and deaths due to accidents and assault, deaths due to natural and non-

natural causes are identified separately. All external causes of morbidity and mortality are treated as non-natural causes of death.

#### *Reported Causes of death*

Information on diseases, injuries and complications that caused the death was noted from both the patient records and available death certificates. One or more causes of death can be recorded on current death notification forms. **Table 5** shows the number of reported causes of death for 97 cases.

**Table 5:** Number of Reported Causes of Deaths

<b>Number of Reported causes of death</b>	<b>Number</b>	<b>Percentage</b>
One	60	62%
Two	37	38%
Three or more	0	0%

#### *Main groups of the underlying causes of death*

The causes of death were aggregated according to the BoD classification (see **table 6**). These are categorized into three broad groups:

- Group 1: are pre-transitional causes: communicable diseases, maternal causes, perinatal conditions and nutritional deficiencies. HIV disease is part of this group, but is kept separate in the South African National BoD analysis due to the size of the burden it contributes in South Africa. Group 1 causes are conditions that typically occur in poorer populations.
- Group 2: are non-communicable causes such as stroke, ischaemic heart disease and chronic obstructive pulmonary disease.
- Group 3: are injuries, both intentional and non-intentional.

**Table 6:** Broad cause of Death Groups

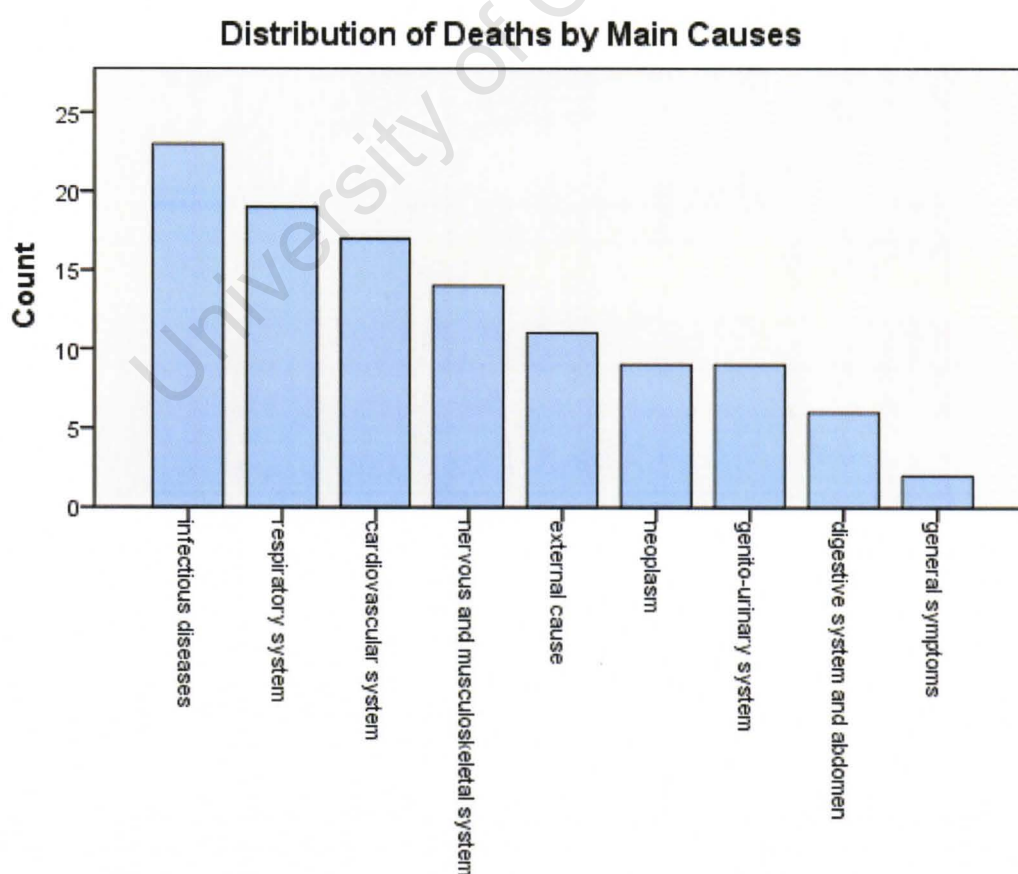
Broad Cause	n	%
Communicable disease (excl HIV)	34	31
HIV disease	12	11
Non-communicable disease	53	48
Injuries	11	10

Non-communicable diseases accounted for a large proportion of deaths, almost half of the total recorded (48%). Communicable diseases, including HIV disease (11%), also formed a significant burden (42%).

*Deaths by Main Categories*

**Figure 5** shows the distribution of deaths by the main groups of the classification of causes of death.

**Figure 5:**



The top ranking main group of causes of death is due to infectious diseases (23.7%). The majority of deaths in this group are due to TB (65%). There was however, insufficient information documented to determine the extent of deaths due to multidrug-resistant tuberculosis and extensively drug-resistant tuberculosis.

Diseases of the respiratory system (19.6%) ranked next, accounting for almost a fifth of all deaths. The majority of deaths in this group were due to lower respiratory tract infections (84%), the remainder due to asthma and chronic obstructive pulmonary disease.

The third most common main group of causes of death was diseases of the cardiovascular system (17.5%). These deaths were due to ischaemic heart disease and cardiac failure. Deaths due to ischaemic heart disease were all post acute myocardial infarction. Deaths due to cardiac failure are an ill defined group, one that represents complications of cardiac disease and does not reflect the actual underlying cause of death. However, inadequate documentation existed to accurately define whether these deaths were due to rheumatic heart disease, ischaemic heart disease, hypertensive heart disease, pulmonary heart disease or other cardiovascular diseases.

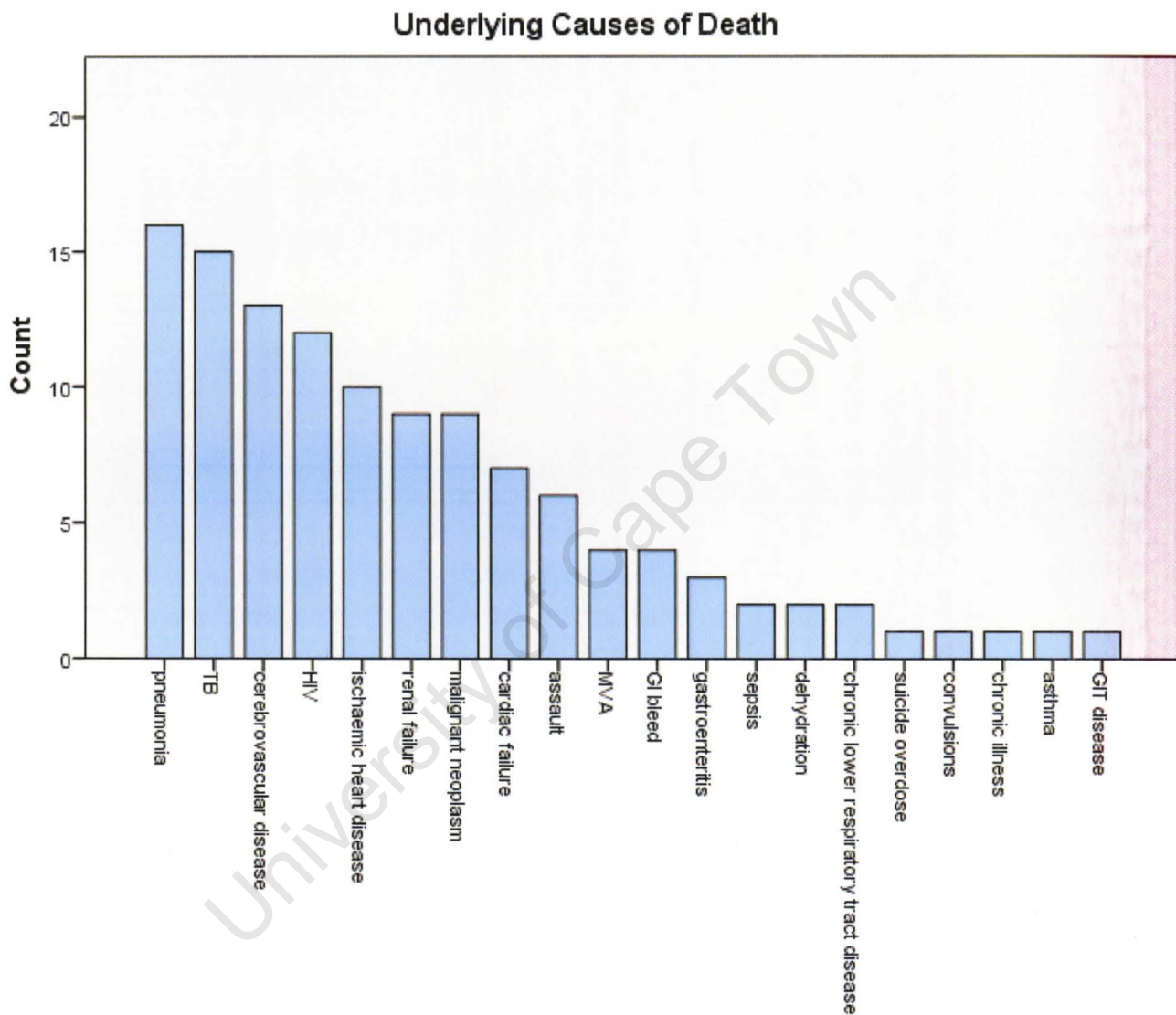
Diseases of the nervous system ranked fourth (14.4%). These deaths were all due to strokes, except for one due to status epilepticus. 11.3% of deaths were due to external causes of morbidity and mortality, ranking fifth. Neoplasms comprised 9% of all deaths, as did disease of the genito-urinary system (renal failure), ranking joint sixth. Disease of the gastrointestinal (GIT) system contributed 6% of all deaths. Most of these deaths were due to a GI bleed. However, a specific underlying cause, such as peptic ulcer disease or chronic liver disease was poorly documented. Ill - defined general symptoms were documented in 2%.

#### *Underlying causes of Death: Natural and Non-Natural*

**Figure 6** shows the distribution of underlying causes of death in both natural and non-natural deaths. Ranking the underlying causes of death is informative in illustrating the relative burden of cause-specific mortality. The ranking merely denotes the frequency of causes of death among those causes eligible to be ranked,

and is not reflective of the causes of death in terms of their importance from a public health point of view.

Figure 6:



The causes of death were ranked according to the number of deaths in each corresponding category. The ten leading causes are shown in **Table 7**.

**Table 7:** The Ten Leading Causes of Death

Cause of Death	Rank	Number	Percentage
Pneumonia	1	16	16.5%
Tuberculosis	2	15	15.5%
Cerebrovascular disease	3	13	13.4%
HIV disease	4	12	12.4%
Ischaemic heart disease	5	10	10.3%
Malignant neoplasms	6	9	9.3%
Renal failure	6	9	9.3%
Cardiac failure	8	7	7.2%
Assault	9	6	6.2%
Motor vehicle accident	10	4	4%

The top-ranking causes determine the leading causes of death. Causes that had the same number of deaths were allocated the same rank, and a rank was skipped for the next cause.

Pneumonia was the leading underlying cause of death (16.5%), followed by TB (15.5%) and cerebrovascular disease (13.4%). These three leading causes of death accounted for almost half of all the deaths recorded. HIV disease was the fourth leading cause of death, accounting for 12.4% of all deaths. Ischaemic heart disease was the fifth leading cause of death (10.3%). Underlying malignancy contributed to 9.3% of all deaths. Of these patients, there were four with metastatic disease (primary malignancy not recorded), three with lung cancer, one with cervical cancer and one with a brain primary. Deaths due to renal failure and cardiac failure contributed 9.3 and 7.2% respectively.

It was observed that the majority of deaths were due to natural causes (88.6%). Non-natural causes of death due to assault and motor vehicle accidents, ranked ninth and tenth respectively, and accounted for 10, 2% of all deaths.

## Underlying causes of death by gender

**Table 8:** Broad Cause of Death Group by Gender

Broad cause	Male (n)	Female (n)
Communicable disease (excl HIV)	20	14
HIV disease	6	6
Non-communicable disease	28	25
Injuries	10	1
All causes	64	46

The majority of deaths for both sexes are due to Group 2 causes (non-communicable diseases). Group 2 causes were higher in women (54.3%) than in men (44%). The proportions of Group 1 deaths (pre-transitional diseases) were similar for men and women (31% vs. 30%). HIV contributed 9% in males and 13% in females. The proportion of deaths due to Group 3 causes was markedly different between the sexes, with deaths due to injuries present in 15.6% of males and 2% of females. The top causes of mortality burden again reflect the quadruple burden of disease and the different patterns for males and females.

The distribution of the underlying natural causes of death by gender is shown in **Figure 7** and non-natural deaths in **Figure 8**. These graphs illustrate the relative importance of the respective causes of death and of male–female differences.

The largest differences between men and women are observed for intentional and unintentional injuries, lower respiratory tract infections, cardiovascular disease, strokes and malignancy. Women had higher proportions of deaths due to TB, stroke, HIV, and cardiac disease (ischaemic heart disease and cardiac failure) than men (see **Table 9**). In contrast, men had higher proportions of deaths due to pneumonia, malignancy, chronic lower respiratory infections, homicide and motor vehicle accidents.

Overall, nine of the ten leading causes were the same for both male and females, although with different rankings. Chronic lower respiratory tract disease was among

the ten leading causes of death for males, but not for females. Deaths due to gastroenteritis and dehydration ranked number 10 for females (2%), and did not feature as a cause in male deaths.

Figure 7:

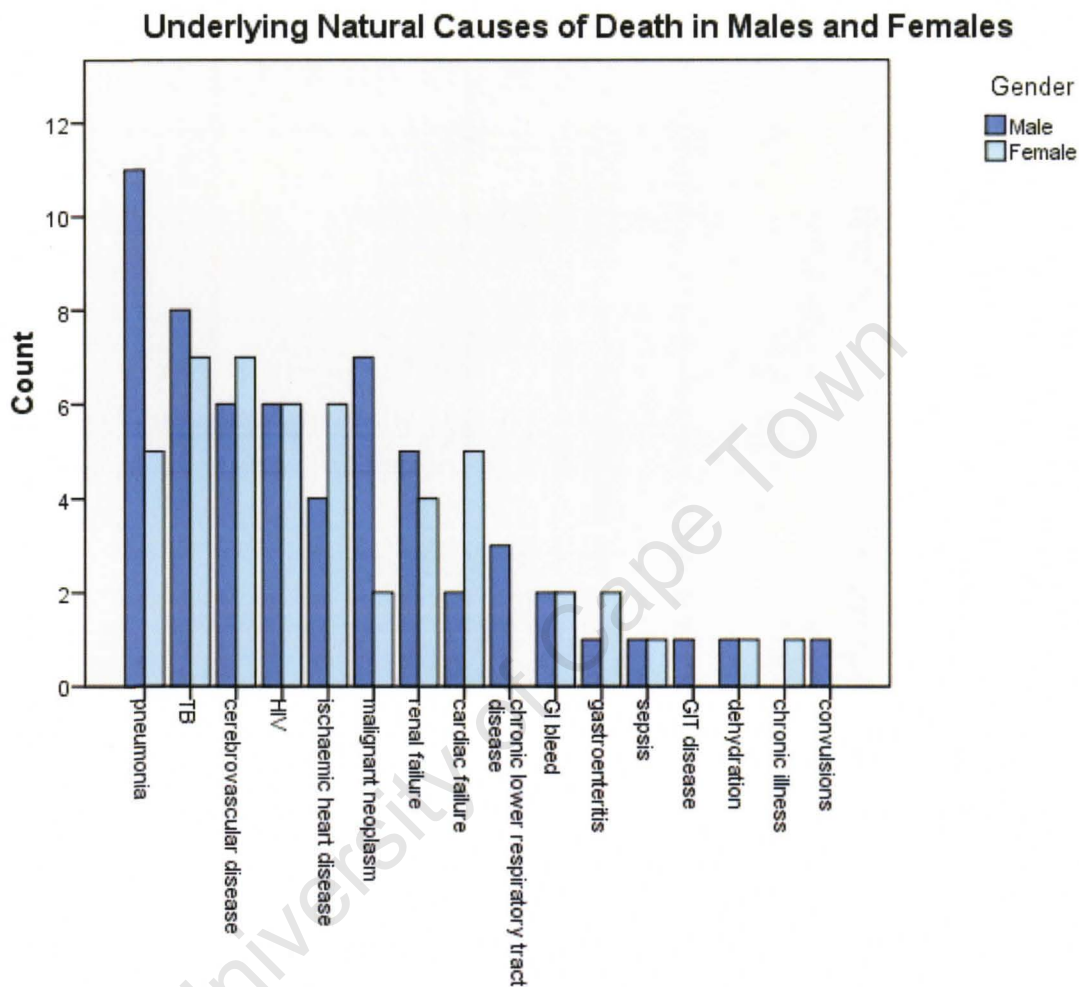
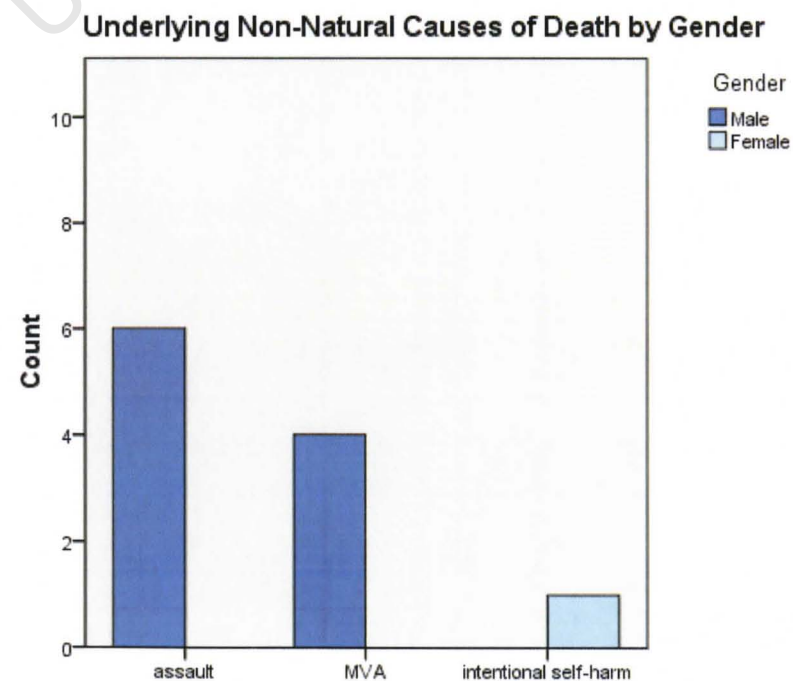


Figure 8:



**Table 9:** Leading Causes of Death in Males and Females

Cause of Death	Male		Female	
	Rank	Percent	Rank	Percent
Pneumonia	1	17.5	5	11
Tuberculosis	2	12.7	1	15.5
Malignancy	3	11	8	4.4
CVA	4	9.5	1	15.5
HIV	4	9.5	3	13
Renal Failure	6	8	7	9
Ischaemic Heart disease	7	6	3	13
Chronic lower airway disease	8	4.7	-	-
GI bleed	9	3	8	4.4
Cardiac Failure	9	3	5	11

The three leading causes of death were different amongst males and females. Deaths due to TB were common to both, but with different rankings.

Pneumonia (17.5%), TB (12.7%) and malignancy (11%) are the leading causes of mortality amongst men. Deaths due to cerebrovascular events and HIV disease were co-ranked at number four (9.5% each). Deaths due to cardiovascular disease ranked much lower for males, with deaths due to ischaemic heart disease occurring in 6% of patients and cardiac failure in 3%, ranking number 7 and 9 respectively. Deaths due to chronic respiratory tract disease ranked eighth, representing 3% of the overall frequency.

Compared to females, males had a higher proportion of deaths due to non-natural causes (15.8% for males and 2% for females). For males 9.5% and 6.3% of all deaths were due to homicide/violence and transport accidents respectively. None of the homicides involved the use of a firearm, but were rather all due to stabbings. For each of the sexes, intentional self-harm was uncommon, with only one recorded female case.

For females, TB and cerebrovascular disease shared the leading underlying cause of death, contributing 15.5% each. Deaths due to HIV disease and ischaemic heart

disease were ranked next, accounting for 13% each. Pneumonia, the leading cause of death in males, ranked number five for females, together with deaths due to cardiac failure (11% each). Malignancy featured much higher for males than females (ranked third vs. eighth, accounting for 11% and 4% of deaths respectively). Deaths due to renal failure and GI bleed showed much smaller overall sex differentials.

#### *Leading underlying causes of death by age*

The leading causes of death classified by broad age groups 15–29, 30–49, 50–64 and 65 years and older are presented in **Table 10**. As previously, causes that had the same number of deaths were allocated the same rank, and a rank was skipped for the next cause.

#### *Leading causes of death among children (<15 years)*

Only two deaths were recorded for the under 15 year age group. These were due to dehydration and a non-natural death following a motor vehicle accident.

#### *Leading causes of death among adults*

For young adults, deaths due to Group 3 (injuries) and Group 1 (pre-transitional) causes were the leading causes. In older persons the majority of the leading causes of death were Group 2 (non-communicable) diseases.

**TABLE 10: Causes of Deaths by Age Groups**

Cause of Death	15 – 29		35 - 49		50 - 64		65+	
	Rank	%	Rank	%	Rank	%	Rank	%
Assault	1	45	8	3	--	--	--	--
HIV disease	2	27	2	22	7	3	--	--
TB	3	18	1	28	4	9	8	2.5
GIT disease	4	9	--	--	7	3	5	8
Renal Failure	5	9	--	--	7	3	2	18
Malignancy			3	8	4	9	5	8
Cardiac Failure			4	5.5	2	18	--	--
Ischaemic Heart disease			4	5.5	4	9	4	13
Pneumonia			4	5.5	3	15	1	20.5
MVA			4	5.5	--	--	--	--
Cerebrovascular disease			8	3	--	--	--	--
Suicide			8	3	1	21	3	15
Chronic lung disease			--	--	7	3	7	5

1. 15 -29 years (n=12)

Most recorded non-natural deaths secondary to assault occurred in the 15–29 year group (83%). Deaths due to stabbings were the leading cause of death amongst young adults, accounting for 45% of the total deaths. The next leading causes of death were due to HIV disease (27%) and TB (18%). Deaths due to GIT disease and renal failure contributed 9% each. All the deaths due to GIT disease were caused by an underlying GI bleed, and may be indicative of the high alcohol intake amongst the young population.

The pattern differed for young adult males and females, with high numbers of deaths resulting from injuries in young men while HIV/AIDS and TB deaths predominated in young women.

## 2. 30 - 49 years (n=34)

Deaths due to TB and HIV disease were also amongst the leading causes of death in the 30 - 49 year age group, but with different rankings. Combined they accounted for 50% of the deaths in this age group. TB was the leading cause of death, accounting for 28% of deaths. HIV disease ranked second at 22%. Deaths due to malignant neoplasm ranked third at 8%. Cardiovascular disease accounted for 11% of deaths, with cardiac failure and myocardial infarction the underlying cause in 5.5% of cases each. Non-natural deaths accounted for 11.5% of cases, these being due to motor vehicle accidents (5.5%), intentional self-harm (3%) and assault (3%). Once again, deaths due to injuries predominated in the men.

## 3. Over 50 years (n=60)

Although the ranks differed, three of the top five underlying causes of death were common for those aged 50 - 64 (n=26) and those aged 65 years and older (n=34). Deaths due to cerebrovascular disease, pneumonia and malignancy were significant causes for both groups (45% and 43.5% respectively), ranking first, third and fourth in the 50 - 64 year group and third, first and fifth in the over 65 year group. Other causes of death similar to both groups were deaths due to ischaemic heart disease, TB, gastrointestinal bleeding, renal failure and chronic lung disease.

The proportion of deaths due to infectious diseases was much lower compared to the other age groups. TB accounted for 9% of deaths in the 50 – 64 year group, and only 2.5% in the over 65 group. There were no recorded deaths due to HIV disease in those ages 65 and older, and only one in the 50-64 year age group.

## **CHAPTER 6: DISCUSSION**

This is the first study specifically addressing the cause of mortality in a regional hospital in the Cape Winelands district in the Western Cape. Statistics regarding cause of death findings may be used together with the mortality surveillance system in the Cape Winelands to add to locally collected data. The information may also be used at a district level for policy formulation, implementation and monitoring of health interventions aimed at improving the health status of the local population. At a health facility level the findings may help practitioners gain insight into the health status of the community they serve.

### *Triage Practice*

The study also provides useful information regarding the implementation and use of the SATS in Paarl hospital EC. It assesses whether patients are being triaged, if this is being performed correctly, and if patients are seen within the appropriate time frames as per triage category. This information may be used as part of an ongoing quality assurance and monitoring system.

The goal of an effective triage system is to identify those patients that need to be evaluated and treated rapidly to avoid potential morbidity or mortality. Triage has the potential to improve quality of care by identifying a group of patients with high levels of acuity needing immediate assessment and treatment. It is an effective way to deal with an overwhelming demand for services. This is relevant for many ECs, including Paarl hospital, that are increasingly facing gridlock caused primarily by reduced access to inpatient beds, together with increased patient volumes and complexities.

The use of the SATS has been implemented over the past 4 years, and seems to have a positive effect on patient flow through ECs.<sup>49</sup> However, although it is fully supported by the Provincial Department of Health, the triage system is still not being used in all ECs.

In the sample group 30 patients were not triaged (27.7%) and almost 10% of patients were undertriaged. This highlights the scope for increased triage utilization and

efficiency. When determining the correct triage category it is always important to gain sufficient information. This is especially true when there are lengthy waiting times to see the physician, as is frequently the case with increased patient volumes. Assignment of an inappropriate low triage category can increase the risk of a bad outcome due to the associated long wait. This is highlighted by the patient who was triaged yellow with the presenting complaint noted as generalized weakness. The patient waited 90 minutes to be seen by the attending physician, was then diagnosed with an acute MI and died shortly thereafter.

Rendering the most appropriate type of care within the shortest time possible is one of the most important aspects in the prevention of death and disability in any EC. This is in recognition of the fact that there are unavoidable fluctuations in demand for services and that most systems are not resourced to meet peak demands at all times. Recommended time guidelines are as follows: resuscitation patients to be seen immediately, emergent patients within 10 min, urgent patients within 60 min, and nonurgent patients within 4 hours. In the study sample the average time for red (resuscitation) patients to be seen was 44 min, and for orange (emergent) patients 61 min.

Expediting immediate care for life-threatening problems needs to be prioritized. Failure to meet time objectives on a frequent basis should lead to a process review to determine whether EC design, operation, utilization or resourcing is sufficient to ensure safe access. Having a system that is well designed and resourced, and with sufficient capacity to deal with variability in demand is what is needed. Such a system should expedite care by accurate initial assessment, ensuring prioritization in accordance with severity of medical condition, instigate preliminary therapeutic procedures, and improve patient flow patterns within ECs.

#### *Cause of Death Certification*

In the context of competing priorities for limited resources, the importance of good data in making informed healthcare decisions cannot be overstated. Correct diagnosis and certification of the cause and manner of death are major determinants of the accuracy and completeness of mortality statistics. Accuracy is determined by

the details provided by medical practitioners, and their ability to correctly identify and certify the cause and manner of death.<sup>55</sup>

The underlying cause of death, which is extremely relevant for public health, should be a distinct entity and aetiologically specific. Causal sequence, leading from the underlying cause to the immediate cause of death, and contributory causes should also be clearly identified. Documentation should also clearly state whether the death was natural or unnatural.

In the study sample, information regarding patient gender and age were all clearly identified. An unacceptable cause of death was noted in one case, where the cause of death was documented as 'chronic illness.' Ill-defined causes of death such as cardiac failure were noted in seven patients. Causal sequence was not recorded in several cases - as with GI Bleeds, where no further information regarding underlying cause, such as liver cirrhosis or peptic ulcer disease, was provided. 62% of the cases had only a single cause of death noted, while 38% had two causes, including common combinations such as TB with HIV disease.

These findings suggest that there is scope for improving the quality of medical certification so as to provide sufficient details to allow for accurate identification of the underlying cause. It highlights the need for improving the quality of documentation and certification through training.

#### *Cause of Death Findings*

As a developing country, South Africa is undergoing a major health transition, with a change in disease profiles. As countries become more developed, disease profiles tend to change, from one predominantly influenced by infectious diseases, childhood and maternal under nutrition and high childhood mortality, to one where chronic degenerative diseases predominate. Developing countries, however, often experience a double burden, resulting from the simultaneous occurrence of both these disease spectrums.<sup>56</sup>

In the 1990's and early 2000's South Africa's burden of disease profile was characterized by a very high injury burden, in addition to the double burden of

disease, resulting in a 'triple burden'.<sup>57</sup> More recently, the impact of the HIV/AIDS epidemic has created a quadruple burden of disease in South Africa. As a consequence, when compared to countries where income levels and expenditure on health services are similar, our mortality rates are very high.<sup>58</sup>

Similarly, the leading causes of death in this study reflect the quadruple burden of disease, as experienced at a subdistrict level. The causes of death include the pre-transitional diseases and conditions related to poverty, the emerging chronic diseases, injuries, and HIV/AIDS. The pre-transitional conditions encompass lower respiratory infections, TB and diarrhoeal disease. For the non-communicable diseases, strokes and cardiac disease are the main contributors.

### **Contrast with provincial and national profile**

According to the STATS SA 2009 release,<sup>33</sup> the Western Cape had the lowest mortality of all the provinces. Non-communicable diseases accounted for a much larger proportion of deaths (58%), than nationally (38%). This is largely accounted for by the Western Cape population being older than the national population. Although there was evidence of the quadruple burden of disease, the Western Cape had a lower mortality from HIV/AIDS and other Group I conditions. Natural deaths accounted for 85.2% of deaths and non-natural causes for 14.8% of all deaths.

Similarly, the Cause of Death and Premature Mortality 2004-2006 report for the Cape Winelands and Overberg Districts, indicates that the majority of deaths (49.4%) were due to non-communicable diseases. Pre-transitional diseases accounted for 22.3% and injuries for 16.1% of deaths.

In this study non-communicable diseases were also the leading group of causes (48.6%), with pre-transitional disease, including HIV disease, causing 42% of deaths, and injuries 9% of deaths.

Based on the data from the 2009 report (see **Figure 10**), TB continued to be the leading cause of death in South Africa, accounting for over 10% of deaths in the country. Influenza and pneumonia was the second leading cause, followed by

intestinal infectious diseases, other forms of heart disease and cerebrovascular diseases. HIV disease was the ninth leading cause of death, accounting for about 2.2% of all deaths occurring in 2007. Hypertensive diseases and ischaemic heart disease ranked tenth and eleventh respectively.

**FIGURE 10:** STATS SA Leading underlying Natural Causes of Death in 2007

<b>Causes of Death: 2007</b>	<b>Rank</b>	<b>Number</b>	<b>%</b>
Tuberculosis	1	76 761	12.8
Influenza and pneumonia	2	49 722	8.3
Intestinal infectious diseases	3	37 398	6.2
Other forms of heart disease	4	26 030	4.3
Cerebrovascular diseases	5	25 321	4.2
Diabetes mellitus	6	20 139	3.4
Chronic lower respiratory diseases	7	15 313	2.5
Disorders involving immune mechanism	8	15 253	2.5
HIV disease	9	13 521	2.2
Hypertensive disease	10	13 381	2.2
Ischaemic heart disease	11	12 506	2.1
Non-natural causes		54 216	9.0

Comparing the SA stats to the study data, (refer to **Figure 6** and **Table 7**), seven of the top ten leading causes of death were similar to that experienced at a national level. Exceptions were deaths due to diabetes mellitus and certain disorders of the immune system, which did not feature in this study data, and deaths due to chronic lower respiratory disease which ranked much lower. Deaths due to TB and pneumonia were substantial causes in both groupings – a fifth of all deaths in South Africa and a third of deaths in the Paarl hospital study.

Compared to Stats SA provincial data for the Western Cape, eight of the ten leading causes of death were shared with the study findings, but with different rankings. These were deaths due to TB, cardiac disease, strokes, malignancy, HIV disease, pneumonia and intestinal infectious disease. The Western Cape incidence of HIV disease and pneumonia ranked much lower than the study sample, at number eight

and nine respectively. Despite the high incidence of TB in the province, mortality rates were average at 9.9%.

Injuries were higher as a proportion of the deaths in the Western Cape (14.8%) compared with South Africa overall (8.7%). Males had a higher proportion of deaths due to non-natural causes, and in particular, deaths due to assault. In the study sample, deaths due to homicide and violence was the leading cause of death in males aged 15 – 30.

The analysis on causes of death, according to sex, shows that there are pronounced gender differences. Even though the province and the Cape Winelands Municipal area have more females than males, there are consistently more male deaths than females, as indicated in the following:

- South African report (51% vs. 49%)
- Western Cape provincial profile (56.3% vs. 43.7%),
- and for this study (58.3% vs. 41.7%)

At a national, provincial and district level, mortality rates due to non-communicable diseases were high for both sexes, followed by deaths due to pre-transitional disease and injury. Non-communicable diseases accounted for a substantial proportion of deaths and premature mortality, particularly among adult women. For the non-communicable diseases, stroke and cardiac disease ranked highest for females in both the SA report and in this study sample. Similarly, cardiac disease and stroke were leading causes of death for South African men, whilst malignant disease and strokes were the leading underlying causes for the study group.

In this study HIV disease was the third and the fifth leading cause of death for females and males respectively. In the SA report, the HIV burden ranked much lower at number nine and ten, contributing 2.5 and 2% of all deaths. In reality one would expect the number of reported deaths to be much higher considering the current HIV/AIDS epidemic. This is likely due to the fact that indicator conditions (such as TB, pneumonia, meningitis) or co-morbidity are specified on the death certificate rather than the actual underlying cause. Also, the HIV status of the patient

is sometimes unknown or unverified, or HIV is not recorded as the underlying cause of death, due to the associated stigma.

## **Important Conditions**

### *Non- Communicable Diseases*

Health care in South Africa faces not only the demands of the traditional acute care model that is needed for high levels of diseases of poverty involving acute conditions, such as infections and trauma. Health care also needs to address the added requirements of care for chronic diseases and disease of lifestyle.

Approximately 50% of all deaths in this study were due to non-communicable disease. This contribution of chronic illness to the burden of disease is significant, especially with projections on the age structure of South Africans suggesting that by 2025 one in ten persons will be 60 years or older.

The National Department of Health's 5-year strategic plan<sup>59</sup> specifically includes chronic disease care. Essential drug lists for primary and hospital care have been formulated. Multiple therapeutic guidelines have also been created for many conditions. Quality improvement, including the use of locally collected data to monitor progress, is required to assess current service provision.

In this study, the group of patients identified as needing more attention are those requiring acute care for strokes and myocardial infarctions (the leading causes of death in the group 2 diseases, accounting for a quarter of the total deaths). Appropriate and timely acute care, delivered as soon as possible after presentation, is critical in order to improve the outcome of these catastrophic events. Numerous studies have shown the benefit of early intervention for these patients, with improvements in morbidity and mortality, and reduction in costs and length of stay of hospitalisation.<sup>60, 61, 62</sup> Management guidelines and treatment algorithms would help to provide an adequate standard of care for these patients, and ideally should be in use by primary care givers. Guidelines should be cost-effective, locally appropriate, and collaborative in nature, and potentially provide a structured plan for acute and chronic care conditions.

A multi-faceted approach to this BoD should address both promotive and preventive health care strategies, and focus not only on treatment interventions, but also reduction of risk exposure. It should be designed to target individuals, family units, and community structures. It should be appropriate and cost-effective, with the aim to improve and protect the health of the nation. At a macro-level, interventions should also seek to address public policy, legislation and financing. The need for a multi-faceted and intersectoral approach is highlighted by the SACRA study<sup>2</sup>: interventions are shown to span three spheres, namely: 1. the social sphere 2. the health sphere 3. the development sphere.

There is a need to improve the effectiveness and role of primary care services in promotive and preventive health. Healthy lifestyles (reducing smoking, alcohol and substance abuse, regular exercise, healthy nutrition) must be promoted. There is an ongoing and increasing need to motivate the public to seek appropriate disease screening, and to provide forums to educate and counsel the general public accordingly. There is also a need to educate regarding early signs of disease, since this may facilitate early diagnosis, and as a consequence decrease morbidity and mortality rates. A typical example would be the early symptoms of a transient ischaemic attack. Appropriate public education may aid in early identification and diagnosis, and health measures may then be put into place to potentially reduce the high risk of suffering a cerebrovascular accident.

Looking to the future, it is therefore imperative that primary care for the management of non-communicable diseases be strengthened. In our overextended services, the tendency is for health-care providers to focus on the urgent, more immediate and demanding needs of acute care patients. We need to ensure a balance between acute and chronic care to appropriately address the needs of all patients.

### *TB and HIV*

The deprivation cluster of migration, overcrowding, poverty and malnutrition are all proven risk factors for the high burden of TB and HIV disease in the area.

TB, a preventable disease through a comprehensive health care approach, was the second leading cause of death. Targeted levels of successful treatment are

currently not being met, and efforts to bolster TB control programmes must be made.<sup>63</sup> In terms of the main health indicators within the Cape Winelands District, there is a concern that the TB incidence is increasing. This could be an indicator of deepening poverty and/or the spread of HIV/AIDs within the community.

The links between poverty and TB disease burden have been well documented. Factors that fuel the high TB incidence in Paarl and its surroundings include poverty, overcrowding, damp, poorly ventilated houses/shacks, high HIV prevalence, clients presenting or being identified late in the course of the disease (which means that they infect many others before treatment), poor treatment outcomes due to treatment interruption (defaulters), substance abuse and smoking.<sup>63</sup> An effective TB control programme will therefore require intersectoral interventions aimed at reducing poverty, improving living conditions and continuing to strengthen the health service response.

Because of the increased susceptibility of HIV positive persons to TB disease and mortality, it is even more important that the HIV/AIDS epidemic is controlled in this area in which the TB mortality rate ranks high.

Health services need to provide treatment, together with care and support to HIV positive patients. The National Strategic Plan for 2007- 2011 has identified several important interventions.<sup>64</sup> However, it has also highlighted the current lack of resources and human infrastructure. One of the current goals for local communities to reduce the transmission of HIV and delay mortality from AIDS is through improving treatment of sexually transmitted infections (STI's).<sup>65</sup> In a recent survey it was estimated that local GP's in Paarl treated an estimated 574 STI's per month,<sup>54</sup> indicative of the extent of the problem. Prevention strategies for HIV (e.g. Prevention of mother to child transmission (PMTCT), condom distribution, STI treatment) need to be reviewed and strengthened where necessary.

### *Injuries*

Interpersonal violence accounts for a high burden of disease in South Africa. In general, South African injury rates are approximately six times higher than the global average. Homicide is eight times higher than the global rate and road traffic injuries

are double.<sup>66</sup> In our study population 6.5% of deaths were due to homicide/violence. Of particular concern, is that this was the leading cause of premature mortality amongst young males. As it is also one of the leading causes of premature mortality in the Cape Winelands,<sup>37, 63</sup> homicide needs to be prioritized as a health need.

A multisectoral approach is needed to identify and implement strategies to prevent violence and injuries. This would require commitment from provincial and local authorities, including Health, Justice and Social Welfare, Safety and Security, Education and Housing, to implement, monitor, and evaluate programmes and surveillance systems.

Complex social factors and behaviours also need to be addressed. Social cohesion needs to be fostered to ensure safe and caring communities. A strong association between alcohol and fatal injuries has been shown in many studies.<sup>67, 68</sup> Other substances of abuse, such as tik, are also likely to be important contributors, but limited routine data has been collected in this area. Multi-level interventions are required to target such high risk behaviour.

### ***Women's health***

Most deaths were recorded for the older adult female population with just over 70% of deaths noted in those over 50 years of age.

Non - communicable diseases accounted for a high proportion of mortality in adult women, contributing more than 50% of the recorded deaths. Strokes (15.5%), ischaemic heart disease (13%) and cardiac failure (11%) accounted for about 40% of these deaths. Mortality rates for cardiovascular conditions need to be reduced through health promotion, lifestyle modifications, improved risk factor management at a primary care level, and secondary prevention after a cardiovascular event. Smoking rates are particularly high in the coloured population, especially among females, and a major predisposing risk factor in these chronic diseases.<sup>69</sup>

Tuberculosis was the other single largest cause of mortality amongst adult women accounting for 15.5% of deaths. HIV disease accounted for 13% of deaths. This burden of communicable disease was seen mainly in younger women.

While the focus of a women's health programme needs to continue to address women's specific conditions, it is clear that reducing the premature mortality burden for women will require interventions targeting TB and HIV/AIDS on the one hand, and strokes and cardiovascular diseases on the other.

### ***Men's health***

Men's health has traditionally been overlooked, which is of concern given that there are consistently more male deaths than females, and high mortality rates among young adult men. The range of conditions in the leading causes of mortality for males indicates a quadruple burden of disease:

1. infectious diseases comprising TB and lower respiratory infections
2. injuries, especially among young adults
3. non-communicable diseases such as stroke, heart disease and malignancy in the older adults
4. the growing HIV/AIDS epidemic

The data indicates a need to focus health efforts on violence and injuries, TB and HIV/AIDS, smoking and other risk factors for chronic diseases.

A larger proportion of deaths were recorded for the younger male population, with more than half of the recorded deaths in those younger than 50. Peak incidence of deaths occurred in young adult males. In this group communicable diseases predominated, namely pneumonia, TB and HIV disease.

Pneumonia, malignancy and strokes were the leading causes of death in older males. Globally, lung cancers are the most common cause of death from cancer among men. Prostate cancer is the most common amongst South African men, with the incidence of lung cancer on the increase, particularly amongst smokers.<sup>21</sup> Amongst the noted deaths due to malignancy, extensive metastatic disease and lung cancer predominated.

### *Limitations*

The results are based on information gained from patient folders and, as with any surveillance system it is important to assess the completeness and quality of the data before drawing final conclusions. Certain limitations of this study have been identified, including:

- data are subject to content errors and omissions. For example, even though provision is made in the patient's folder and death certificate to record race and marital status, many folders do not contain this critical information
- the cause of death will be misreported if an incorrect cause of death has been documented in the folder. It was not possible to validate the accuracy of the cause of death
- many folders contain non-specific information on the causes of death, making accurate interpretation difficult

## **CHAPTER 7: CONCLUSION**

This study has provided useful data on the mortality profile of the local population in Paarl. Analysis of the data points to emerging health issues and vulnerable groups who can be identified and targeted for interventions. In addition, it has highlighted the need for more reliable and accurate cause-of-death statistics, and for improving completeness and quality of death certification. The study has also provided information regarding triage practices, identifying the need for continued training of doctors and nurses using the SATS.

Notably:

- Lower respiratory infections are the leading cause of mortality in the EC
- The high burden of deaths due to TB HIV/AIDS is cause for concern (TB is the second leading cause of death)
- HIV/AIDS ranks fourth, higher than in both provincial and national rankings
- Overall, mortality rates due to non-communicable diseases are high (stroke and cardiac disease are leading causes of death)
- There are pronounced gender differences. There are more male deaths than females, despite the province having more females than males. The nature of non-communicable diseases differs between males and females.
- Homicide / violence is a particular concern amongst young adult males

Diseases profiled highlight the relationship between inequality and social determinants that impact upon health. These include poverty, unemployment or low income, education, housing conditions, lifecycle influences, and location. Inequities in health remain a challenge not just for poverty related conditions and injuries but also for non-communicable diseases.

## **CHAPTER 8: RECOMMENDATIONS**

### ***Recommendations concerning Cause of Death and BoD***

While efforts are being made to combat the chief causes of death in the study population, it is clear that these need to be expanded. The quadruple burden of disease demonstrated in the study sample requires a broad range of interventions to address and alleviate the needs of the population.

#### *Chronic Diseases*

- Primary care for the management of non-communicable diseases must be improved.
- Further local audits are needed to provide current information regarding levels of staff training, competency, staffing, equipment, patient load and available resources.
- Promotive and preventive healthcare strategies need to be strengthened.

#### *Communicable Diseases*

##### *Tuberculosis*

- TB control must be prioritized within the provincial Health Department.
- Intersectoral interventions aimed at reducing poverty and improving living conditions need to be increased.
- Integration with HIV care is needed, to strengthen the health service response.

##### *HIV Disease*

- Increase and strengthen intersectoral prevention strategies and health promotion.
- Strengthen the HIV/AIDS, Voluntary Counselling and Testing (VCT) and PMTCT programmes.
- Support and maintain the antiretroviral treatment (ART) roll-out to pregnant HIV-positive and HIV-positive patients.
- Promotion of safe sexual practices and improved treatment of STIs.

### *Injuries*

- An intersectoral approach is needed to identify and implement strategies to prevent violence and injuries.
- Poverty alleviation and unemployment needs to be addressed.
- Evaluate the readiness of ECs and staff to deal with serious road traffic accidents and homicides.

### ***Recommendations concerning documentation of Causes of Death***

- Medical students and doctors should have improved training in the completion of death notifications.
- Cover this topic as part of a CPD programme, including:
  - the public health importance of mortality data ,
  - process of death certification,
  - concept of a causal sequence and the underlying cause of death,
  - distinction between cause and mechanism of death,
  - appropriate terminology to use when writing cause of death statements

### ***Recommendations concerning Triage Practice***

- Triage practices should form part of a quality assurance programme.
- Triage challenges should be identified, researched and addressed.
- Regular audits and in-service education should be used to help address these challenges.
- Periodic refresher courses and train-the-trainer courses should be offered to staff.
- Waiting times must be improved to meet current recommendations. Specifically, immediate care for life-threatening problems needs to be prioritized. Regular assessments and audits should be done on these waiting times and form part of the quality assurance programme.

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