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Morbidity and mortality patterns among the under 5 year old children admitted to district hospitals in the Eastern Cape, 2000-2004

by

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DECLARATION

"I declare that the dissertation that I am hereby submitting to the University of Pretoria for the Masters of Science in Epidemiology degree is my own work and that I have never before submitted it to any other tertiary institution for any degree."

The ethics reference number for this study was S116/2005 and was approved on the 31st August 2005.

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Acronyms and Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
LOS	Length of Stay
BoDx	Burden of disease
DoH	Department of Health
DHIS	District Health Information System
ECP	Eastern Cape Province
HIV	Human Immunodeficiency Virus
ICD-10	International Classification of Disease 10th Revision
IMCI	Integrated Management of Childhood Illnesses
GBD	Global Burden of disease
LRTI	Lower Respiratory Tract Infections
MRC	Medical Research Council
NBD	National Burden of Disease
PEM	Protein-energy malnutrition
PGDP	Provincial Growth & Development Plan
SA	South Africa
StatsSA	Statistics South Africa
TB	Tuberculosis
URTI	Upper Respiratory Tract Infections
VCT	Voluntary Testing & Testing
WHO	World Health Organization

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ABSTRACT

Introduction: The evaluation and improvement of the quality of health care services begins with the knowledge about the trends and causes of diseases.

Purpose: To describe the morbidity and mortality patterns for the under-5 year old children who were admitted in 11 district hospitals in Eastern Cape Province from 2000 to 2004.

Methods: Descriptive study where a multi-stage sampling technique was used to select 11 district hospitals. There were 25,122 causes of paediatric ward admissions (2000 to 2004) among under-5 children from ward register were reviewed and ICD-10 coded.

Findings: Pre-transitional causes were the leading causes of morbidity **(**68.4%) and mortality (74.2%) especially diarrhoeal lower respiratory tract infections and protein-energy malnutrition. There was particularly among male high infant morbidity and mortality rates observed from 2000 to 2004. Non-communicable diseases (8% morbidity and 4.2% mortality) and injuries (10% morbidity and 4.4% mortality) appeared to be of less public health concern among the under-5 children.
Majority of under-5 mortality (43.4%) occurred within 24 hours of admissions (23.7% died on arrival). Influential variables for morbidity and mortality were region (Eastern), age (infants), year admitted and broad classification of the diseases (group I causes). There was a constant increase in morbidity and mortality which was observed during studied period.

Conclusion: Pre-transitional causes (especially diarrhoeal, lower respiratory tract infections and protein energy malnutrition) were of public health concern among the under-5 children and their magnitude has increased over the years studied.
Key words: mortality, morbidity, pre-transitional causes

CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

1.1. INTRODUCTION

Currently, there is no information available on the leading causes of under-5 mortality, associated factors, and updated health indicators like neonatal, peri-natal, infant and mortality rates for the Eastern Cape.

In the Eastern Cape Province Provincial growth and development plan (PGDP) for 2004 to 2014, one of the priorities for government is to reduce by two-thirds the under-5 mortality rate by 2014.

The Eastern Cape province has been using information from previous studies like 1998 South Africa Demographic & Health survey, 1996 South African Cause of Death profile, 2000 South African National Burden of Disease, etc for planning and decision making. This information has probably changed over the years with the impact of HIV/AIDS.

This study intends to describe the under-5 morbidity and mortality patterns in the public sector district hospital in the Eastern Cape during the period 2000 to 2004.

It is aimed at identifying the leading causes of under-5 mortality. This information will influence planning and decision making on disease management and treatment, health intervention strategies; assessments of the quality of care and resource allocation to improve quality of health care.

This will be the first attempt to undertake a provincial hospital based morbidity and mortality study among the under-5 years children with an aim of addressing the question of major causes of death in that age group.

Eastern Cape Province

Eastern Cape is one of the 9 provinces in South Africa with 6 districts and 1 metro. It occupies a large area size of 169, 580 km^2, which constitutes 13.9% of the total land area of South Africa (1).

It is located in the south-east part of South Africa, bordering with Free State, in the North-West Kwazulu Natal in the north-east and Lesotho in the north, the Indian Ocean along its south and eastern boarders, and western and Northern Cape in the west (1). Figure 1 below shows the different districts/regions of the Eastern Cape Province.

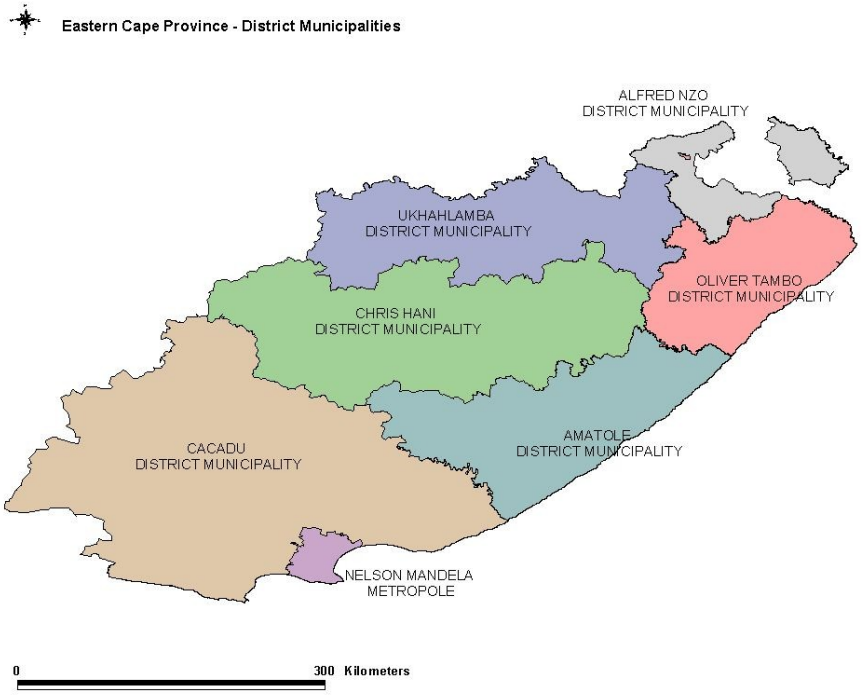


Figure 1: Eastern Cape Province Map (Source: Eastern Cape Department of Health)

According to Census (2001) the Eastern Cape Province population was 6.4 million i.e. 87.5% blacks, 7.4% colored, 4.8% whites and 0.3% Asians/Indians (2). The population is predominately rural with 36.6% urban and 63.4% rural and it is the third largest after Gauteng and Kwazulu Natal provinces (2).

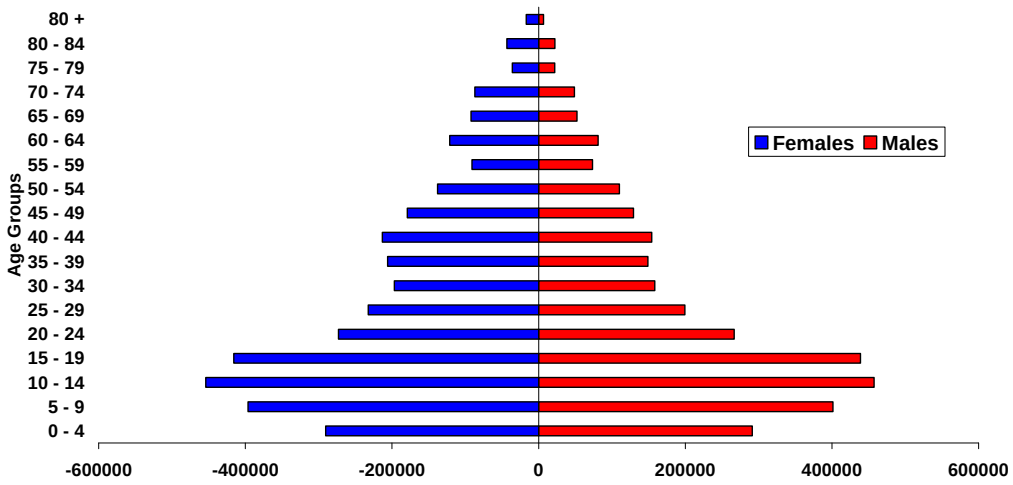


Figure 2: Eastern Cape Population Pyramid, 2005
(Source: 2005 ECP DHIS estimates)

The data which were used to construct the abovementioned pyramid were from DHIS software and was extrapolated from the Republic of South Africa population census 2001 data.

The gender distribution of the Eastern Cape Province was 43.8% females and 53.2% males. The age distribution was 35% under-15 year olds, 8.9% under-5 year and 12.2% were between the age of 5 and 9 years (2).

These may suggest that the population of the Eastern Cape Province was generally a young population as observed in most of the less developed countries.

1.2. LITERATURE REVIEW

Reports indicate that globally, mortality in the under-5 child population has decreased from 17 million (147 per 1,000 live births) in 1970 to 15 million (30% of deaths globally) in the mid-1980s and further to 10.5 million (80 per 1,000 live births) in 2000 (3). This decrease was evident in Eastern Mediterranean, South East Asia, Americas i.e. Latin America, while that of African Region remained high (3).

In 2002, 57 million deaths were reported across the world, of these, 10.5 million were children under the age of 5 years (4). The causes of deaths arising in the peri-natal period were the leading causes of death (>2.4 million deaths), followed by lower respiratory tract infections (2.1.million), diarrhoeal diseases (1.3 million), malaria (>900,000) and measles (approximately 590,000 deaths) (4).

Despite decades of sustained progress in all regions of the world in reducing child mortality due to Group I cases, five of ten leading causes of under-5 mortality were communicable diseases and peri-natal disorders (5).

In 1990, it was estimated that 7.5 million under-5 children died due to both diarrhoeal diseases and acute respiratory infections (7). In 2004, it was indicated that 19% of deaths were due to pneumonia, 17% diarrhoeal diseases, 10% neonatal severe infections, 27% other neonatal causes, malaria (8%) and measles (4%) (6).

Reports further indicated that communicable diseases accounted for 60% of child deaths in 2000, and were among the top ten causes of deaths among the under-5 children.
Infectious and parasitic diseases are the major causes of death among children in developing world partly as a result of HIV/AIDS (4).

The probability of child death in industrialized countries was less than 1% compared to that in Africa and other developing countries, (e.g. Sierra Leone had almost 300 deaths per 1000 live births) while in parts of Asia (Afghanistan, Cambodia, Laos, Myanmar, Nepal and Pakistan) the figure was more than 10% i.e. 100 per 1000 live births (8).

The decline in child mortality has masked the widening gap between the rich and poor. However, in many parts of the world which includes Africa and Central Asia, child mortality remains unacceptably high (10).

In countries where child mortality was high, multi-sectoral approach combined with direct intervention (like immunization) and indirect interventions (education and family planning) have increased life expectancy and decreased child mortality (10).

Throughout the past century, Europe had the lowest under-5 mortality rate, followed by the Americas and Western Pacific, Eastern Mediterranean, South East Asia and Africa respectively (9).

As the HIV/AIDS epidemic continues in Africa, particularly in southern Africa (with sero-prevalence above 20%), and in parts of Asia, further reduction in child mortality become increasingly unlikely until substantial progress in controlling the spread of HIV is achieved. It is estimated that an average of about 15% of newborn children in Africa are expected to die before reaching their fifth birthday (11).

Becker and colleagues (2004) suggested that a death of a mother was one of the risk factors for child survival (13). Africa has the highest Maternal Mortality Rate (MMR) (830 per 100,000) followed by Asia (330 per 100,000), Oceania (240 per 100,000), Latin America and Caribbean (190 per 100,000) and the developed countries (20 per 100,000) (9).

Numerous factors which include socio-economic and developmental factors like education level and poor environmental conditions affect disease incidence through a broad group of proximal determinants of child survival: maternal factors, nutrient deficiency, environmental contamination, injury and personal illness control (12).

The additional determinant of child health and child survival is the availability of health services and the capacity to use these services (12). In addition, other common risk factors which were found to be associated with high child mortality rates were high fertility rates with early child bearing, short birth spacing and high parity. Hence there is a need for effective and targeted family planning programmes (10).

Children born of younger mothers were found to have a higher risk of dying than those born to women aged 25-34. The effect of the demographic structure that is dominated by the young in the developing countries has been to produce an upward bias in estimates of the under-5 mortality rate (11).

The Burkina Faso study (2004) on infant and child mortality identified risk factors like the death of the mother (<10% live beyond their first year of life) and twin birth (both pronounced in the first year of life), reduced child care, no breastfeeding, improper bottle feeding, and birth spacing of less than 18 months, births during rainy seasons and belonging to an ethnic and religious group (13).

In South Africa, HIV/AIDS was the leading cause of death among the under-5 year's children (where it accounted for 40% of deaths) in 2000, with the highest number of deaths occurring among the under-1 year old children (14).

Some of the causes of death which accounted for 30% of childhood deaths were associated with poor socio-economic conditions (i.e. low birth weight, diarrhoeal diseases, lower respiratory infections and protein-energy malnutrition) and could have been prevented through the delivery of effective primary health care (14).
According to the Statistics South Africa 1997 to 2001 report, the emergence of HIV, TB, Influenza and pneumonia are the main causes of deaths (16).

The key health problems that were identified in South Africa were malnutrition which is a critical factor which increases the likelihood of children being susceptible to preventable childhood infections such as diarrhea and acute respiratory infections, emerging epidemics including HIV/AIDS and the scourge of violence and trauma against children (3, 15).

The findings of the 1997-2001 Limpopo Province disease burden study, was that for boys and girls under-5, lower respiratory tract infections and diarrhea were ranked the highest respectively (17). Among the top ten causes of death in the under-5 year olds were protein-energy malnutrition; undetermined intentional or unintentional injuries, HIV/AIDS, low birth weight, ill-defined natural causes, other nervous system disorders, cot death and other peri-natal causes. However, there was a difference in ranking of those causes among boys and girls (17).

South Africa Demographic & Health survey (1998) indicated that neonatal, infant and under-5 mortality rates were 25, 61.2 and 83 deaths per 1,000 live births respectively in Eastern Cape. These rates were higher in the former Transkei than in areas outside the former Transkei (18).

In 2000, the South African National Burden of Disease (NBD) study estimated that infant and under-5 mortality rates have increased to 60 and 95 per 1,000 live births respectively (19).

The National Department of Health's Strategic Framework for the four years has made provision for specific child-related interventions which include reduction of infant and under-5 mortality, implementation of National Programme of Action (NPA) for all children and implementation of integrated Management of Childhood Illnesses (IMCI) (18).

Morbidity is not well documented and is not a simple problem with a single solution but with a multiple and interrelated determinants which required a series of approach and policies (19).

In 2000, it was estimated that 90% of diarrhoeal disease morbidity were attributed to poor sanitation, lack of access to clean water and inadequate personal hygiene (20).
Global immunization programmes which were implemented through the Expanded Programme on Immunization led to a decrease in measles pneumonia and childhood pertusis (20).

In 2003, Lancet indicated that infants aged 0-5 months who are not breastfed have seven-fold and five-fold increased risks of death from diarrhoea and pneumonia respectively, compared with infants who are exclusively breastfed (21). At the same age, non-exclusive rather than exclusive breastfeeding results in more than two-fold increased risks of dying from diarrhea and pneumonia (21, 22).

In 2004, it was estimated that the poverty rate in the Eastern Cape Province was 68.4% and the highest poverty rate was observed in Alfred Nzo District Municipality (82.4%), OR Tambo District Municipality (81.5%), Ukhahlamba District Municipality (80.8%), Chris Hani District Municipality (75.7%) and Amatole District Municipality (68.1%). Poverty rate was low in Cacadu District Municipality (45.8%) and Nelson Mandela Metro (38.6%) (23).

There are several challenges which affect the population of the Eastern Cape Province which includes unemployment, low coverage of safe water and sanitation services. There are only 20.4% of people who are employed, 24.6% unemployed among the 55% economically inactive population (24). It was further estimated that the unemployment rate was 30% in the Eastern Cape Province and 41% in Nelson Mandela Metro, 35% in Amatole and 32% in Cacadu which may be attributed to the fact that both districts are better developed that the other districts (23).

In 2001, there were 62.4% of households with access to piped water, 30.8% without toilet facilities and 36.3% with refusal removal at least once a week (1, 2).

In 2004, it was estimated that HIV prevalence among Antenatal care attendees in the Eastern Cape was 28% and syphilis prevalence was 2.4 % (24).

Rationale for the study

Under-5 morbidity and mortality rates are among the well-recognized sensitive indicators of the health status of the community. Improvements in the health of the population will be reflected at an early stage through the reduction in under-5 mortality rate. The Eastern Cape is not only predominately rural but it is one of the poorest provinces in South Africa.

As with other parts of South Africa, the coverage and access to primary health care services are high for both urban and rural communities. The majority of the population in the Eastern Cape relies on the public sector health services for health care. The province has a well distributed network of district hospitals (Figure 3).

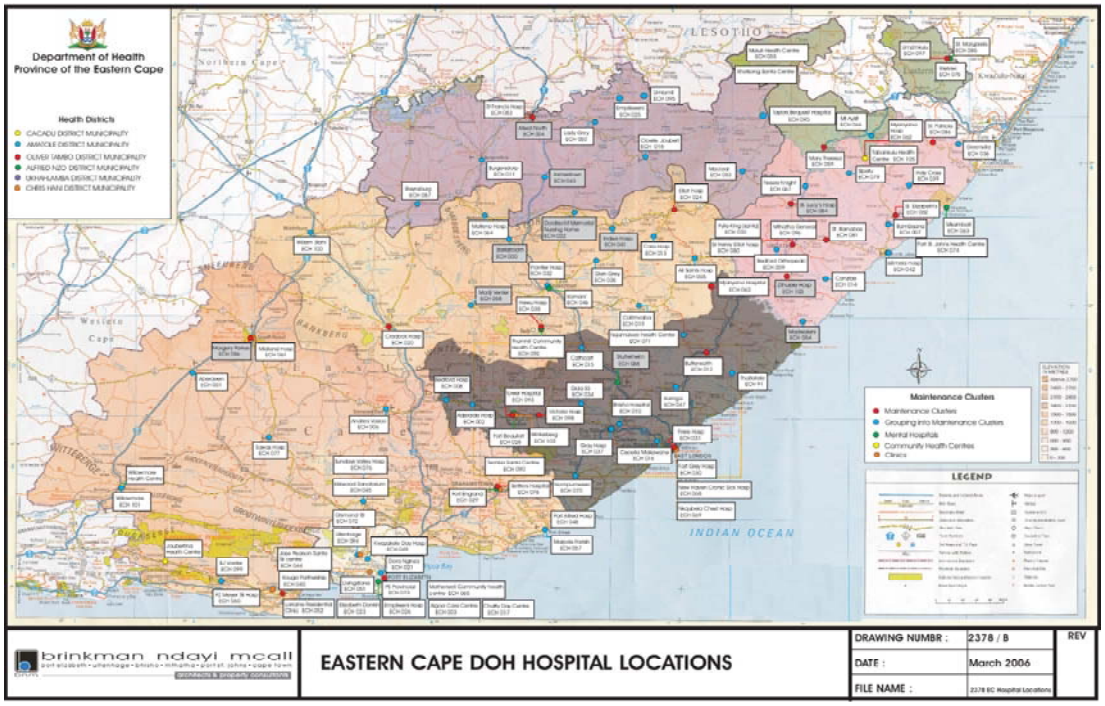


Figure 3: Hospital distribution in the Eastern Cape (Source: Eastern Cape Department of Health)

Thus a study on morbidity and mortality patterns in the Eastern Cape public sector district hospitals will provide reasonable and accurate estimates of morbidity and mortality patterns in the province. These estimates will be useful to influence priority setting and improvement of the quality of health care services especially for children.

CHAPTER 2: AIM AND OBJECTIVES

2.1. Aim of study

- The aim of the study was to describe the morbidity and mortality patterns for the under-5 year old children of the Eastern Cape Province from 2000 to 2004.

2.2. Objectives

- To describe morbidity and mortality patterns among the under-5 year old children admitted in paediatric wards in district hospitals from 2000 to 2004.
- To rank according to the magnitude the causes of death and further classify them according to Global Burden of Disease list that divide them into three broad groups i.e. pre-transitional causes, non-communicable diseases and injuries.

CHAPTER 3: METHODOLOGY

3.1. Definition of terms

a. Proportional mortality (PM): the number of observed deaths from a specified condition in a defined population, divided by the number of deaths observed in that particular year in that population (25).

Proportional mortality for all the children who died during the studied period was calculated using the formula below.

$$\textbf{Proportional mortality (PM)} = \frac{\text{Number of deaths due to cause Y}}{\text{Total number of deaths in that year}} \times 100$$

3.2. Exclusion and inclusion criteria

Inclusion criteria

- All children under the age of 5 years who were admitted from the 1st January 2000 and 31st December 2004.
- Children admitted in paediatric ward in sampled district hospitals.

Exclusion criteria

- Current clients of private, regional and provincial hospitals and primary health care facilities were excluded.
- Children who were transferred from other provinces to Eastern Cape hospitals or with place of residence outside Eastern Cape Province.
- Children with age not recorded in the records.
- Above 5 years old children were excluded.

3.3. Methodology of the study

3. 3. 1. Study design and study population

The study design was a cross-sectional study which was based on a retrospective record reviews which were conducted in paediatric wards in selected district hospitals in the Eastern Cape Province, covering the 5 year period from 1st January 2000 – 31st December 2004.

All under-5 children who were admitted in the eleven sampled district hospitals from 1st January 2000 – 31 December 2004 constituted the study population.

3. 3. 2. Sampling methods

In 2005, there were 92 hospitals in the Eastern Cape Province. These included 47 districts, 10 regional, 5 psychiatric or specialized, 18 provincial aided and 12 TB hospitals. Hence, the sampling frames for this study were 47 district hospitals in the province.

Sampling technique

A multi-stage random sampling technique was used where district hospitals were randomly selected from the district hospitals data-base from the Department of Health using Epi Info version 6 (Centers for Disease Control, Atlanta, GA, USA). All district hospitals were grouped into clusters using the current demarcations i.e. district and metro demarcations of the province.

Sample size calculation was done using Epi Info version 6 and 21 district hospitals were randomly selected from 7 clusters (6 districts and 1 metro). However, due to financial constraints (especially for traveling and accommodation costs), re-sampling of district hospitals was conducted.

When re-sampling was conducted, data collection already occurred two clusters i.e. Amatole (4 hospitals) and OR Tambo (two hospitals). In the remaining 5 clusters, one district hospital per cluster was randomly selected using Epi Info version 6. And the number of hospitals was reduced from 21 to 11 hospitals i.e. 4 hospitals in Amatole and 2 hospitals in OR Tambo and one district hospital from the remaining 5 clusters.

In this study there were more hospitals that were selected from the Central region and fewer from the Eastern and Western regions. This re-sampling might have introduced selection bias.

The following district hospitals were selected for this study:

- Central Region
  - Amatole district - Bisho Hospital, Butterworth Hospital, SS Gida Hospital(Keiskamahoek), Nompumelelo Hospital (Peddie)
  - Chris Hani District - Glen Grey Hospital (Lady Grey)
  - Ukhahlamba District - Empilisweni Hospital (Sterkspruit)
- Eastern Region
  - Alfred Nzo District - Mary Theresa Hospital (Umzimvubu)
  - OR Tambo District - St Barnabas Hospital (Lebode) and Zithulele Hospital (Zithulele)
- Western Region
  - Cacadu District - Settlers hospital (Grahamstown)
  - Nelson Mandela Metro - Uitenhage Hospital (Uitenhage)

3.3.3. Data collection, capturing and analysis

Data were collected by the researcher using a data collection tool created by the researcher. This study tool was piloted in one of the hospitals in Amatole district.

The tool was then modified to meet the needs of the study.

Data collection took place from December 2005 to May 2006. Data capturing was done using Epi Info version 3.4.3.

The variables which were extracted from the records using the data collection form (see Appendix 1) were the name of hospital, age, gender, place of residence (does not include the exact address but just a place), date admitted, admission diagnosis, date discharged, date of death and final diagnosis.
Data capturing was done using Microsoft 1997-2003 Excel spreadsheet.

Descriptive analysis was done using Epi Info version 3.3.2 and Stata version 9 for both morbidity and mortality for the 2000-2004 period studied. This analysis included the calculation of frequencies, proportions and confidence interval, estimates on causes of morbidity and mortality by age, gender, year and regions.

There were two hospitals (Nompumelelo and Zitulele) which did not have admission registers for 2000 and 2001.
Sampled district hospitals were using two different types of admission registers. The first type of register only required that the age of the child should be selected between under-5 and above 5 years. These four hospitals included Empilisweni (from 2000 to 2002), Glen Grey, SS Gida and Zitulele hospitals. The second type of a register required that the age of a child be recorded.

3.3.4. Classification and coding of diseases

Diagnoses were classified using South African Burden of Disease (NBD) list and also International Classification of Diseases (ICD-10) coding list developed by World Health Organization.

Both were classified into three groups i.e.:-

- Group I are pre-transitional causes: communicable diseases, maternal causes, peri-natal conditions and nutritional deficiencies. HIV and AIDS were also included into Group I.
- Group II, non communicable causes
- Group III, injuries: These may include both intentional and unintentional causes of deaths.
- Group IV, Ill-defined causes: Admission or final diagnosis not recorded.

Coding of multiple diagnosis

In cases where there was more than one diagnosis, the second and third diagnoses were coded separately.

This study was not aimed at providing the exact number of deaths and admissions (morbidity) but to show the major causes of deaths and trends over time.

3.3.5. Ethical considerations

The research proposal was submitted to the University of Pretoria Ethics Committee. Ethical approval was granted on the 31st August 2005 (Appendix 3).

Permission to conduct record reviews in district hospitals was also requested in writing from the Superintendent General of the Department of Health, Chief Executive Officers (CEO), Medical Superintendents and Matrons. Permission was granted to conduct the study (Appendix 2, 4 and 5).

The names of the patients and their residential address were not collected but only the place of residence. Confidentiality on information for each study participants or patients was maintained.

3.3.6. Outcomes

- Essential baseline information on the major causes of morbidity and mortality among the under-5 years old children who were admitted in district hospitals which will lead to information driven planning and influence policy formulation.
- This study will lead to another study which will concentrate on the other age groups which were not covered by this study.

3.3.7. Limitations of the study

- Exclusion of community morbidity and mortality information of those individuals who never presented in district hospitals. Those children under 5 years of age who were not hospitalized even though they were sick and or died outside the hospital setting were excluded in the study. There may be a gross under-reporting of both morbidity and mortality.
- Selection bias of the facility-based study. According to WHO, facility based studies will always be based on biased samples of the disability present in the community.
- Misclassification of cases e.g. some of the patients had no diagnosis or symptoms recorded instead of a diagnosis. These contributed to an increased number of Ill-defined causes of morbidity and mortality.
- Under-estimation of the impact of HIV and AIDS. Due to fear of stigma, discrimination and the legal implications, indicator conditions or co-morbidity were specified in the records of the patients rather than the underlying cause e.g. HIV or AIDS. The HIV status of the deceased may thus be unknown or unverifiable.

- Risk factors which contributed to morbidity and mortality were not properly quantified. The study will not properly address or quantify the contribution of risk factors such as water and sanitation, malnutrition, methods of feeding of baby (breast, formula and mixed feeding) etc.
- Exclusion of other hospitals (i.e. private health facilities, provincial aided, regional, tertiary hospitals) and primary health care data which might have under-estimated morbidity and mortality.
- Incompleteness, accuracy and availability of records. In some of the hospitals, 2000 and or 2001 records were not available because of their archiving policies where old records are destroyed after every five year period. Incompleteness of information e.g. final diagnosis, date of discharge, HIV test results and other important variables were not available in some cases.
- Financial constraints. The number of sampled hospitals had to be reduced from 21 hospitals to 11 district hospitals due to financial and logistical constraints.
  The distribution of the 11 district hospitals studied was however uniform throughout the province and all district were fairly represented.

Even though primary health and private sector facilities were excluded, the study population represented the communities which they were coming from. The purpose of the study did not necessarily look at the number of deaths and morbidity in the community but the causes of morbidity and mortality. Hence, the impact of the limitations which includes excluded facilities may not have a significant impact to the study.

CHAPTER 4: RESULTS

This study on morbidity and mortality in Eastern Cape Province was based on 25,122 diagnoses of the under-5 year old children admitted in 11 sampled district hospitals from 2000 to 2004. There were 2097 (8.3%) deaths which were attributed to all causes of mortality (figure 9).

This study might have under-estimated under-5 mortality because not all records had the date of discharge or outcome recorded.
Ill-defined causes might have influenced the magnitude of other causes of morbidity and mortality.

4.1. Morbidity profile

4.1.1. Descriptive analysis of morbidity

a. Distribution of under-5 children by hospital

Table 1: Number (%) of under-5 children admitted during 2000-2004 by district hospital

Name of hospital	Age group (years)						Total	%
	< 1	%	1 - 4	%	Unknown	%		
Bisho	1270	45.78	1502	54.15	2	0.07	2774	100
Butterworth	1263	35.61	990	27.91	1294	36.48	3547	100
Empilisweni	1637	47.78	1655	48.31	134	3.91	3426	100
Glen Grey	137	12.48	201	18.31	760	69.22	1098	100
Mary Teresa	1042	51.20	975	47.91	18	0.88	2035	100
Nompumelelo	244	49.39	250	50.61	0	0.00	494	100
Settlers	1804	42.28	2457	57.58	6	0.14	4267	100
SS Gida	227	18.03	343	27.24	689	54.73	1259	100
St Barnabas	887	44.17	1120	55.78	1	0.05	2008	100
Uitenhage	754	22.52	2581	77.09	13	0.39	3348	100
Zitulele	177	20.44	286	33.03	403	46.54	866	100
Total	9442	37.58	12360	49.20	3320	13.22	25122	100

Settlers (17.0%), Butterworth (14.1%), Empilisweni (13.6%), Uitenhage (13.3%) and Bisho (11%) hospitals had high number of admission compared to other district hospitals which participated in the study.

b. Age distribution of under-5 children

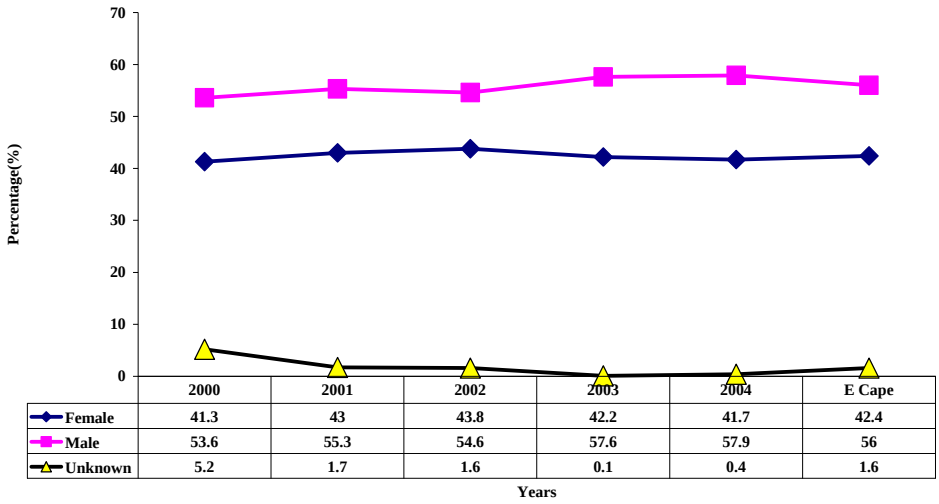
Table 2: Number (%) of under-5 children admitted in district hospitals in the Eastern Cape, 2000-2004

Year	Age group (years)			TOTAL
	< 1	1 – 4	Unknown	
2000	1872 (41.7%)	2616 (58.2%)	3 (0.1%)	4491(100%)
2001	1827 (39.6%)	2350 (50.9%)	439 (9.5%)	4616(100%)
2002	1391 (30.3%)	1943 (42.3%)	1257 (27.4%)	4591(100%)
2003	2100 (36.1%)	2830 (48.7%)	885 (15.2%)	5815(100%)
2004	2252 (40.1%)	2621(46.7%)	736 (13.1%)	5609(100%)
2000- 2004	9442 (37.6%)	12360 (49.2%)	3320 (13.2%)	25122 (100%)

Data was ICD10 coded and where there were more than 1 diagnosis, each diagnosis was coded separately.

Majority of admissions (49.2%) were 1 to 4 age group children compared to 37.6% infants and 13.2% with unknown age group i.e. the age of the child was not recorded in the hospital records but was just indicated that the child was under-5 child.

c. Gender distribution of under-5 children



	2000	2001	2002	2003	2004	E Cape
Female	41.3	43	43.8	42.2	41.7	42.4
Male	53.6	55.3	54.6	57.6	57.9	56
Unknown	5.2	1.7	1.6	0.1	0.4	1.6

Fig 4. Gender distribution of under-5 children admitted in district hospitals, 2000- 2004

From 2000 to 2004, there were 56% male admissions which were admitted compared 42.4% female admissions and 1.6% unknown gender.
This study did not explore factors which might have influenced the high number of male admissions compared to female admissions in the selected district hospitals as observed in the period studied (Figure 4).

There was an increase in male admissions from 53.6% in 2000 to 57.9% in 2004 with an unexplored decrease to 54.6% in 2002. Female admissions has also increased from 41.3% in 2000 to 41.7% in 2004 and decreased from 42.2% in 2003 to 41.7% in 2004.

d. Morbidity among the under-5 children per year

There was an increase in the proportion of under-5 admissions in selected district hospitals from 17.8% in 2000 to 23.2% in 2003 and 22.3% in 2004 (Figure 5).

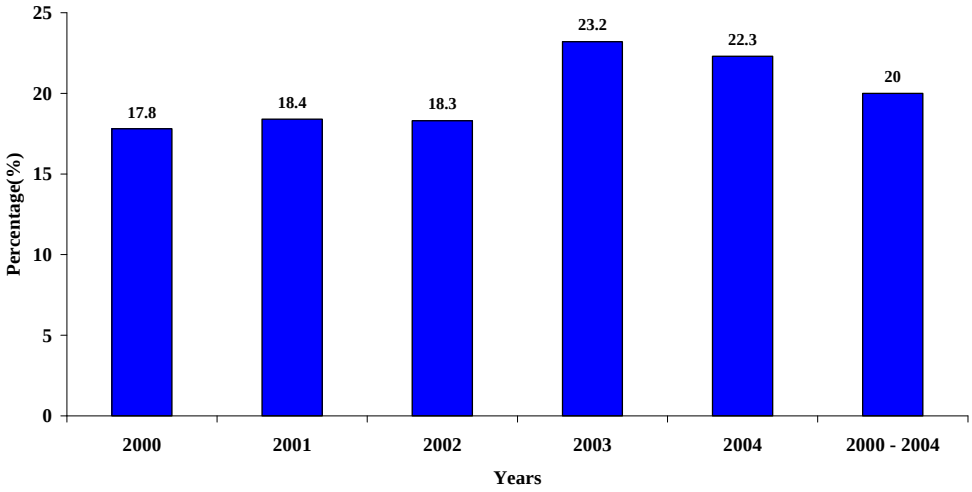


Fig 5. Morbidity among the under-5 admitted in district hospitals in the Eastern Cape, 2000-2004

Figure 5 indicates that there was a decrease in the proportion of admissions of the under-5 children from 23.3% in 2003 to 22.3% in 2004.

There was annual variation of morbidity patterns which was observed from 2000 to 2004. However, this study did not explore the reasons for such annual variations of child morbidity (Figure 5).

4.1.2. Causes of morbidity

4.1.2.1. Broad causes of morbidity

Group I (pre-transitional) causes were responsible for 68.4 % (95%CI: 67.9-69.0) of all causes of admissions or morbidity while 8% (95%CI: 7.7- 8.3) admissions were attributed to Group II (non-communicable) causes (Table 3).

Group III (i.e. injuries) were responsible for 10% (95%CI: 9.6- 10.3) of the admissions whereas 13.6% (95%CI: 13.2- 14.0) were attributed to Group IV (Ill-defined) causes (diagnosis not recorded) (Table 3).

Table 3. Global Burden of Disease (GBD) classification of the causes of morbidity in the Eastern Cape province, 2000-2004

	2000		2001		2002		2003		2004		2000-2004	
		95%CI		95%CI		95%CI		95%CI		95%CI		95%CI
Group I	2958(65.9)	64.5-67.2	3148(68.2)	66.8-69.5	3196(69.6)	68.3-70.9	3980(68.4)	67.2-69.6	3914(69.8)	68.6-71.0	17196(68.4)	67.9-69
Group II	415(9.2)	8.4-10.1	365(7.9)	7.2-8.7	369(8.0)	7.3-8.9	468(8.0)	7.4-8.8	394(7.0)	6.4-7.7	2011(8.0)	7.7-8.3
Group III	504(11.2)	10.3-12.2	470(10.2)	9.3-11.1	429(9.3)	8.5-10.2	570(9.8)	9.1-10.6	527(9.4)	8.7-10.2	2500(10.0)	9.6-10.3
Group IV	614 (13.7)	12.7-14.7	633(13.7)	12.7-14.7	597(13.0)	12.1-14.0	797(13.7)	12.8-14.6	774(13.8)	12.9-14.7	3415(13.6)	13.2-14
Total	**4491**	**100**	**4616**	**100**	**4591**	**100**	**5815**	**100**	**5609**	**100**	**25122**	**100**

Group I – Pre-transitional causes: peri-natal conditions and nutritional deficiencies, Group II - Non communicable causes, Group III – Injuries & Group IV - Ill-defined causes

Data was ICD10 coded and where there were more than one diagnosis, each diagnosis was coded separately.

There was an increase in the proportion of Group I causes (transitional causes, peri-natal conditions and nutritional deficiencies communicable diseases) from 65.9% (95% CI: 64.5-7.2) in 2000 to 69.8% (95% CI: 68.6-71.0) in 2004.

These findings further indicated that there was a decrease in Group II causes (non-communicable causes) which was observed from 9.2% (95%CI: 8.4 – 10.1) in 2000 to 7% (95%CI: 6.4 – 7.7) in 2004.

The proportion of Group III causes (Injuries) have decreased from 11.2 % (95%CI: 10.3 – 12.2) in 2000 to 9.4% (95% CI: 8.7 – 10.2) in 2004.

The greatest concern was the fact that there was a slight increase in the proportion of Group IV causes from 13.7% (95% CI: 12.7 – 14.7) in 2000 to 13.8% (95% CI: 12.9 – 14.7) in 2004.

These may suggest that there was no improvement in recording of patient information (including initial and final diagnosis) in the patient records or files, admission and discharge registers.

4.1.2.2. Disease specific causes of morbidity

Causes of morbidity among the under-5 children

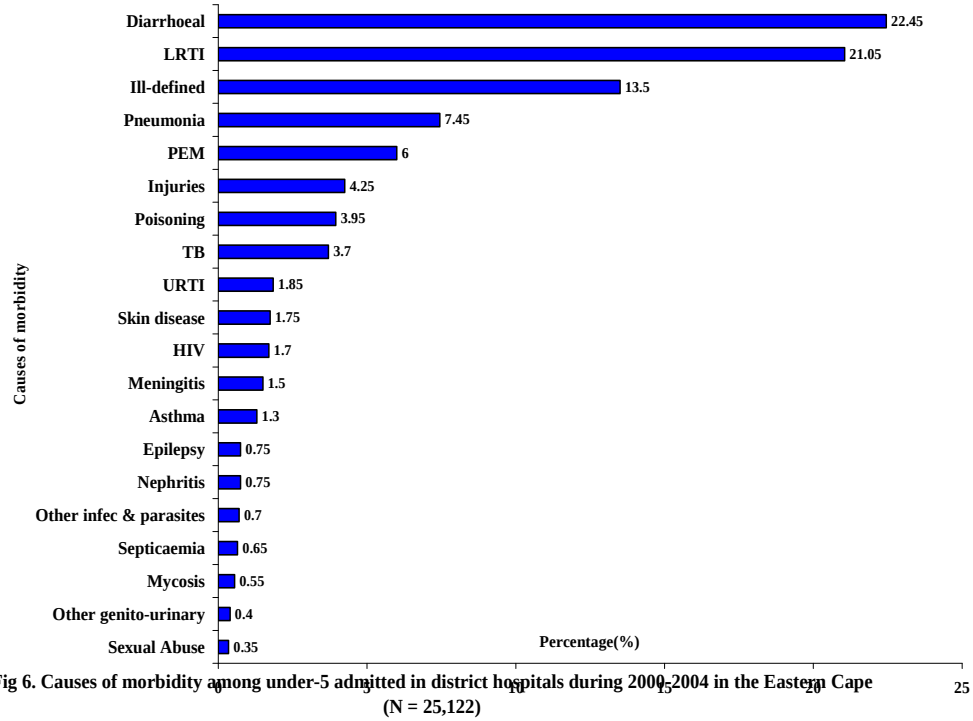


Fig 6. Causes of morbidity among under-5 admitted in district hospitals during 2000-2004 in the Eastern Cape (N = 25,122)

Diarrhoeal diseases (22.45%), lower respiratory tract infections (21.05%), pneumonia (7.45%), protein-energy malnutrition (6.0%) and injuries (4.25%) were the most common cause of admission or morbidity among the under-5 year old children who were admitted in district hospitals in the province (Figure 6).

TB was ranked 8th and accounted for 3.7% morbidity whereas HIV was not even among the top 10 causes of morbidity and was ranked 12th (accounted for 1.7% morbidity). However, it should be noted that not all children who were admitted in district hospitals were tested for HIV. This study further indicated that 13.6% causes of admission were ill-defined causes because of lack of information or instead of a diagnosis a symptom or sign was written in the hospital registers.

Causes of morbidity by gender

Table 4: Twenty commonest causes of admissions among the under-5 children admitted in district hospitals by gender in the Eastern Cape during 2000-2004 period

	Males (N = 14,009)		Females (N = 10,686)	
	Causes of admission	**% (95CI)**	**Causes of admission**	**% (95CI)**
1.	Diarrhoeal	22.1% (21.4-22.8)	Diarrhoeal	22.2% (21.4 – 23.0)
2.	LRTI	21.1% (20.4 – 21.7)	LRTI	21.0% (20.3 – 21.8)
3.	Ill-defined	13.6% (13.0 – 14.2)	Ill-defined	13.4% (12.8 – 14.1)
4.	Pneumonia	7.5% (7.1 – 7.9)	Pneumonia	7.4% (6.9 – 7.9)
5.	PEM	5.6% (5.3 – 6)	PEM	6.4% (6.0 – 6.9)
6.	Injuries	4.6% (4.2 – 4.9)	Injuries	3.9% (3.5 – 4.3)
7.	Poisoning	4.10% (3.8 – 4.5)	TB	3.80% (3.5 – 4.2)
8.	TB	3.60% (3.3 – 4.0)	Poisoning	3.80% (3.4 – 4.1)
9.	Skin disease	1.90% (1.7 – 2.1)	HIV	1.90%(1.7 -2.2)
10.	URTI	1.80% (1.6 – 2.1)	URTI	1.90% (1.6 – 2.1)
11.	Meningitis	1.60% (1.4 – 1.8)	Skin disease	1.60% (1.4 – 1.9)
12.	HIV	1.50% (1.3 – 1.7)	Meningitis	1.40% (1.2 – 1.7)
13.	Asthma	1.30% (1.2 – 1.6)	Asthma	1.30% (1.1 – 1.6)
14.	Nephritis	0.80% (0.7 – 1.0)	Epilepsy	0.80% (0.6 – 0.9)
15.	Epilepsy	0.70% (0.6 – 0.9)	Mycosis	0.70% (0.5 – 0.9)
16.	Septicaemia	0.70% (0.5 – 0.8)	Nephritis	0.70% (0.5 – 0.8)
17.	Other infectious and parasitic	0.60% (0.5 – 0.7)	Septicaemia	0.60% (0.5 – 0.8)
18.	Other genito-urinary	0.50% (0.4 – 0.6)	Sexual Assault	0.60% (0.5 – 0.8)
19.	Otitis Media	0.50% (0.4 – 0.6)	Other infectious and parasitic	0.60% (0.4 – 0.7)
20.	Assault	0.40% (0.3 – 0.6)	Otitis Media	0.40% (0.3 – 0.6)

Note: Data was ICD10 coded and where there was more than 1 diagnosis, each diagnosis was coded separately

Diarrhoeal diseases (22.1%), lower respiratory tract infections (21.1%), Ill-defined diseases (13.6%), pneumonia (7.5%) and protein-energy malnutrition (5.6%) were the major causes of admissions in those selected district hospital among males. Both TB and HIV were respectively ranked 8th and 12th causes of morbidity among the under-5 male children (Table 4).

There were no differences among males and females in terms of the causes of morbidity. Diarrhoeal (22.2%), lower respiratory tract infections (21.0%), ill-defined causes (13.4%), pneumonia (7.4%) and protein-energy malnutrition (6.4%) were among the major causes of morbidity among the under-5 female children.

TB and HIV were respectively ranked 7th and 9th causes of morbidity. Injuries were ranked 6th for both males and females and poisoning was ranked 8th cause of morbidity among females compared to 7th among male children.

Causes of morbidity by age group

Causes of morbidity among infants

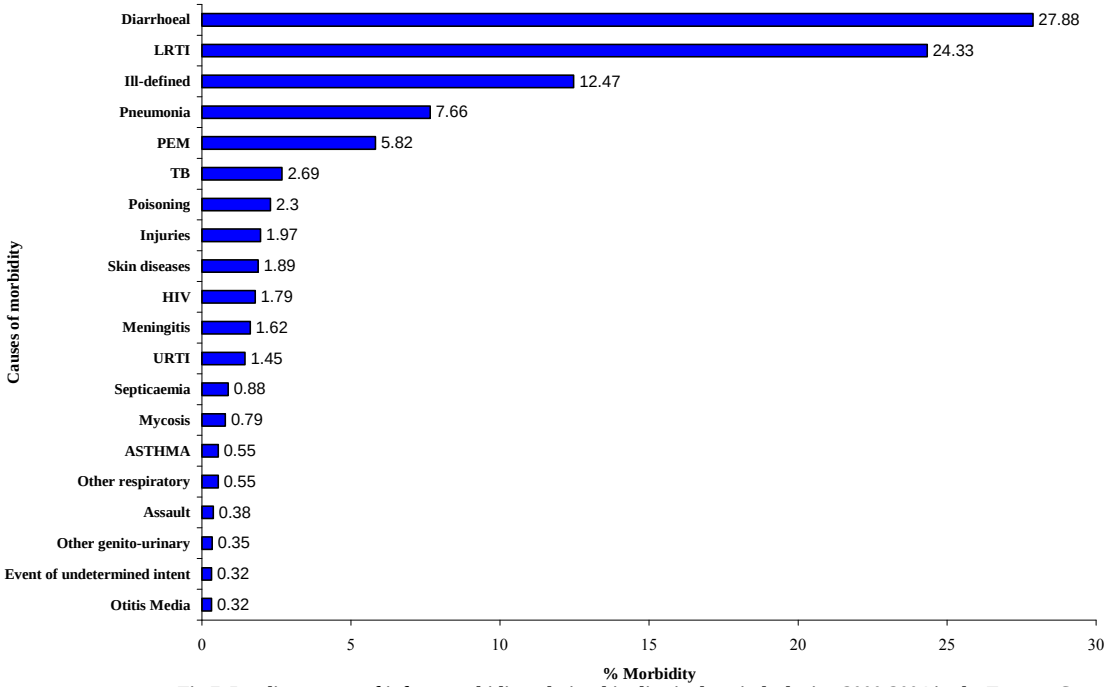


Fig 7. Leading causes of infant morbidity admitted in district hospitals during 2000-2004 in the Eastern Cape (N = 9,455)

The major causes of morbidity among infants were diarrhoeal diseases (27.88%), lower respiratory tract infections (24.33%), ill-defined (12.47%), pneumonia (7.66%) and PEM (5.82%) (Figure 7).

There were other causes of morbidity which were of public health importance which included TB (2.69%), poisoning (2.3%), injuries (1.97%), skin diseases (1.89%) and HIV (1.79%).

Causes of morbidity among the 1 – 4 year age group

Lower respiratory tract infections were the major cause of morbidity and has accounted for 18.98% followed by diarrhoeal diseases which accounted for 19.39% morbidity (Figure 8).

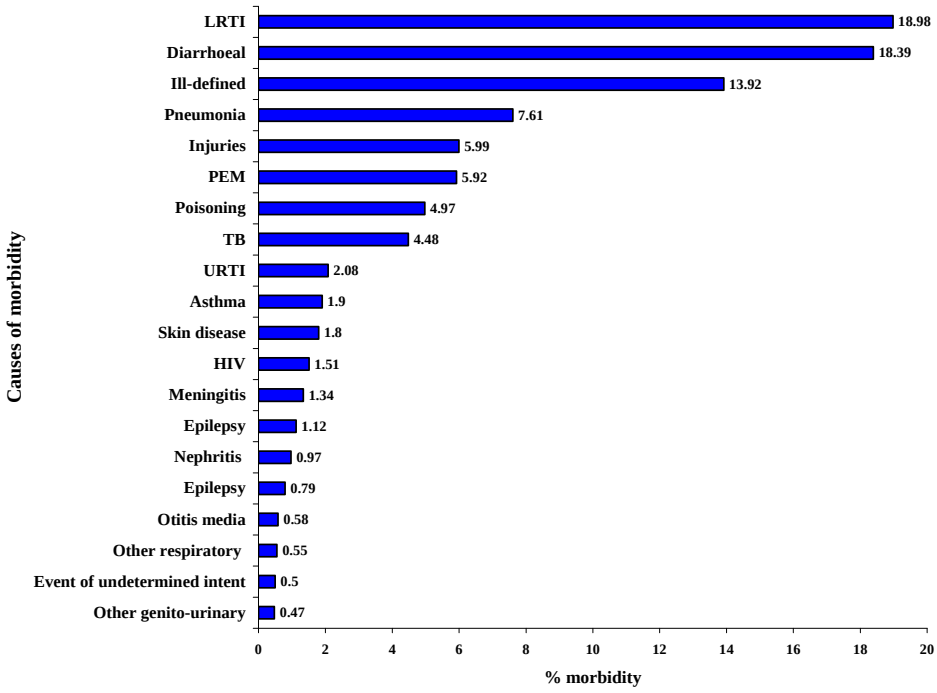


Fig 8. Causes of morbidity among 1 - 4 years old children admitted in district hospitals in 2000-2004 period in the Estern Cape(N = 12,346)

These findings further indicated that ill-defined (13.92%), pneumonia (7.6%), injuries (5.99%) and protein-energy malnutrition (5.92%) were major causes of morbidity and mortality among children aged 1- 4 years. Poisoning (4.97%) and TB (4.48%) were among the top 10 causes of morbidity. HIV was ranked the 12th cause of admissions or morbidity in the province.

Causes of under-5 morbidity by region

Table 5. Leading causes of under-5 morbidity in selected district hospitals during 2000 to 2004 period in Eastern Cape

	Central Region (%)	Eastern Region %)	Western Region (%)
1	Diarrhoeal (25.13)	LRTI (22.44)	LRTI (20.53)
2	LRTI (20.5)	Diarrhoeal (19.93)	Diarrheal (19.18)
3	Ill-defined (14.04)	Ill-defined (11.65)	Ill-defined (14.31)
4	Pneumonia (7.04)	PEM (11.05)	Pneumonia (8.96)
5	PEM (5.71)	Injuries (6.44)	TB (5.29)
6	Poisoning (4.51)	Pneumonia (6.43)	Injuries (3.44)
7	Injuries (3.64)	Poisoning (3.90)	Poisoning (3.24)
8	TB (3.04)	TB (3.11)	HIV (2.81)
9	URTI (1.79)	Skin diseases (1.95)	URTI (2.76)
10	Skin diseases (1.53)	Meningitis (1.70)	PEM (2.42)
11	Meningitis (1.39)	HIV (0.97)	Skin diseases (2.01)
12	Asthma (1.34)	Septicaemia (0.97)	Asthma (1.73)
13	HIV (1.23)	Asthma (0.93)	Meningitis (1.50)
14	Nephritis (0.90)	Other infectious & parasitic (0.92)	Assault (0.96)
15	Epilepsy (0.72)	URTI (0.87)	Child Sexual Abuse (0.92)
16	Mycosis (0.68)	Nephritis (0.85)	Epilepsy (0.83)
17	Septicaemia (0.59)	Epilepsy (0.65)	Other infectious & parasitic (0.70)
18	Other infectious and parasitic (0.55)	Otitis Media (0.53)	Otitis Media (0.66)
19	Other genito-urinary (0.47)	Other Respiratory Conditions (0.50)	Circumcision (0.58)
20	Event of undetermined intent (0.43)	Peripheral vascular disorders (0.30)	Other genito-urinary (0.53)

Diarrhoeal diseases, lower respiratory tract infections, protein-energy malnutrition and pneumonia were the leading causes of admissions in selected district hospitals in all regions in the province. Lower respiratory tract infections was ranked number 1 cause of admissions in both the Eastern and Western regions whereas diarrhoeal diseases were ranked the second cause of admissions both regions.

In the Central region, diarrhoeal diseases, lower respiratory tract infections and pneumonia were the leading causes of admissions.

4.2. Mortality patterns

4.2.1. Mortality among children under-5 in the province

Mortality by age group, gender and region

Table 6: Number (%) of under-5 deaths during 2000 – 2004 period by age group, gender and region in the Eastern Cape

		Number (%)	**95% CI**
Gender	Male	1146 (54.6)	52.5 -56.8
	Female	916 (43.7)	41.5 – 45.8
	Unknown	35 (1.7)	1.2 – 2.3
Age group (years)	< 1	1175 (56.0)	53.9 – 58.2
	1 - 4 y	635 (30.3)	28.3 – 32.3
	Unknown	287 (13.7)	12.3 – 15.2
Regions	Central	1133 (54.0)	51.9 - 56.2
	Eastern	642 (30.6)	28.7 - 32.6
	Western	322 (15.4)	13.9 - 17.0

There was 54.6% (95% CI: 52.5- 56.8) male mortality, 43.7% (95% CI: 41.5- 45.8) were females (Table 6).

There were 56.0% (95% CI: 53.9- 58.2) infant mortality, 30.3% (95% CI: 28.3- 32.3) were children aged 1 – 4 years and 13.7 % (95% CI: 12.3-15.2) unknown age group.

There were 54.0% (95% CI: 51.9 – 56.2) mortality occurred in Central region, 30.6% (95%CI: 28.7 – 32.6) in Eastern region and 15.4% (95% CI: 13.9 – 17.0) were from Western region.

Mortality by year

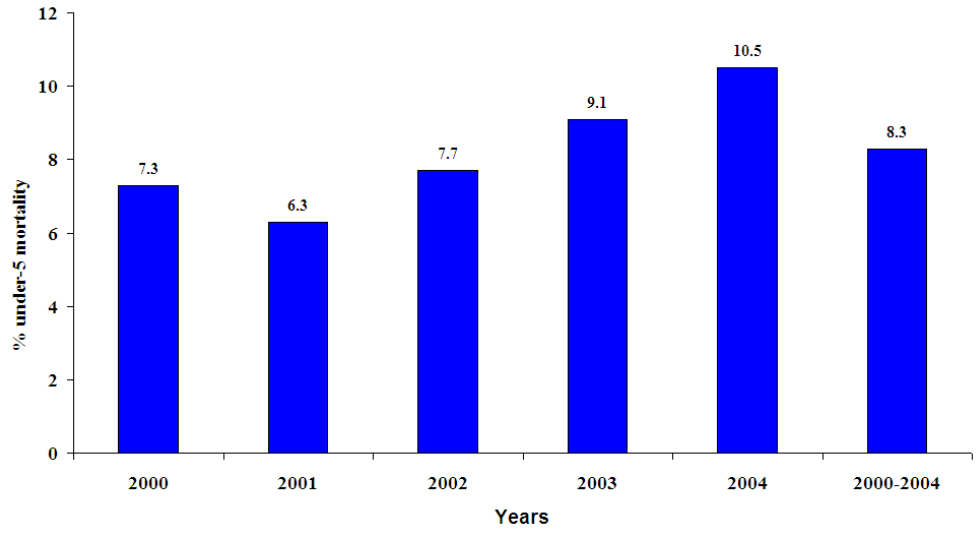


Fig 9. Mortality among under-5 admitted in district hospitals in Eastern Cape, 2000 - 2004 (N = 2097)

There was an increase in under-5 mortality from 7.3% in 2000 to 10.5% in 2004. However, there was a decrease in the proportion of deaths which was observed from 7.3% in 2000 to 6.3% in 2001 (Figure 9). There was 8.3% under-5 mortality due all causes of mortality which occurred during the studied period.

However, this decrease should be carefully interpreted because there were some hospitals which did not provide all the requested records because some had already destroyed or could not retrieve such records especially during 2000 to 2002.

Broad causes of mortality

Broad causes of mortality by year

Table 7. Broad classification of causes of mortality among under-5 children by year in the Eastern Cape, 2000-2004

	Group I	Group II	Group III	Group IV	Total
2000	234 (71%) (95% CI: 65.9 – 76.0)	51 (15.5%) (95% CI: 11.9 – 20.0)	19 (5.8%) (95% CI: 3.6 – 9.0)	25 (7.6%) (95% CI: 5.1 – 11.2)	329 (100%)
2001	215 (72%) (95% CI: 66.7 – 77.2)	42 (14.7%) (95% CI: 10.4 – 18.6)	17 (5.7%) (95% CI: 3.6 – 9.0)	24 (8.1%) (95% CI: 5.2 -11.7)	298 (100%)
2002	269 (75.8%) (95% CI: 71.0 – 80.1)	45 (12.7%) (95% CI: 9.5 – 16.7)	9 (2.5%) (95% CI:1.2 – 4.9)	32 (9.0%) (95% CI: 6.3 – 12.6)	355 (100%)
2003	393 (74.6%) (95% CI: 70.6 – 78.2)	60 (11.4%) (95% CI: 8.9 – 14.5)	21 (4.0%) (95% CI: 2.5 – 6.1)	53 (10.1%) (95% CI: 7.7 – 13.0)	527 (100%)
2004	445 (75.7%) (95% CI: 72 – 79.1)	63 (10.7%) (95% CI: 8.4 – 13.6)	25 (4.3%) (95% CI: 2.8 – 6.3)	55 (9.4%) (95% CI: 7.2 – 12.1)	588(100%)
Total	1556 (74.2%) (95%CI: 74.2-76.1)	261 (12.6%) (95% CI: 11.1 – 14.0)	91 (4.3%) (95% CI: 3.5 – 5.3)	189 (9.1%) (95% CI: 7.8 – 10.3)	2097 (100%)

Group I - Transitional causes, peri-natal conditions and nutritional deficiencies, Group II - Non communicable causes, Group III – Injuries & Group IV - Ill-defined causes. Pearson chi2(12) = 15.5741 Pr = 0.212

The leading causes of under-5 mortality were Group I causes and were accountable for 74.2% (95% CI: 72.3 – 76.1) deaths. Group I causes deaths has increased from 71.0% (65.9 – 76.0) in 2000 to 75.7% (95% CI: 72 – 79.1) in 2004.

Group II cases were accountable for 12.6% (95% CI: 11.1 – 14.0). There was annual decrease in under-5 mortality from 5.8% in 2000 to 2.4% in 2004 which was attributed to Group II causes. Group III causes were accountable for 4.3% (95% CI: 3.5 – 5.3) deaths and there was a decrease in under-5 mortality from 5.8% (95%CI: 3.6-9.0) in 2000 to 4.3% (95%CI: 2.8-6.3) in 2004.

Group IV causes were responsible for 9.1% (95% CI: 7.8 – 10.3) under-5 deaths.

The greatest concern was that there was an increase in the annual mortality which was due to Group IV causes from 7.6% (95%CI: 5.1-11.2) in 2000 to 9.5% (95%CI: 7.2-12.1) in 2004.

Broad causes of mortality by age

Table 8: Number (%) of under-5 deaths in selected district hospitals from 2000-2004 by age group and broad cause of death

Age group (years)	Group I	Group II	Group III	Group IV	Total (all causes)
< 1	883 (75.1) (95%CI:72.6–77.6)	150 (12.8) (95%CI: 10.9–14.8)	45 (3.8) (95%CI: 2.8–5.1)	97 (8.3) (95%CI:6.8–10.0)	1175 (100)
1 – 4	462(72.8) (95%CI:69.1–76.1)	81 (12.8) (95%CI: 10.3–15.7)	34 (5.4) (95%CI: 3.8–7.5)	58 (9.1) (95%CI:7.1–11.7)	635 (100)
Unknown	211 (73.5) (95%CI: 68–78.5)	30 (10.5) (95%CI: 7.2-14.6)	12 (4.2) (95%CI: 2.2–7.2)	34 (11.8) (95%CI:8.3-16.2)	287 (100)
Total	**1556 (74.2) (95%CI:72.3–76.1)**	**261 (12.4) (95%CI: 11.1–14.0)**	**91 (4.3) (95%CI: 3.5–5.3)**	**189 (9.25) (95%CI:7.8-10.3)**	**2097 (100)**

Group I - Transitional causes, peri-natal conditions and nutritional deficiencies, Group II - Non communicable causes, Group III – Injuries & Group IV - Ill-defined causes

Figure 8 showed that infant mortality i.e. 75.1% (95% CI: 72.6 – 77.6) were due to Group I causes.
However, Group II causes were accountable for 12.8% (95%CI: 10.9 – 14.8) deaths and 3.8% (95%CI: 2.8 – 5.1) deaths were due to Group III causes. Group IV causes might have under or over-estimated other causes of infant deaths and these were accountable for 8.3% (95%CI: 6.8 – 10.0) deaths.

Group I causes were accountable for 72.8% (95% CI: 69.1 – 76.1) child mortality and 12.8% (95% CI: 10.3 – 15.7) child mortality was attributed to Group II causes. There were only 5.4% (95%CI: 3.8 – 7.5) deaths which were due to Group III and 9.1% (95% CI: 7.1 – 11.7) attributed to Group IV causes.

The unknown age group deaths were due to Group I causes i.e. 73.5% (95% CI: 68 – 78.5), Group II causes (10.5%), Group III causes (4.2%) and 11.8% were Group IV causes.

4.2.3. Disease-specific causes of mortality

Causes of mortality by gender

Table 9: Twenty leading causes of mortality among under-5 admitted in district hospitals during the 2000-2004 period by gender (Males =1146 &Females = 916)

	Males	% (95% CI)	Females	% (95% CI)
1.	Diarrhoeal	22.60%(20.2-25.2)	Diarrhoeal	22.70% (20.1-25.6)
2.	LRTI	20.90% (18.6-23.3)	LRTI	21.70% (19.1-24.6)
3.	PEM	14.60% (12.6-16.8)	PEM	16.9% (14.6 – 19.5)
4.	Ill-defined	9.80% (8.1-11.7)	Ill-defined	8.50% (6.8-10.6)
5.	Pneumonia	8.20% (6.7-10)	Pneumonia	8.20% (6.5-10.2)
6.	HIV	4.80% (3.7-6.2)	HIV	5.8% (4.4-7.6)
7.	Poisoning	3.80% (2.8-5.1)	TB	2.80% (1.9-4.2)
8.	TB	2.70% (1.9-3.9)	Poisoning	2.30% (1.5-3.5)
9.	Meningitis	2.30% (1.5-3.4)	Meningitis	1.40% (0.8-2.5)
10.	Skin disease	1.60% (1.0-2.5)	Mycosis	1.20% (0.6-2.2)
11.	Injuries	1.30% (0.8-2.2)	Septicaemia	1.10% (0.6-2.1)
12.	Septicaemia	1.00% (0.6-1.9)	URTI	1.0% (0.5-1.9)
13.	Premature	0.70% (0.3-1.4)	Skin disease	0.80% (0.3 – 1.6)
14.	Mycosis	0.60% (0.3-1.3)	Def anaemias	0.70 %(0.3-1.5%)
15.	Nephritis	0.60% (0.3-1.3)	Other infectious and parasitic	0.70% (0.3 – 1.5)
16.	Congenital heart disease	0.40% (0.2 -1.1)	Other Resp Conditions	0.70% (0.3 – 1.5)
17.	URTI	0.40% (0.2-1.1)	Other respiratory	0.40% (0.1 – 1.2)
18.	Other nervous system disorders	0.30% (0.1-1.0)	Injuries	0.30% (0.1-1.0)
19.	Cholera	0.30% (0.1-0.8)	Down syndrome	0.20% (0.0 – 0.9)
20.	Epilepsy	0.30% (0.1-0.8)	Hepatitis	0.20% (0.0 – 0.9)
Total		100.00%	Total	100.00%

Diarrhoeal diseases (22.7%), lower respiratory tract infections (21.7%), protein-energy malnutrition (16.9%), pneumonia (8.2%), poisoning (2.8%), HIV (5.8%) and TB (2.3%) were the leading causes of the under-5 female mortality (Table 9).

The leading causes of under-5 male mortality were diarrhoeal diseases (22.6%), lower respiratory tract infections (20.9%), protein-energy malnutrition (14.6%), pneumonia (8.2%), HIV (4.8%) and Poisoning (3.8%) and TB (2.7%).

Causes of under-5 mortality

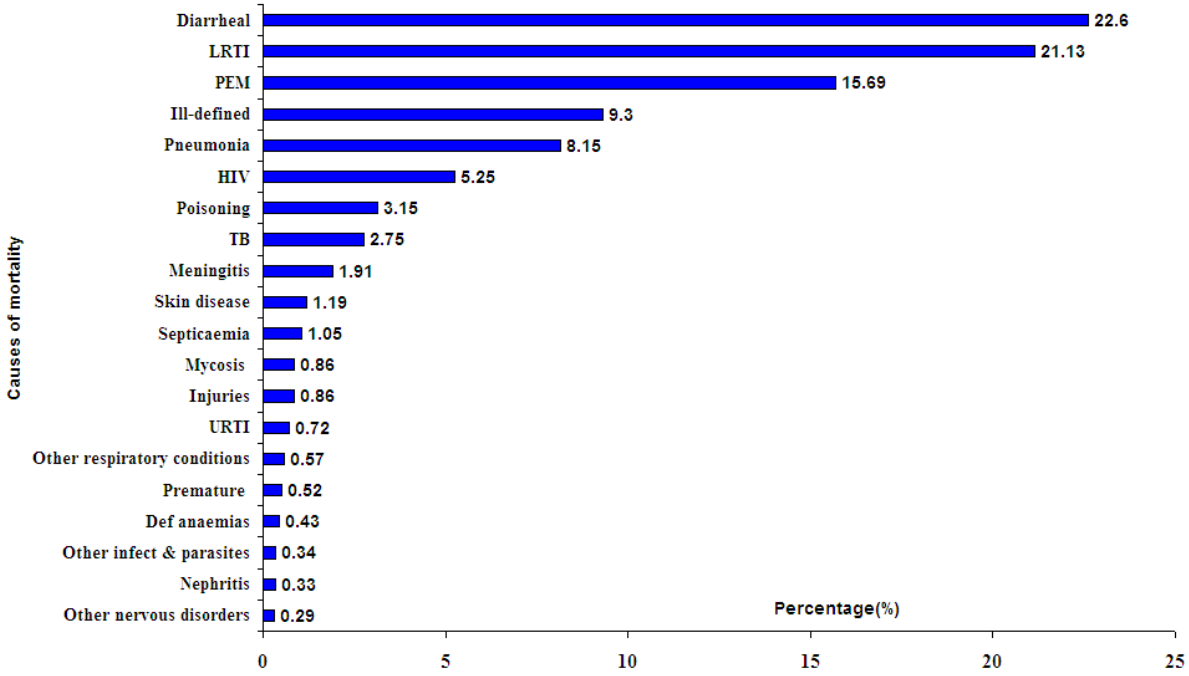


Fig 10. Leading causes of under-5 mortality in district hospitals from 2000-2004 in the Eastern Cape(N = 2097)

Diarrhoeal diseases (22.6%), LRTI (21.13%), PEM (15.69%), pneumonia (8.15%) and ill-defined cases were the major causes of under-5 mortality in the province.

These study findings further indicated that HIV accounted for 5.25% mortality. However, 94.8% deaths reviewed did not have information on HIV status. Poisoning of all types accounted for 3.15% mortality while TB and meningitis accounted for 2.75% and 1.91% of mortality respectively.

Mortality by age group

Causes of infant mortality

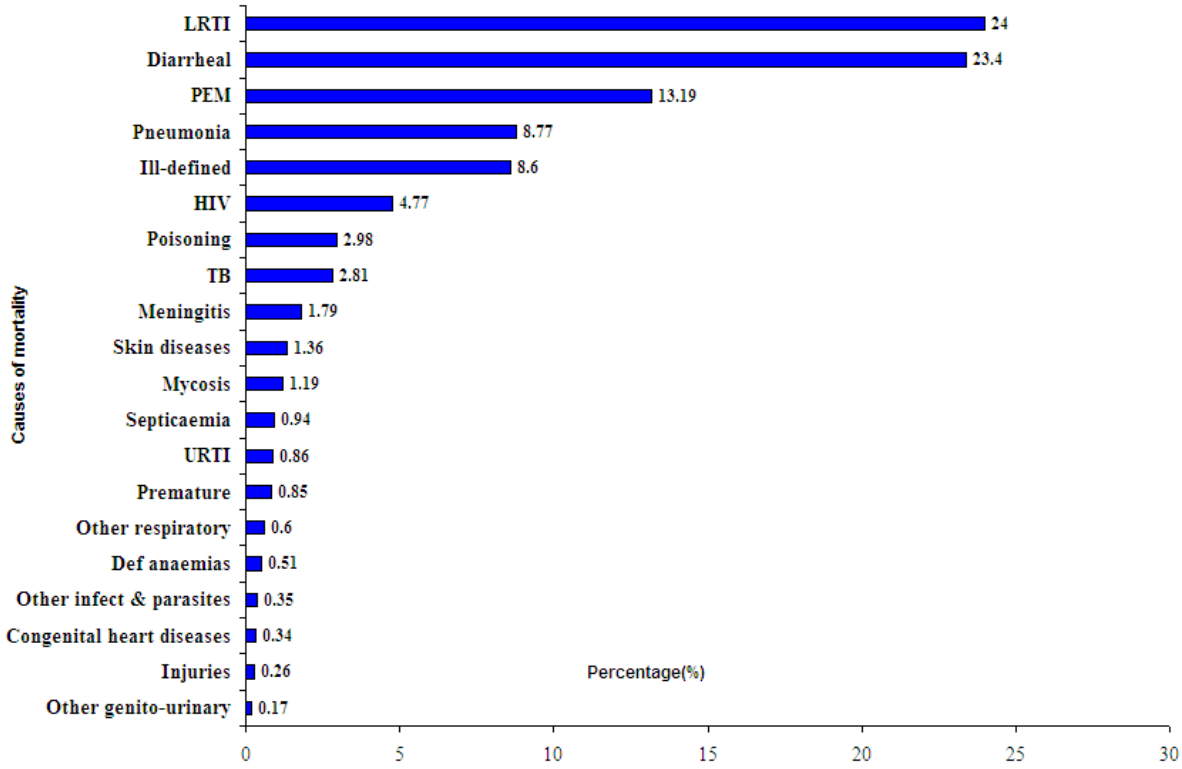


Fig 11. Leading causes of infant mortality in district hospitals during 2000-2004 period in the Eastern Cape (N =1175)

Among the infants communicable diseases like lower respiratory tract infections (24%), diarrhoeal diseases (23.4%), protein-energy malnutrition (13.19%), pneumonia (8.77%); HIV (4.77%), TB (2.81%), meningitis (1.79%) and other conditions were the major causes of deaths (Figure 11).

Ill-defined causes accounted for 8.6% of all deaths in the province which had a negative impact in the analysis of the data.

Causes of mortality among 1 – 4 years old children

Protein-energy malnutrition was ranked number cause of mortality among the 1 to 4 year old children and accounted for 22.83% of all deaths in this age group.

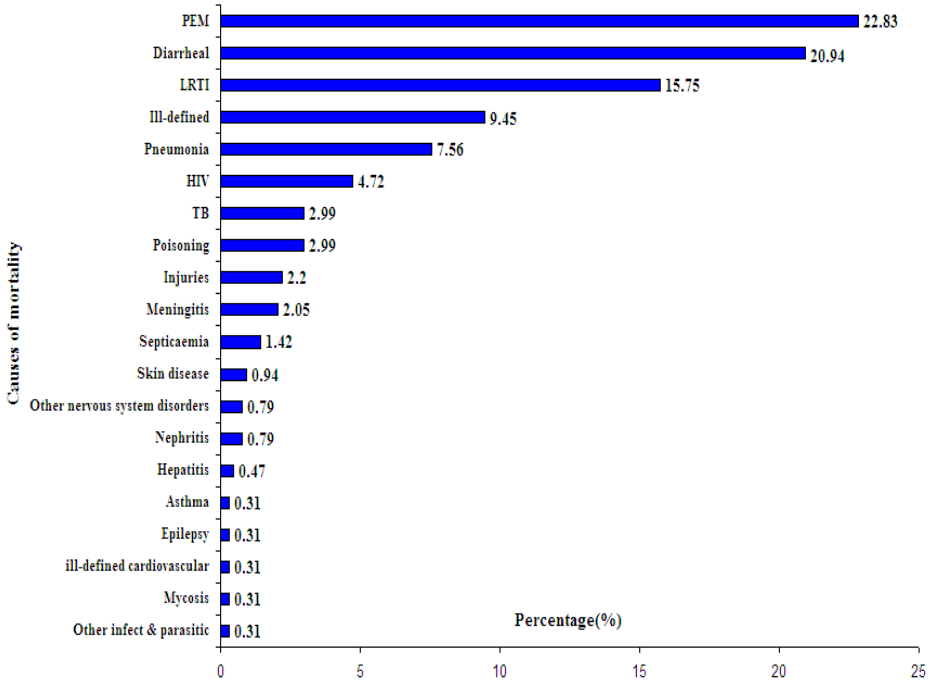


Fig 12. Leading causes of child mortality (1 - 4 years old) in district hospitals from 2000-2004 in the Eastern Cape (N =635)

Diarrhoeal diseases (20.94%) lower respiratory tract infections (15.75%), pneumonia (7.56%), HIV (4.72%), TB (2.99%), poisoning (2.99%) and injuries (2.2%) (Figure 12).

These abovementioned graphs suggested that there was a difference between the infants and 1- 4 years age group in the magnitude of deaths due to different causes of deaths.

Causes of under-5 mortality by region

Table 10. Twenty leading causes of under-5 mortality in selected district hospitals from 2000 to 2004 by region

	Central Region (%)	Eastern Region (%)	Western Region (%)
1	Diarhoeal (24.34)	Diarrhoeal (23.14) LRTI (23.14)	Diarrhoeal (16.77)
2	LRTI (21.31)	PEM (19.95)	LRTI (15.84)
3	PEM (14.37)	Ill-defined (8.78)	HIV (15.22)
4	Ill-defined (9.58)	Pneumonia (4.65)	Pneumonia (15.22)
5	Pneumonia (8.5)	Poisoning (3.46)	PEM (9.94)
6	Poisoning (3.71)	HIV (2.93)	Ill-defined (9.63)
7	TB (1.47)	Meningitis (2.93)	TB (7.45)
8	Meningitis (1.47)	TB (2.39)	Down syndrome (0.93)
9	Skin diseases (1.37)	Septicaemia (1.2)	Ill-defined cardio-vascular (0.93)
10	Mycosis (1.37)	Skin diseases (1.06)	Meningitis (0.93)
11	Injuries (1.27)	Premature (0.93)	Septicaemia (0.93)
12	Septicaemia (0.98)	Injuries (0.66)	Skin diseases (0.93)
13	URTI (0.78)	URTI (0.66)	Mycosis (0.62)
14	Def anaemias (0.68)	Nephritis (0.53)	Other infectious & parasitic diseases (0.62)
15	Other respiratory conditions (0.59)	Other respiratory conditions (0.27)	Poisoning (0.62)
16	Hepatitis (0.49)	Event of undetermined intent (0.27)	URTI (0.62)
17	Congenital heart diseases (0.39)	Mycosis (0.27)	Def anaemias (0.31)
18	Other nervous system disorders (0.39)	Other infectious & parasitic diseases (0.27)	Other respiratory conditions (0.31)
19	Premature (0.37)	Other respiratory conditions (0.27)	Heart failure (0.31)
20	Other infectious & parasitic diseases (0.29)	Otitis Media (0.27)	Nephritis (0.31)

The leading causes of under-5 mortality all three regions were diarrhoeal diseases, lower respiratory tract infections, protein-energy malnutrition and pneumonia (Table 10). Diarrhoeal and lower respiratory tract infections were ranked number 1 leading causes of mortality in the Eastern region.
However, the causes of mortality for both Central and Eastern regions were not necessarily different compared to the Western region. HIV was the third cause of mortality in the Western region, 7th cause of death in the Eastern region and not among the leading causes of deaths in Central.

4.3. Annual proportional mortality

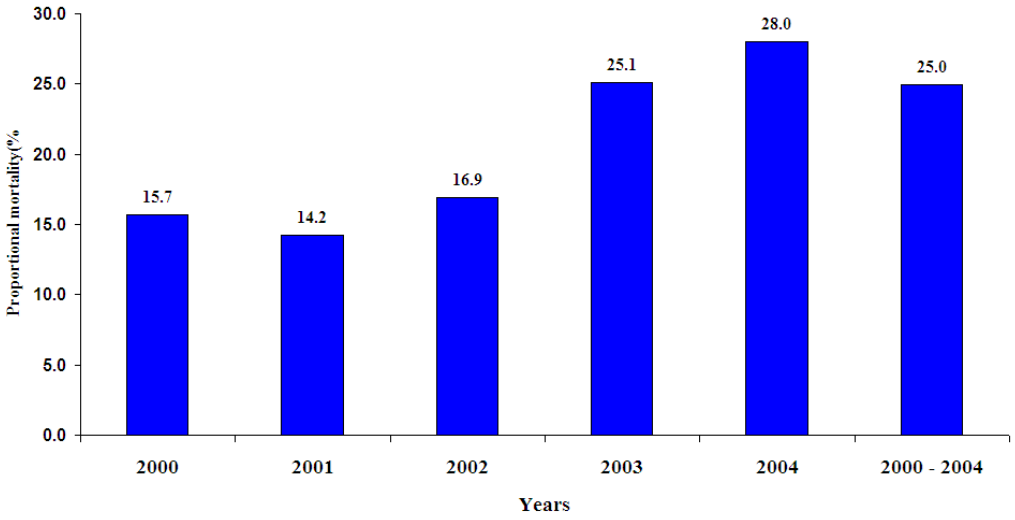


Fig 13. Annual proportional mortality among under-5 children admitted in district hospitals in the Eastern Cape, 2000-2004

The annual proportional mortality among the under-5 children has increased from 15.7% in 2000 to 28.0% in 2004 (Figure 13).

However, a decrease in proportional mortality from 15.7% in 2000 to 14.2% in 2001 was observed. This decrease in proportional mortality should be carefully interpreted because there may be other factors like consistency and accuracy of reporting which might have influenced such a decrease.

However, there was a marked increase in proportional mortality that was observed from 14.2% in 2001 to 28% in 2004 which could not be accounted for.

4.4.Length of stay (days)

Table 11. Mean length of stay of under-5 mortality in selected district hospitals in the Eastern Cape, 2000-2004		
Years	Number	Mean (95% CI)
2000	329	6.16(5.2 - 7.12)
2001	298	7.63(6.45 - 8.82)
2002	355	7.35(6.3 - 8.4)
2003	527	6.43(5.64 - 7.23)
2004	588	6.479(5.73 - 7.22)
2000-2004 (average)	419.4	6.81 (6.32 - 7.14)

The mean length of stay has increased from 6.16 days (95% CI: 5.2, 7.12) to 6. 5% (95% CI: 5.73 – 7.22) in 2004. However, there was a decrease in mean length of stay which was observed from 2001 to 2003.

Length of stay in hospital

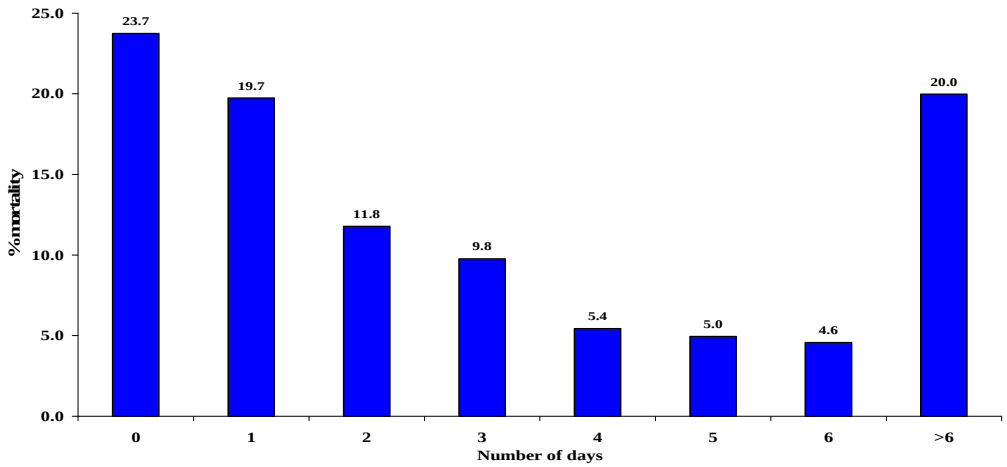


Fig 14. Length of stay (days) of under-5 children admitted from 2000-2004 in hospitals in Eastern Cape

Figure 14 indicated that 43.4% mortality occurred within 24 hours of admission (i.e. 23.7% died on arrival and 19.7% died after 1 day) (Figure 14). The proportion of deaths was decreasing with the increase in the number of days.

4.5.Influential variables for morbidity and mortality

Table 12: Binary logistic regression analysis to identify influential variables for morbidity and mortality

		Odds ratio	Standard error	Z	P>/z/	95% Confidence Interval
Gender		1.05	0.46	1.11	0.27	0.96 – 1.15
Age(yrs)	< 1	1.79	0.13	7.98	0.00	1.55- 2.07
	1 – 4	0.80	0.06	-2.64	0.01	0.70 – 0.95
Years	2000	1.10	0.09	1.24	0.22	0.94 – 1.31
	2001	0.90	0.08	-1.24	0.22	0.76 – 1.06
	2002	1.19	0.99	2.04	0.04	1.01 – 1.40
	2003	1.32	0.10	3.71	0.00	1.14 – 1.53
	2004	1.41	0.10	4.66	0.00	1.22 – 1.63
Global burden of disease classification(groups)	I	1.70	0.13	6.71	0.00	1.50 – 1.98
	II	0.83	0.11	-1.43	0.15	0.64 – 1.07
	III	0.70	0.09	-2.73	0.01	0.54 – 0.90
Regions	Eastern	1.49	0.08	7.73	0.00	1.35 – 1.65
	Central	0.67	0.03	-7.73	0.00	0.61 – 0.74
	Western	0.50	0.03	-1.03	0.00	0.43 – 0.57

Criteria used

a. The estimated odds ratios should be significantly different from 1
b. The p-value should be less than α where α is the level of significance (p-value< 0.05)
c. The 95% confidence intervals of odds ratios should not contain 1.
d. And the fitted model must be reliable (% classification should be >75%)

The odd ratio for gender of the under-5 children was 1.05 (95%CI: 0.96 – 1.15). These indicated that the odds ratio for gender was not significantly different from 1 and its confidence interval contained 1. However, the p-value was 0.27 and was above the level of significance (Table 12).

The odds ratio for the infants was 1.79 (95% CI: 1.55 – 2.07) and confidence interval does not include 1. The p-value was less than the level of significance (i.e. p-value=0.00).

The year in which the child died (especially 2002 to 2004), had the odds ratio greater than 1 and their confidence interval did not include 1.The p-values were all less than the level of significance.

The classification of diseases especially group I causes had odds ratio which was 1.70 (95% CI: 1.50 – 1.98) and the confidence intervals did not include 1. The p-value was less than the level of significance (p-value=0.00).

The odds of the under-5 children's dying was significantly Eastern region was 1.70 (95%CI: 1.35 – 1.65) times likely than in other region. The p-value was less than the level of significance.

Logistic model for death

Table 13: Logistic model for death among under-5 children in the Eastern Cape

	True		
Classified	D	~D	Total
+	0	0	0
-	2097	23025	25122
Total	2097	23025	25122

Classified + if predicted Pr (D) >= 0.5
True D defined as death ~= 0

Sensitivity	Pr(+| D)	0.00%
Specificity	Pr (-|~D)	100.00%
Positive predictive value	Pr (D| +)	.%
Negative predictive value	Pr (~D| -)	91.65%

False + rate for true ~D	Pr (+|~D)	0.00%
False - rate for true D	Pr (-| D)	100.00%
False + rate for classified +	Pr (~D| +)	.%
False - rate for classified -	Pr (D| -)	8.35%

Correctly classified 91.65%

Logistic model for death suggested that the fitted model is totally insensitive and perfectly specific (i.e. 100%) but it was correctly classified (91.65%) (Table 13).

The Hosmer and Lemeshow goodness of fit test

Logistic model for death, goodness-of-fit test was also performed

Number of observations	=	25122
Number of covariate patterns	=	379
Pearson chi2 (365)	=	549
Prob > chi2	=	0.0000

- H0: Fitted model is reliable
- H1: Fitted model is not reliable

P=0.00 < 0.05. Reject H0.

The fitted model is not so reliable according to the Hosmer and Lemeshow goodness of fit test at the 5% level of significance.

Binary logistic regression analysis was performed; it indicated that the age of the child, years (i.e. from 2002 to 2004), GBD classification (especially Group I) and region (especially Eastern region) were influential variables to both mortality and morbidity of children under the age of 5 years.

CHAPTER 5: DISCUSSION

Information that is reliable on the magnitude and causes of child morbidity and mortality is essential for health policy development or amendment, planning and decision making for the prevention and control of diseases and injuries.

This study focused on describing the under-5 morbidity and mortality which occurred during the 2000 to 2004 period in selected district hospitals in the Eastern Cape Province.

However, it should be noted that such an analysis was not yet done routinely at the time the study was conducted because of lack of a routine mortality surveillance system which can be used to easily analyze data to improve the quality of health care.

5.1. Morbidity

The findings of this study suggested that from 2000 to 2004, infant and child morbidity form the selected district hospitals have been increasing. These pose a challenge to the government because Census 2001 data indicated that the number of the under-5 children has been decreasing over the years (1, 2).

Majority of admissions were from district hospitals included Settlers, Butterworth, Empilisweni, Uitenhage and Bisho hospitals. This may be because of the fact that these hospitals have a large number of beds and their catchment areas were larger than the other hospitals.

Two hospitals (Butterworth and Mary Theresa hospitals) had high infant morbidity compared to child morbidity while other hospitals had high child morbidity compared to infant morbidity. This study did not explore factors which influenced such high infant admissions than other hospitals.
However, there is a need to explore the effectiveness of the health system including primary health care services and promote early presentation of children in health facilities before the development of complications.

Zwi and Pettifor (2006) indicated that there was a 23% increase in annual paediatric ward admissions which was observed in Chris Hani Baragwanath Hospital (i.e. from 1992 to 1996) was observed (28).
Contrary to the fact that Census 2001 data showed that the Eastern Cape population was 53.8% females and 46.2% males according to Census 2001, majority of the under-5 admissions from the selected district hospitals were males (i.e. 56%). This study did not explore factors which influenced such a gender difference in the number of admissions in those selected district hospitals.

It should be noted that this study did not explore the impact of the HIV & AIDS intervention strategies including PMTCT due to the fact that most of the children studied did not have information which suggested that they were on PMTCT programme including those children with known HIV status.

5.1.1. Causes of morbidity

The leading causes of under-5 children admissions were pre-transitional causes which included communicable diseases and nutritional deficiencies. Cause-specific analysis indicated that childhood diarrhoeal diseases, lower respiratory tract infections, protein-energy malnutrition, pneumonia and TB were the leading causes of admissions. The magnitude of peri-natal conditions might have been under-estimated by this study.

There was an annual increase in the proportion of pre-transitional causes in the period studied. The increase in the magnitude of pre-transitional causes may suggest that government interventions should begin to target multi-deprivation risk factors which may include poverty, unemployment, food insecurity and housing shortage.

This increase in child admissions due to transitional causes may be attributed to socio-economic and developmental factors which may affect child morbidity and mortality which may include poverty, nutritional deficiencies, and high fertility rates with early child bearing, availability and capacity to use these health services (12).

One of the limitations of this study is that it could not show a significant impact of the HIV & AIDS, which is contrary to the findings by medical research council publication (14). This study might have estimated the impact of HIV and AIDS on the under-5 admissions. Similarly child mortality due to HIV infection in district hospitals might have been under-estimated by this study because most of the health facilities might not have been doing HIV tests or reluctant to write HIV results during the studied period.

The most common non-communicable diseases were asthma, nephritis, and other genito-urinary infections accounted for less than 10% of under-5 children admissions or morbidity.

Pneumonia was ranked the 4th cause of admissions or morbidity. Asthma and nephritis were among the top 20 causes of morbidity and were ranked 13th and 14th causes of morbidity respectively.

Injuries which also includes poisoning and other forms of injuries accounted for 10% of all admissions or morbidity among the under-5 year old children (Table 2). Child sexual abuse was among the top 20 leading causes of admissions of the under-5 children in the province. However, it should be noted that they may be other child sexual abuse cases which might have presented to a private health facility or not presented to any public facility at all.

Ill-defined causes might have over or under-estimated other causes of morbidity in this study. There is a need to encourage clinicians to write the diagnosis of the patients than signs and symptoms.

5.1.2. Age and gender-distribution of morbidity

Protein-energy malnutrition, diarrhoeal diseases, lower respiratory tract infections, ill-defined causes and pneumonia were the leading five causes of infant morbidity. Poisoning and injuries were also among the top 10 causes of infant morbidity. HIV and TB were ranked 6th and 8th cause of infant morbidity respectively.

Contrary to infant morbidity, lower respiratory tract infections were ranked number one cause of morbidity among the 1 to 4 years old children. However, diarrhoeal, protein-energy malnutrition, pneumonia, ill-defined and HIV remains the major causes of 1 to 4 years old morbidity.

Diarrhoeal diseases lower respiratory tract infections, ill-defined, pneumonia and protein-energy malnutrition were the leading causes of morbidity among the male and female children admitted in district hospitals. Majority of these children were males compared to females. This study did not explore the contributory factors which led to such gender differences among the under-5 children.

Injuries and poisoning were the 6th and 7th causes of morbidity among male children respectively compared to 6th and 8th respectively among the female children.

5. 1. 3. Causes of morbidity by region

Diarrhoeal diseases, lower respiratory tract infections, pneumonia and malnutrition were the leading causes of under-5 morbidity or admissions. Diarrhoeal diseases were ranked number one cause of admissions in Central region where as it was ranked second in the Eastern and Western regions.

Lower respiratory tract infections were ranked number one cause of morbidity in the Eastern and Western regions while pneumonia was ranked the fourth cause of morbidity in both Central and Western regions. The less developed the region was, the more likely the children presented with poverty-related diseases which included diarrhoeal diseases, lower respiratory tract infections, malnutrition and other communicable diseases.

5.2. Mortality

There was an annual increase in under-5 mortality which was observed during the five years period studied. The annual increase in mortality was consistent to an increase in admissions which was observed. This is also consistent with the Medical Research Council findings which suggested that from 1992 to 1997, there was an increase in infant mortality from 39 to 56 per 1,000 and under-5 mortality from 53 to 71 per 1,000 live births in South Africa (27).

Statistics South Africa report for 1997 to 2005 suggested that there was an increase in under-5 mortality from 35,000 in 1997 to 61,000 in 2005 (31). However, Bradshaw and Dorrington suggested that this increase may also be attributed to completeness of vital registration (32).

Gender difference in under-5 mortality was observed where more than half of deaths were males. This study did not explore factors which might have influenced the outcome such as a gender difference among the under-5 children. More than 50% of the infants died before reaching the age of 1 year. Both morbidity and mortality declined with an increase in age.

5.2.1. Broad classification of causes of mortality

The high proportion of pre-transitional causes suggested that government policies should begin to address poverty and under-development which may include provision of basic services like safe water supplies, sanitation, reduce unemployment rates, proper housing etc.

Pre-transitional causes remain of public health concern compared non-communicable diseases and injuries which were not of public health concern. There was an annual increase in the proportion of pre-transitional

causes of mortality whereas the non-communicable diseases were decreasing over the years.
The high proportion of Ill-defined (i.e. Group IV) causes of mortality might have resulted in under- or over-estimation of the magnitude of some of the causes of mortality. Poor record keeping and incompleteness of information which include admission and final diagnosis might have also contributed to such high proportion of ill-defined causes.

5.2.2. Disease specific causes of mortality

The leading causes of under-5 mortality in the province were communicable diseases which include diarrhoeal diseases, respiratory infections and nutritional deficiencies (figure 5 and figure 10). Majority of these child deaths were preventable with an implementation of effective primary health care services and provision of basic services especially in under-developed regions like the Eastern region.

Diarrhoeal diseases, lower respiratory tract infections and protein-energy malnutrition were accountable for approximately 59% of the under-5 mortality (figure 10). Poerwanto and colleagues (2003) indicated that most of the causes of mortality may be associated to low socio-economic status, environmental, behavioral factors (i.e. unhygienic practices), fertility related indicators which includes young maternal age, birth intervals, peri-natal care and absence of contraception (33).

In the Eastern Cape Province, 22.8% of the 20 years and above population had no formal education, 47.3% households had formal dwellings, 62.4% households had access to piped water, 30.8% had no toilet facilities and 24.6% were unemployed (54.6% unemployment rates) (35). These abovementioned risk factors might have contributed to the burden of disease among the under-5 children.

In 2000, Lopez indicated that malnutrition among children is a critical risk factor which increases the likelihood of children to succumb to major childhood infections like diarrhea and acute respiratory infections (8). There were differences which were observed among the under-5 children whereby lower respiratory tract infections were ranked number one leading causes of infant mortality but 3rd leading causes of child mortality.

Diarrhoeal diseases, protein-energy malnutrition, pneumonia, HIV, poisoning and TB were among the leading causes of infant mortality. However, this study might have under-estimated the magnitude of HIV & AIDS and further contradict other reports which suggested that HIV & AIDS was the leading cause of infant and child mortality in South Africa (14). This may be attributed to poor recording and misclassification of other cases.

HIV & AIDS were not recorded as a cause of death by clinicians. The cause of death recorded was either TB, pneumonia or other opportunistic infections. The national burden of disease study suggested that HIV & AIDS was ranked 1st among the causes of deaths with 27.1% of deaths among males and 29.9% females (19).

This study did not explore the impact of PMTCT and breastfeeding methods in the under-5 morbidity and mortality. However, mixed and formula feeding practices may also introduce other risk factors like unhygienic practices which may contribute to the increase in the number of childhood diarrhoeal diseases.

Coovadia and colleagues (2007) indicated that early mixed-feeding increases the risk of HIV transmission compared to exclusive breastfeeding from birth (22).

Grey and colleagues (2008) suggested that late postnatal transmission of HIV through breastfeeding can be substantial, increasing the risk of HIV infection by a factor of about 7.5 (35).

The Ivory Coast cohort study indicated that combination of antiretroviral treatment to prevent mother-to-child transmission together with either exclusive formula feeding or shortened breastfeeding significantly reduced postnatal transmission of HIV at 18 months as compared to long-term breastfeeding without increasing mortality (35).

In another randomized clinical trial conducted in Kenya, infants who were formula-fed or breastfed had similar mortality rates and incidence of diarrhea and pneumonia during the first two years of life (36).

Protein-energy malnutrition was the leading cause of child mortality (1-4 years old children) followed by diarrhoeal diseases, lower respiratory tract infections, pneumonia, HIV and TB. There were other communicable diseases which were of public health concern among the infants compared to 1-4 years old children.

In 2003, Medical Research Council study indicated that HIV, low birth weight, diarrhea, lower respiratory tract infections and protein energy malnutrition accounted for 30% of deaths in South Africa (14).

A decrease in mortality due to non-communicable diseases was observed during the studied period. Non-communicable diseases accountable for mortality included other respiratory conditions, nephritis, and other nervous systems disorders.

Medical Research Council (2000) indicated that congenital heart diseases (2.4% females) and congenital disorders of the gastrointestinal tract (1.6% males) were among the top 10 leading causes of mortality among the under-5 children in the Eastern Cape (17).

Medical Research Council (2003) showed that congenital heart disease, neural tube effects, cot deaths, Down's syndrome and other chromosomal, congenital disorders of gastrointestinal tract and congenital syphilis were among the 20 leading causes of mortality among children in South Africa (14).

However, some of the abovementioned medical conditions did not appear among the 20 leading causes of under-5 mortality in this study. The extent of under-estimation of non-communicable diseases is not known.

Injuries appeared to be of less public health concern and were accountable for less than 5% of all deaths. There was a decrease in the proportion of mortality which was attributed to injuries. The ranking of other forms of injuries and poisoning were different for females where poisoning was the 8th leading cause of death and other forms of injuries were ranked 17th among the under-5 females in the Eastern Cape Province.

Poisoning was ranked 7th among males whereas other forms of injuries were ranked 11th cause of mortality. These may suggest that female children were less likely to die due to any form of injuries including poisoning compared to male children.

This study did not differentiate road traffic accidents and other forms of injuries. Igumbor (2000) indicated that road traffic accidents accounted for 1.5% under-5 female deaths and 1.6% male deaths in Limpopo province (17).

The proportion of ill-defined causes for both morbidity and mortality did not have any significant change from the year 2000 to 2004. These may suggest that there were no interventions or interventions were not effective. There was no improvement to recording of diagnosis (initial and final) instead of writing clinical signs and symptoms or the impact of such interventions to reduce ill-defined causes were not effective.

5.2.3. Age and gender distribution of mortality

Infant mortality from the selected district hospitals was high compared to child mortality. These age differences in mortality may be associated with socio-economic status, the age of the mother, parity, and household amenities (37).
However, such deaths could have been prevented through routine vaccination, implementation of IMCI strategy, proper feeding practices and promotion of early presentation of sick children to a health facility.

The leading causes of infant mortality were lower respiratory tract infections, diarrhoeal diseases, protein-energy malnutrition and pneumonia. However, the leading causes of child mortality were protein-energy malnutrition, diarrhoeal diseases, lower respiratory tract infections, Ill-defined and pneumonia.

The only observed differences in both infant and child mortality was the ranking of the causes of mortality but majority of the causes were similar. However, it should be noted that this study might have under-estimated the impact of HIV /AIDS among the under-5 children due to the reasons stated earlier in this report.

These findings are not similar to the MRC findings which suggested that HIV/AIDS was the leading cause of under-5 mortality in South Africa (14).

Lopez (2000) indicated that there has been good progress made in delivering HIV & AIDS interventions that work, however, the greatest threat is failure to maintain and expand those interventions (8).

Jeena and colleagues (2008) suggested that neonatal hyperbilirubinaemia, pneumonia and sepsis were commonly diagnosed among infants by paediatrician and required urgent hospital management (38). Most of these infants presented with non-specific symptoms such as cough, skin lesions, and nasal obstruction, fever, jaundice and eye problems (38).

More than half of the under-5 mortality were males. However, this study did not find any significant difference in the major causes of mortality for males compared to females (Table 6).
This study did not explore the impact of the availability of paediatricians, drug and other services in those selected district hospitals which might have influenced the diagnosis of some of the childhood diseases.

Vital statistics data from 1994 to 1996 showed a similar pattern for the general population where male deaths were higher than female deaths (2). Contrary to the MRC report, low-birth weight and birth asphyxia and trauma were not part of the leading causes of under-5 mortality in this study (14).

5.2.4. Causes of mortality by region

Diarrhoeal diseases, lower respiratory tract infections, protein-energy malnutrition and pneumonia were the leading causes of under-5 mortality in all regions.

However, there was a difference in the proportion of under-5 mortality which was observed in Western region which was different from Central and

Eastern regions. The Central and Eastern regions had similarities in terms of the magnitude of the leading causes of mortality.

Lower respiratory tract infections and diarrhoeal diseases were ranked number one cause of under-5 mortality in the Eastern region. HIV was ranked the third cause of under-5 mortality in the Western region, ranked number 6th cause of mortality in Eastern region and did not even appear as one of the leading causes of mortality in the Central region.

There was a similarity which was observed between the Central and Eastern region in terms of water and sanitation provision and poverty rates which was observed. The Western region has 96% households had formal piped water compared to 31.5% in the Eastern region and 38% in Central region (23).
These might have contributed to diarrhoeal diseases. Lack of proper sanitation services was 6.5% of the households in Western, 38% in Eastern and 37.7% in the Central region (23).

5.2.5. Length of stay in hospital

The mean length of stay of the under-5 children who died was 6.7 days. There was no significant increase in mean length of stay from the year 2000 to 2004 which was observed.

Majority of under-5 children who were admitted in the selected district hospitals died within 24 hours of admission. These may be attributed to late presentation to a facility i.e. presenting with complications or there may be other health care system challenges which may include accessibility of services (i.e. lack of pediatricians, drugs, nearest health facility, etc).

Globally, childhood vaccination has prevented 2 million deaths per year and knowledge and attitudes towards vaccinations were also likely to have influence parents or caregivers to send children for vaccination (41).

Sudan study on compliance with IMCI, indicated that the cost of transport, level of education of the mother or caregiver, employment status of the mother, size of the household, availability of a health facility in the same area and loss of confidence to the nearest facility were risk factors to child morbidity (39).

In four districts in Cape Town an improvement in assessment of danger signs of sick children, co-morbidity and prescription and starting of treatment was observed (40).

There is a need for government to find strategies to regain public confidence and further conduct health promotion and education to promote health seeking practices by communities.

These abovementioned factors might have also contributed to more than 40% child deaths which occurred within 24 hours of admission from selected district hospitals in the Eastern Cape Province as shown in this study.

5.2.6. Influential variables to morbidity and mortality

Binary logistic regression analysis showed that influential variables for under-5 morbidity and mortality were the age of the child (especially infants), the cause of morbidity and mortality (i.e. group I causes), the year (i.e. 2002 to 2004) and the region (i.e. Eastern region) in which the child was admitted in a district hospital. It should be noted that the Eastern region is one of the most under-developed part of the province (23).

Gender of the child was not an influential variable for both morbidity and mortality of children**.** These abovementioned analyses should be carefully interpreted because of under-representations of other regions.

Hence, government interventions should not only use health related approach but should also be aimed improving the socio-economic status of the communities. The Eastern region of the province is one of the poorest parts of the Eastern Cape Province.

CHAPTER 6: CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

This study provides information essential to enhance decision making, health care delivery planning and has policy implications for the improvement of quality of health care in the province.

Pre-transitional causes especially communicable diseases and nutritional deficiencies were of public health concern among the under-5 children admitted in selected district hospitals in the province compared to injuries and non-communicable diseases. There was an increase in the proportion of pre-transitional causes which was observed over the studied period.

The leading causes of morbidity and mortality were diarrhoeal diseases, lower respiratory tract infections, protein-energy malnutrition and pneumonia which can also be attributed to poverty-related factors.

The influential variables for morbidity and mortality includes the age of the child (especially infants), the cause of morbidity and mortality (i.e. group I causes), the year (i.e. 2002 to 2004) and the region (i.e. Eastern region) in which the child was admitted in a district hospitals. Hence, intervention strategies should use a multi-sectoral approach and should be aimed at reducing under-5 mortality especially infant mortality.

There was a male dominance which was observed in both admissions and mortality and its causes were not explored. There were no gender differences in terms of the causes of morbidity and mortality.

The greatest challenge which needs to be addressed includes the fact that majority of under-5 mortality occurred within 24 hours of admission in the selected district hospitals. There is a need to increase child care awareness and promote early presentation to a health facility. This study did not explore factors which led to high male admissions and under-5 mortality occurring within 24 hours of admission.

There were other health system-related challenges which can be easily addressed which includes incompleteness of recording of patient information (e.g. initial and final diagnosis, date discharged, outcomes which may indicate whether the patient was dead or alive etc) and the use of two different registers by district hospitals.

However, the greatest challenge for the Eastern Cape Province Government is to develop and or implement policies which are aimed at reducing the burden of diseases among the under-5 children and further eliminate key risk factors which have major contributions to the magnitude of burden of disease in the province.

These may include provision of basic services like safe water and sanitation, promotion of basic hygiene, implement poverty eradication strategies and reduce unemployment levels.

6.2. RECOMMENDATIONS

Majority of deaths are preventable through implementation of primary health care services (vaccination, IMCI implementation and health education and promotion. However, there is a need for a multi-sectoral approach to deal with these challenges.

1. Conduct health promotion and education activities with more emphasis in the Eastern region to reduce diarrhoeal diseases, malnutrition and lower respiratory tract infections
    - Encourage mothers to use oral re-hydration on children with diarrhoea to minimize the possibilities of complications which can lead to death.
    - Promote personal and domestic basic hygiene which includes hand washing before touching food, safe keeping of food and water.
    - Promote best child care practices and optimal feeding practices of babies including optimal breastfeeding.
    - Encourage mothers or child care givers to early present children to a health facility if they suspect any ill-health.
2. Improve recording of information to reduce ill-defined causes.
    - Clinicians should be encouraged to record the diagnosis (admission and final diagnosis) and outcome of patients.
    - Standardized hospital registers should be used by all hospitals in the Eastern Cape.
3. Conduct further research on the following:
    - Identify contributory factors to high male admissions compared to female admissions in district hospitals.
    - Why do more babies die within 24 hours of admission in the selected district hospitals in the province?
    - What is the impact of HIV intervention strategies like PMTCT, methods of feeding in child health?

CHAPTER 7: REFERENCES AND APPENDICES

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7.2. Appendices

Appendix 1							
Hospital Name							
Year							
	Age	**Gender**	**Name of suburb/ village)**	**Date admitted**	**Admission diagnosis**	**Date died**	**Final diagnosis**
1.							
2.							
3.							
4.							
5							
6							
7							
8							
9							
10							

Appendix 2

Eastern Cape Department of Health

Enquiries:	Dhlamini Thomas	Tel No:	040 609 3408/9
Date:	20 September 2005	Fax No:	040 639 1440

TO: FACULTY OF HEALTH SCIENCES RESEARCH ETHICS COMMITTEE
UNIVERSITY OF PRETORIA
ATTENTION TO: MRS. DEEPEKA BEHARI
Fax No: 012 339 8587

MORBIDITY AND MORTALITY PATTERNS AMONG THE UNDER 5 YEAR OLD CHILDREN ADMITTED TO DISTRICT HOSPITALS IN EASTERN CAPE, 2000 – 2004 (NUMBER S116/2005)

This is to confirm that approval has been granted for Mr. Thomas Dhlamini to conduct the abovementioned research (i.e. patient record reviews) in district hospitals in the province.

At the end of this study, he shall be expected to give a written report and or oral presentation to the management of the department.

SUPERITENDENT GENERAL
EASTERN CAPE DEPARTMENT OF HEALTH

Appendix 3

06/10 '05 THU 10:15 FAX 0123398812 DR SOMMERS GMT/NP+E PTA 001

University of Pretoria
Faculty of Health Sciences Research Ethics Committee
University of Pretoria
Tel (012) 339 8619 Fax (012) 339 8567
E Mail dumpeka.behari@up.ac.za
Soutpansberg Road Private Bag x 385
MRC-Building Pretoria
Level 2, Room 20 0001

Date: 31/08/2005

Number : **S116/2005**

Title : Morbidity and mortality patterns among the under 5 year old children admitted to district hospitals in the Eastern Cape, 2000 - 2004

Investigator : Thomas Dhlamini, School of Health Systems and Public Health, University of Pretoria
(SUPERVISOR: PROF JOHN MATTILA)

Sponsor : **None**

Study Degree : **Masters of Science in Epidemiology**

This Student Protocol has been considered by the Faculty of Health Sciences Research Ethics Committee, University of Pretoria on 30/08/2005 and found to be acceptable.

Mr K P Behari	B.Proc. KZN; LLM – Unisa;
Advocate AG Nienaber	(female)BA(Hons) (Wits); LLB; LLM (UP); Dipl.Datametrics (UNISA)
Prof V.O.L. Karusseit	MBChB; MFGP (SA); M.Med (Chir); FCS (SA): Surgeon
Dr M E Kenoshi	MB,CHB; DTM & H (Wits); C.E.O. of the Pretoria Academic Hospital
Prof M Kruger	(female) MB.ChB.(Pret); Mmed.Paed (Pret); PhDd. (Leuven)
Dr N K Likibi	MB.BCh., Med.Adviser (Gauteng Dept.of Health)
Dr F M Mulaudzi	(female) Department of Nursing.
Mrs E.L. Nombe	(Female) B.A. CUR Honours; MSC Nursing - UNISA
Snr Sr J. Phatoli	(female) BCur (Et.Al) Senior Nursing-Sister
Dr L Schoeman	(female) Bpharm, BA Hons (Psy), PhD
Mrs E H Pattison	(Female) BSc (Hons) UK
Prof H.W. Pretorius	MBChB; M.Med (Psych) MD: Psychiatrist
Prof J.R. Snyman	MBChB, M.Pharm.Med: MD: Pharmacologist
Dr R Sommers	(female) MBChB; M.Med (Int); MPhar.Med;
Prof TJP Swart	BChD, MSc (Odont), MChD (Oral Path) Senior Specialist; Oral Pathology
Prof C W van Staden	MBChB; Mmed (Psych); MD; FTCL; UPLM; Dept of Psychiatry

Student Ethics Sub-Committee

Mrs L Ahrens	(female) B.Cur
Dr L Schoeman	(female) Bpharm, BA Hons (Psy), PhD
Dr R Sommers	SECRETARIAT (female) MBChB; M.Med (Int); MPharMed
Dr S.J.C. van der Walt	(female) B Art et Scien (PU for CHE),M Soc Sc (UFS), M Ed (UFS), D.Cur (RAU)
Mrs N Lizamore	(female) BSc(Stell), BSc (Hons) (Pret),MSc (Pret) DHETP (Pret)
Prof R S K Apatu	MBChB(Legon); PhD(Cambridge)
Dr S I Cronje	DD (UP) – Old Testament Theology
Dr M M Geyser	(female) BSc; MBChB; BSc HONS (Pharm); Dip PEC; MpraxMed

DR R SOMMERS; MBChB; M.Med (Int); MPhar.Med
SECRETARIAT of the Faculty of Health Sciences Research Ethics Committee
University of Pretoria

Appendix 4

Eastern Cape Department of Health

Enquiries:	Merle ZP	Tel No:	040 609 3916
Date:	12 October 2005	Fax No:	040 639 1440

Dear Dhlamini Thomas

RE: MORBIDITY AND MORTALITY PATTERNS AMONG UNDER 5 YEAR OLD CHILDREN ADMITTED IN DISTRICT HOSPITALS IN THE EASTERN CAPE

The Department of Health would like to inform you that your application for conducting a research on the abovementioned topic has been approved based on the following conditions:

1. During your study, you will follow the submitted protocol with ethical approval and can only deviate from it after having a written approval from the Department of Health in writing.
2. You are advised to ensure observe and respect the rights and culture of your research participants and maintain confidentiality of their identities and shall remove or not collect any information which can be used to link the participants. You will not impose or force individuals or possible research participants to participate in you study. Research participants have a right to withdraw anytime they want to. However, you shall be responsible in dealing with any adverse effects following the research treatment provided in your study.
3. The Department of Health expects you to provide a progress on your study within 3 months (from date you received this letter) in writing and shall have a right to come and check if the study does not cause more harm to the patients.
4. At the end of your study, you will be expected to send a full written report with your findings and implementable recommendations to the Epidemiological Research & Surveillance Management. You may be invited to the department to come and present your research findings with your implementable recommendations.
5. Your results on the Eastern Cape will not be presented anywhere unless you have shared them with the Department of Health as indicated above.

Your compliance in this regard will be highly appreciated.

EPIDEMIOLOGICAL RESEARCH & SURVEILLANCE MANAGEMENT
EASTERN CAPE DEPARTMENT OF HEALTH

The copy of this letter should be presented to the Hospital Superintendent or CEO for approval and ensure that confidentiality and observe ethical consideration.

Appendix 5

P. O. Box 98
King Williams Town
5600
Tel No: 040 609 3409
Fax No: 040 639 1440
Cell No: 083 378 0189
Date __ / ___/ 2006

Name of Hospital_____
Fax No:_____

Attention to: Chief Executive Officer
Medical Superintendent
Matron

Request to collect data from Pediatric ward for the "Morbidity and mortality among the under 5 year old children admitted to District Hospitals in Eastern Cape, 2000-2004" research

---

I am a student with the University of Pretoria doing Masters in Epidemiology but also working for the Department of Health: Epidemiological Research & Surveillance Management coordinating research in the province.

As part of my studies I am doing a study on "Morbidity and mortality among the under 5 year old children admitted to District Hospitals in Eastern Cape, 2000-2004". I will be expected to do record reviews in pediatric ward in your hospital. I will bring along all the required documents including the Ethics Committee approval and letter from the department.

I am therefore requesting for approval to conduct record review in the Pediatric ward from _____ to _____2006.

It is therefore requested that the pediatric admission and or discharge books from 2000 to 2004 should be made available for the data collection.

Regards

DLAMINI THOMAS

SCHOOL OF HEALTH SYSTEMS AND PUBLIC HEALTH

UNIVERSITY OF PRETORIA

Appendix 6

Appendix: South Africa National Burden of Disease List and corresponding ICD-10 codes

SA NBD code			Title of SA NBD cause	ICD-10 Code
I			**Communicable, maternal, perinatal and nutritional Diseases**	**A00-A99, B00-B99, D50-D53, E00-E02,E40-E46, E50-E64,J00-J22, O00-O99, P00-P99, G00, N70 - N73,H66, J90**
I	**A**		**Infectious and parasitic**	**A00-A99, B00-B99, G00, N70-N73**
I	**A**	**ZA1**	Tuberculosis	A15-A19, B90, J90
I	**A**	**ZA2**	STDs excluding HIV	A50-A64, N70-N73
I	**A**	**ZA2a**	Syphilis	A50-A53
I	**A**	**ZA2b**	Other STDs	A54-A64, N70-N73
I	**A**	**ZA3**	HIV/AIDS	B20-B24
I	**A**	**ZA4**	Diarrhoeal diseases	A00-A04, A06-A09
I	**A**	**ZA5**	Childhood (Vaccine preventable) cluster	A33-A37, A80, B03,B05-B06, B91
I	**A**	**ZA5a**	Pertussis	A37
I	**A**	**ZA5b**	Polio	A80;B91
I	**A**	**ZA5c**	Diptheria	A36
I	**A**	**ZA5d**	Measles	B05
I	**A**	**ZA5e**	Tetanus	A33-A35
I	**A**	**ZA5f**	Rubella	B06
I	**A**	**ZA6**	Bacterial meningitis	A39, G00
I	**A**	**ZA7**	Hepatitis	B15-B19
I	**A**	**ZA8**	Malaria	B50-B54
I	**A**	**ZA9**	Schistosomiasis and other tropical diseases	B55-B56, B65, B74
I	**A**	**ZA10**	Leprosy	A30,B92
I	**A**	**ZA11**	Intestinal parasites	B66-B 73; B75 -B83
I	**A**	**ZA12**	Septicaemia	A40-A41
I	**A**	**ZA13**	Other infectious and parasitic	A05, A20-A28, A31, A32, A38, A42-A49, A65-A69, A70-A74, A75-A79, A81- A89, A90-A99, B00-B02, B04,, B07-B09, B25-B34, B35-B49, B57-B64, B85-B89, B94-B99
I	**B**		**Respiratory infections**	**J00-J06, J10-22, H66**
I	**B**	**ZA14**	Lower respiratory infections	J10-J18, J20-J22
I	**B**	**ZA15**	Upper respiratory infections	J00-J06
I	**B**	**ZA16**	Otitis media	H66
I	**C**		**Maternal conditions**	**O00-O99**
I	**C**	**ZA17**	Maternal haemorrhage	O20, O44-O46, O67,O72
I	**C**	**ZA18**	Maternal sepsis	O85-086
I	**C**	**ZA19**	Hypertension in pregnancy	O10-O16
I	**C**	**ZA20**	Obstructed labour	O64-O66
I	**C**	**ZA21**	Abortion	O00-O08
I	**C**	**ZA22**	Other maternal	O21-O29, O30-O43, O47-O48, O60-O63, O68-O71, O73-O75, O80-O84, O87-O92, O95-O99
I	**D**		**Perinatal conditions**	**P00-P96**
I	**D**	**ZA23**	Low birth weight	P05-P07, P22
I	**D**	**ZA24**	Birth asphyxia and trauma	P03, P10-P15, P20-P21
I	**D**	**ZA25**	Other respiratory conditions	P23-P28
I	**D**	**ZA26**	Neonatal infections	P35-P39
I	**D**	**ZA27**	Foetal alcohol syndrome	P00
I	**D**	**ZA28**	Other perinatal	P01-P02, P04, P08, P29, P50-P61, P70-P74, P76-P94
			Ill-defined	P95-96
I	**E**		**Nutritional deficiencies**	**D50-D53, E00-E02, E40-E46, E50-E64**
I	**E**	**ZA29**	Protein-energy malnutrition	E40-E46
I	**E**	**ZA30**	Deficiency anaemias6	D50-D53
I	**E**	**ZA31**	Other nutritional deficiencies including pellagra and vitamin A deficiency	E00 – E02, E50-E64

SA NBD code			Title of SA NBD cause	ICD-10 Code
II			**Non-communicable diseases**	**C00-C97, D00-D48, D55-D76, D80-D89, E03-E07, E10-E14, E15-E34, E65-E90, F00-F99, G03-G99, H00-H61, H68-H95, I00-I99, J30--J89, J92-98, K00-K93, L00-L98, M00-M99, N00-N64, N75-N99, Q00-Q99, R95, R96-R98<12mths**
II	**F**		**Malignant neoplasms**	**C00-C97;D00-D09**
II	**F**	**ZA32**	Mouth and oropharynx	C00-C14
II	**F**	**ZA33**	Oesophagus	C15
II	**F**	**ZA34**	Stomach	C16
II	**F**	**ZA35**	Colo-rectal	C18-C21
II	**F**	**ZA36**	Liver	C22
II	**F**	**ZA37**	Pancreas	C25
II	**F**	**ZA38**	Larynx	C32
II	**F**	**ZA39**	Trachea/bronchi/lung	C33-C34
II	**F**	**ZA40**	Bone and connective tissue	C40-C41
II	**F**	**ZA41**	Melanoma	C43
II	**F**	**ZA42**	Other skin cancer	C44
II	**F**	**ZA43**	Breast	C50
II	**F**	**ZA44**	Cervix	C53
II	**F**	**ZA45**	Corpus uteri	C54, C55
II	**F**	**ZA46**	Ovary	C56
II	**F**	**ZA47**	Prostate	C61
II	**F**	**ZA48**	Bladder	C67
II	**F**	**ZA49**	Kidney	C64-C65
II	**F**	**ZA50**	Brain	C71
II	**F**	**ZA51**	Lymphoma	C81-C85
II	**F**	**ZA52**	Leukaemia	C91-C95
II	**F**	**ZA53**	Other malignant neoplasms	C17, C23-C24, C26, C30-C31, C37-C39, C45- C49, C51-C52, C57-C58, C60, C62-C63, C66, C68,C69-C70, C72-C75, C88, C90, C96, D00-D09
			Ill-defined	C76-C80, C97
II	**G**	**ZA54**	**Benign neoplasms**	**D10-D36, D37-D48**
II	**H**	**ZA55**	**Diabetes mellitus**	**E10-E14**
II	**I**		**Endocrine and metabolic disorders**	**D55-D76, E03-E07, E15-E34, E65-89**
II	**I**	**ZA56**	Albinism	E70-E72
II	**I**	**ZA57**	Other endocrine and metabolic	E03-E07, E15-E16, E20-E34, E65-E68, E73-E89
II	**J**		**Mental disorders**	**F04-F99**
II	**J**	**ZA58**	Alcohol dependence	F10
II	**J**	**ZA59**	Drug use	F11-F16, F18 -F19
II	**J**	**ZA60**	Schizophrenia	F20-F29
II	**J**	**ZA61**	Affective disorders (depression, bipolar)	F30-F39
II	**J**	**ZA62**	Anorexia nervosa	F50
II	**J**	**ZA63**	Anxiety disorders (Obsessive compulsive/ panic disorders)	F40-F42
II	**J**	**ZA64**	Hyperkinetic Syndrome of childhood	F90
II	**J**	**ZA65**	Adjustment reaction (PTSS)	F43
II	**J**	**ZA66**	Mental disability	F70-F79
II	**J**	**ZA67**	Other mental disorders	F04-F09, F17, F44-F48, F51-F59, F60-F69, F80-F89, F91-F98, F99
			Nervous system disorders	**F01-F03, G03-G99**
II	**K**	**ZA68**	Alzheimer and other dementias	G30-G31,F01, F03
II	**K**	**ZA69**	Parkinsons disease	G20-G21
II	**K**	**ZA70**	Multiple sclerosis	G35
	K	**ZA71**	Epilepsy	G40-G47
II	**K**	**ZA72**	Encephalitis and brain abscess	G04, G06, G09
II	**K**	**ZA73**	Other nervous system disorders	G03,G08, G10-G12, G23-25, G36-37,G50-G58,G60-G64,G70-G72, G80-G83,G90-G98
II	**L**		**Sense organs**	**H00-H13, H15-H59, H60-H61, H68-H95**

II	**L**	**ZA74**	Glaucoma	H40
II	**L**	**ZA75**	Cataracts	H25-H26
II	**L**	**ZA76**	Other visual disorders	H00-H21, H27-H35, H43-H59
II	**L**	**ZA77**	Hearing loss and other ear disorders	H60-H61, H68-H95
II	**M**		**Cardiovascular**	**I00-I11; I13-I99, J81**
II	**M**	**ZA78**	Rheumatic heart disease	I01-I09
II	**M**	**ZA79**	Ischaemic heart disease	I20-I25
II	**M**	**ZA80**	Stroke	I60-I69
II	**M**	**ZA81**	Inflammatory heart disease	I30-I33. I38, I40, I42
II	**M**	**ZA81a**	Peri-, endo, myocarditis	I30-I33,I38,I40
II	**M**	**ZA81b**	Cardiomyopathy	I42
II	**M**	**ZA82**	Hypertensive heart disease	I10-I11; I13-I15
II	**M**	**ZA83**	Non-rheumatic valvular disease	I34-I37
II	**M**	**ZA84**	Pulmonary embolism	I26
II	**M**	**ZA85**	Aortic aneurism	I71
II	**M**	**ZA86**	Peripheral vascular disorders	I72- I78, I80-I89
II	**M**	**ZA87**	Other cardiovascular	I00, I27-I28, I44-I45
			Ill-defined cardiovascular	I46-I49, I50-I51, I70,J81
			Heart failure etc	146-149, 150-151, J81
			Aterosclerosis	I70
II	**N**		**Respiratory**	**J30-J80; J82-J86, J92- J99**
II	**N**	**ZA88**	COPD	J40-J44
II	**N**	**ZA89**	Asthma	J45-46
II	**N**	**ZA90**	Aspiration pneumonia/ lung abscess	J69, J85-J86
II	**N**	**ZA91**	Other respiratory	J30-J39, J47, J60-J68, J70, J80, J82-J84, J92-J98
II	**O**		**Digestive**	**K20-K38, K40-K63, K65-K93**
II	**O**	**ZA92**	Peptic ulcer	K25-K28
II	**O**	**ZA93**	Cirrhosis of liver	K70, K74
II	**O**	**ZA94**	Appendicitis	K35-K37
II	**O**	**ZA95**	Intestinal obstruction, non-infective gastroenteritis and colitis, peritonitis	K50-K52,K55-63, K65-K67
II	**O**	**ZA96**	Gall bladder disease	K80-K83
II	**O**	**ZA97**	Pancreatitis	K85
II	**O**	**ZA98**	Other digestive	K20-K22, K29-K31, K 38, K40-K46, K71-73,K75-K76, K86,K90-K92
II	**P**		**Genito-urinary**	**I12, N00-N50, N60-N64, N75-N99**
II	**P**	**ZA99**	Nephritis/nephrosis	I12, N00-N19
II	**P**	**ZA100**	Benign prostatic hypertrophy	N40
II	**P**	**ZA101**	Stress incontinence	
II	**P**	**ZA102**	Other genito-urinary	N20-N23, N25-N39, N41-N50, N60-N64, N75-N99
II	**Q**	**ZA103**	**Skin disease**	**L00-L99**
II	**R**		**Musculo-skeletal**	**M00-M99**
II	**R**	**ZA104**	Rheumatoid arthritis	M05-M06
II	**R**	**ZA105**	Osteoarthritis	M15-M19
II	**R**	**ZA106**	Other musculo-skeletal	M00-M02, M08-M13, M20-M99
II	**S**		**Congenital abnormalities**	**Q00-Q99**
II	**S**	**ZA107**	Neural tube defects	Q00-Q07
II	**S**	**ZA108**	Cleft lip/palate	Q35-Q37
II	**S**	**ZA109**	Congenital heart disease	Q20-Q28
II	**S**	**ZA110**	Congenital disorders of GIT	Q38-Q45
II	**S**	**ZA111**	Down's syndrome and other chromosomal anomalies	Q90-Q99
II	**S**	**ZA112**	Other congenital abnormalities	Q10-Q18, Q30-Q34, Q50-Q56, Q60-Q64, Q65-Q79, Q80-Q84
			Ill-defined	Q85-Q89
II	**T**		**Oral conditions**	**K00-K14**
II	**T**	**ZA113**	Dental caries	K02
II	**T**	**ZA114**	Periodontal disease	K05
II	**T**	**ZA115**	Other oral health	K00-K01, K03-K04, K06-K14
II	**U**		**Cot death**	**R95, R96-R98 < 12 MTHS**
II	**U**	**ZA116**	Cot death	R95, R96-R98 < 12 MTHS

			Ill-defined	R00-R09, R10-R19, R20-R23, R25-R29, R30-R39, R40-R46, R47-R49, R50-R69, R70-R79, R80-R82, R83-R94, R96,R98,R99
III			**Injuries**	**V01-V99, WOO-W99, X00-X99, Y00-Y98**
III	**V**		**Unintentional**	**V00-V99, W00-W99, X00-X59, Y40-Y86, Y88**
III	**V**	**ZA117**	Road traffic accidents	V01-V04, V09, V10-V14, V19, V20-V24, V29, V30-V39, V40-V49, V50-V59, V60-V69, V70-V79, V98, V99, Y85
III	**V**	**ZA118**	Other transport accidents	V05, V06, V15-V18, V25-V28,V80-V89, V90-V94, V95-V97
III	**V**	**ZA119**	Mining accidents	
III	**V**	**ZA120**	Poisoning	X40-X49
III	**V**	**ZA121**	Surgical / medical misadventure	Y40-Y59, Y60-Y69, Y70-Y82, Y83-Y84, Y88
III	**V**	**ZA122**	Falls	W00-W19
III	**V**	**ZA123**	Fires	X00-X09
III	**V**	**ZA124**	Natural and environmental factors	W53-W64, X20-X29, X30-X39, X50-X57, Y95-Y97
III	**V**	**ZA125**	Drowning	W65-W74
III	**V**	**ZA126**	Suffocation and foreign bodies	W75-W84
III	**V**	**ZA127**	Other unintentional injuries specified	W20-W49, W50-W52, X10-X19, X58
			Ill-defined	X59, Y86, Y98
			Undetermined whether intentional or unintentional	Y10-Y34, Y87, Y89
III	**W**		**Intentional injuries**	**X60-X99, Y00-Y09, Y35-Y36**
III	**W**	**ZA128**	Suicide and self-inflicted	X60-X84
III	**W**	**ZA129**	Homicide and violence	X85-Y09
III	**W**	**ZA129a**	with firearm	X93-X95
III	**W**	**ZA129b**	without firearm	X85-X92, X96-X99, Y01-Y08
			ill-defined	Y09
III	**W**	**ZA130**	Legal intervention and war	Y35-Y36