Mortality Trends at Benedictine Hospital, Nongoma, KwaZulu-Natal, 1995 - 2001

by

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DECLARATION

This paper is original work and has not been submitted previously to this or any other university.

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Dedicated to

my wife,

Linda

Acknowledgments

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Kenneth W Kaufmann MD

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List of Abbreviations

AIDS	Acquired Immunodeficiency Syndrome
ASMR	Age Specific Mortality Rate
BPH	Benign Prostatic Hypertrophy
CCF	Congestive Cardiac Failure
CDR	Crude Death Rate
Chr GE	Chronic Gastroenteritis
CMR	Child Mortality Rate
COAD	Chronic Obstructive Airways Disease
CSMR	Cause Specific Mortality Rate
CVA	Cerebral Vascular Accident
DM	Diabetes Mellitus
DS	District Surgeon
ENND	Early Neonatal Death
ENNMR	Early Neonatal Mortality Rate
FSB	Fresh Stillbirth
GE	Gastroenteritis
HIV	Human Immunodeficiency Virus
IMR	Infant Mortality Rate
KZN	KwaZulu-Natal
LNNMR	Late Neonatal Mortality Rate
MSB	Macerated Stillbirth
NDoH	National Department of Health
NNMR	Neonatal Mortality Rate
PND	Perinatal Death
PNMR	Perinatal Mortality Rate
PNNMR	Post Neonatal Mortality Rate
Ptb	Pulmonary tuberculosis
Rv	Retro-viral Disease
SADHS	South Africa Demographic and Health Survey
SB	Stillbirth
SD/IC	Sub-dural / Intra cerebral
StatsSA	Statistics South Africa
Tb	Tuberculosis
U5MR	Under Five Mortality Rate
WHO	World Health Organization

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Abstract

This epidemiological study is a longitudinal descriptive review of the mortuary register at Benedictine Hospital, with an analysis of the trends which emerge. The descriptive component describes mortality at Benedictine Hospital during the years 1995-2001. It describes both the actual numbers of deaths which occurred according to each sex and age group, and the causes of death as recorded in the mortuary register.

The purpose of this study was twofold. First it was desired to raise AIDS awareness in the district by examining the effects of the AIDS epidemic on mortality. Second as the new district health system was being established, it was desired to develop a baseline of mortality information to be utilized for management in the Nongoma Local Municipality.

In the trend analysis component of the study, first, it is assumed that most of the deaths occurred at Benedictine Hospital as it is the only health facility which handles severe illness in the Nongoma Local Municipality; therefore the number of deaths within the hospital and the population of Nongoma were used to calculate Age Specific (ASMRs) and Cause Specific Mortality Rates (CSMRs). Secondly an analysis of the age and sex distribution of deaths, ASMRs, the distribution of causes of death, and CSMRs was done.

Two research questions were posed. The first research question was, has there been any change in the age distribution of death? It was demonstrated that while there was an 80% increase in the number of deaths, and although deaths increased in every age group except for the neonatal group, 80% of the increase was in the young adult ages particularly in the 20 through 39 years old age groups. By 2001 these groups were recording the largest number of deaths, 179 male deaths and 133 female deaths in the 30 through 39 years old group. Also the ASMRs of young adults had increased three to four times. The second research question was, has there been any change in the distribution of causes of death? It was demonstrated that the infectious diseases which caused the largest numbers of deaths, pulmonary tuberculosis caused 353 deaths, pneumonia 250, gastroenteritis acute and chronic 203, retro-viral disease 66, and meningitis 59, were six of the top seven causes of death in 2001. Chronic gastroenteritis, retro-viral disease, and meningitis had strengthened their position moving from the second ten into the top seven. Only trauma which was in the top five was not an infectious disease. Infectious diseases increased their share of the burden of disease from 36% in 1995 to 57% in 2001. While CSMRs for trauma and the type II non-communicable diseases were basically stable or falling, those of the infectious diseases increased three to four times. It is estimated that because the mortality pattern is similar to that of AIDS deaths in South Africa and Zimbabwe, that because it is young adult mortality that has increased and that it is infectious diseases which have increased that about 50% of mortality in Nongoma is due to AIDS. Recommendations are put forward as to how to disseminate this information and also how to institute a system to carry on monitoring mortality in Nongoma.

Chapter One – Introduction

1.1 Rationale for the study

Benedictine Hospital is in the Nongoma Local Municipality, which lies in the northern part of the KwaZulu-Natal (KZN) province. KZN is the epi-centre of the Human Immunodeficiency Virus (HIV) epidemic in South Africa, and northern KwaZulu-Natal appears to be one of the worst affected areas in the province (York 2002). According to the routine annual anonymous antenatal surveys performed by the government every November, the prevalence of HIV infection in antenatal mothers was 33.5% in KwaZulu-Natal in 2001 (Hoque et al 2002:2) and some of the highest rates are in the rural north of the province, Zululand registered 39.6% in 2000 (York 2002) and 33.1% in 2001(Hoque et al 2002:3). At the time that this study was conceived in late 1999 and early 2000, there was a clinical observation of an increasing death rate among young adults. However there was still significant denial in the community about the reality of Acquired Immune Deficiency Syndrome (AIDS) as a cause of death. Even in the hospital, when deaths were clinically due to AIDS, it was seldom recorded as the cause of death. There was a reluctance to list AIDS as the main or contributory cause of death and rather only the immediate cause of death would be listed. The reality of AIDS as a major cause of death needs to be faced if awareness and other programmes are going to be successful in reducing the prevalence of the disease.

Therefore in late 1999 and early 2000 it was conceived that a study of the trends in mortality and in the causes of mortality could shed some light on the significance of AIDS

as a cause of morbidity and mortality. The changes in the mortality trends for the previous five years would be studied. An attempt would be made to interpret the age distribution of deaths and the distribution of causes of deaths which emerged. For example, an emerging pattern of increase in the mortality rate of young adults might indicate a possible increase in AIDS as a cause of morbidity and mortality. Further, a shift in the causes of death towards the infectious diseases, such as tuberculosis, pneumonia, diarrhoea, and meningitis, might also indicate a possible increase in AIDS as a cause of morbidity and mortality.

A second incentive for a study into mortality trends was the development of the district health system. In planning health services and interventions, it is important to be able to target the most serious diseases and the ones which can be most effectively addressed. In order to determine the most serious diseases, it is important that a health information system be put into place. The interim sub-district health management team had targeted the development of a district health information system as a priority while also targeting tuberculosis, HIV and AIDS as the major health problems which they were facing. A study into the local mortality trends could not only justify and lend support to their decision, but would also provide some important baseline information against which to measure interventions and future measurements of health status. Finally an analysis of these local trends could also be useful to other health planners from local health facility managers to district, and provincial health planners; because although the trends which emerge from this study will only shed some light on what is happening in one rural local municipality of South Africa, the results may be applicable to other similar rural areas of

South Africa particularly in the province of KwaZulu-Natal. The results could also be useful to planners in other sectors such as local government and education.

1.2 Literature review

As the district health system is implemented, mortality data will be important to enable the health planners to plan well (Tollman 1999:853). They need to know who is dying, at what ages, and of what diseases, so that appropriate programmes can be put in place to improve the health of the population. Historically mortality data has been used to assess the standard of health of a population. Mortality rates are very useful and relatively easy indicators to measure which can give a picture of health and even disease. However the calculation of mortality rates depend on reliable mortality and population data (Katzenellenbogen et al 1997:187), which in developing countries is often lacking (Botha and Bradshaw 1985:980). Therefore the WHO recommends utilization of proxy indicators, such as the infant and the under-5 mortality rates which can be measured rather easily using indirect methods. These have been used to not only measure health of the young, but also the quality of health services and the social, economic, and physical environment of the whole community (Katzenellenbogen et al 1997:20). Still as the country develops and improves its health information system, "mortality data should become a cornerstone of monitoring health status" (ibid:193).

However when searching for information on mortality in South Africa one is struck by the lack of this very important information. This lack particularly applies to the black population and in the rural areas. What information exists has been analyzed with reference

to urban communities (Herman and Wyndham 1985) and the white, coloured, and Asian populations (Rothberg et al 1984; Rip et al 1987; Disler et al 1987; Whittaker et al 1987). This lack of information has been described as a 'black hole' by Botha and Bradshaw (1985). When comparing age specific mortality rates for the rural black population with those of the coloured population for the two years 1979-1980, Botha and Bradshaw estimated that death registration was under reported by at least one-third for the black population (1985:980). Thus the lack is not just a lack of analysis but a lack of the data to do analysis.

More recently with the development of the new health information system in South Africa, some limited relevant data has been published. In the Agincourt field site verbal autopsies were used to develop a cause of death profile for this subdistrict which lies in the rural northeast of South Africa. (Kahn et al 1999).

More significant recent studies discuss the impact of AIDS on adult mortality (Dorrington et al 2001), and present a cause of death profile for 1996 in South Africa (Bradshaw et al 2002b). However the data in these studies has several limitations. First after 1990, they were unable to break down the data according to population group; secondly there is a five year delay in access to the information (Dorrington et al 2001:10); also under registration and misclassification of the causes of death makes it difficult to analyze the data (Bradshaw et al 2002a:620).

The most significant recent attempt to address these limitations was made through a nationwide study which determined mortality rates by indirect methods (NDoH 1998). This study, the *South Africa Demographic and Health Survey*, provides the best quality

data but it has its own limitations. Only mortality rates and morbidity were determined and not causes of mortality. The rates were not determined by direct methods based on vital registration data. Because it is a nationwide study, it gives rates which have been generalized to different groups, but still these are not rates which are derived from a specific place. Therefore although recently the situation has improved slightly, there is still limited information with regard to mortality data and cause of death profiles for rural populations.

This limited information however applies not only to death statistics but to all demographic data. The population figures of the Nongoma Local Municipality, which are necessary to calculate age and cause specific mortality rates, vary from just under 207,000 at mid-year 2002 according to StatsSA (HISP 2001), to about 218,000 in the year 2000 as determined by the Water Services Development Plan survey report (ZDM 2001:8), to over 300,000 as determined by our Community Health Workers in 1998 (Glover 1998). Therefore any analysis which is attempted has to be interpreted with care as the data is so questionable (Botha and Bradshaw 1985:980).

1.3 Purpose and objectives of the study

The purpose of this study is to document mortality trends at Benedictine Hospital from 1995 through 2001; in order firstly to provide information for management in the health district and secondly to raise awareness of the AIDS epidemic in the district. Benedictine Hospital is the only hospital in the Nongoma Local Municipality in the Province of KwaZulu-Natal in the Republic of South Africa; therefore the mortality data

for the hospital will be turned into proxy mortality rates for this rural local municipality. Further by analyzing the changes in the mortality trends it is planned to make an assessment of the effects of AIDS on the demographics of the population. Knowledge of these trends will allow health managers at the local and district levels to more effectively plan to appropriately and adequately address not only AIDS but also other health needs in the municipality. These trends could possibly also be generalized to other rural communities, particularly in KZN, and thus prove useful to managers at all levels as to what is happening in rural communities.

This study aims to address two broad research questions:

1) Has there been any change in the age distribution of death between 1995 and 2001?

2) Has there been any change in the distribution of causes of death between 1995 and 2001?

The objectives of this study are:

1) To establish the numbers of death according to each sex and age group at Benedictine Hospital between 1995 and 2001;

2) To determine the Age Specific Mortality Rates in the Nongoma Local Municipality between 1995 and 2001;

3) To establish the numbers of deaths according to cause at Benedictine Hospital between 1995 and 2001;

4) To determine Cause Specific Mortality Rates for the leading causes of mortality in the Nongoma Local Municipality between 1995 and 2001;

5) To analyze the trends in the numbers of death according to each sex and age group at Benedictine Hospital between 1995 and 2001;

6) To analyze the trends in the Age Specific Mortality Rates in the Nongoma Local Municipality between 1995 and 2001;

7) To analyze the trends in the Cause Specific Mortality Rates of the leading Causes of Mortality in the Nongoma Local Municipality between 1995 and 2001;

8) To inform the district of the findings of this study by various methods including stake holder workshops; and

9) To contribute to the literature on mortality rates and causes of mortality in rural South Africa by publishing this study.

Chapter Two – Methods of the Study

2.1 Study design

This epidemiological study is a descriptive observational study (Grimes and Schulz 2002a:58). It is further sub-classified as a passive surveillance study as first it will establish the actual numbers of deaths which occurred at Benedictine Hospital during the years 1995-2001 according to sex and age groups as recorded in the mortuary register. Secondly this study will describe the distribution of causes of death as recorded in the mortuary register (Grimes and Schulz 2002b:146). According to Grimes and Schulz there are three uses for descriptive observational studies; trend analysis, planning and clues about cause (2002b:147). This study will try to make contributions in all three areas. As a longitudinal observational descriptive study one of the major contributions will be to do a trend analysis by establishing the trends which emerge in the number of deaths and causes of death. Trends in the numbers and causes of death can give a picture of which direction the health in an area is going. However for purposes of comparison of health status with other health service areas, and other studies, these numbers must be converted into rates, such as the Age Specific Mortality Rate (ASMR), and the Cause Specific Mortality Rate (CSMR) and other common measures, such as the distribution of the burden of disease. Health service planning decisions must also be based on indicators which are population based. This promotes decisions which address issues of equity and effectiveness. So a second major contribution will be to establish mortality rates and the burden of disease as a baseline for health planning and comparison. The third use is to look for clues as to cause;

therefore the ASMRs, the distribution of the burden of disease, and the CSMRs will be examined in relationship to two research questions. First, has there been any change in the age distribution of death? Second, has there been any change in the distribution of causes of death? Finally, an attempt will be made to interpret the age distribution of deaths and distribution of causes of deaths which emerge.

The study population for the purposes of this study will be the deaths which occurred at Benedictine Hospital and are recorded in their mortuary register. For purposes of analysis and interpretation these deaths will be assumed to have arisen out of the larger study population which will be regarded as the population of the Nongoma Local Municipality.

Two additional sources of data were utilized in order to make the mortality data more complete. Maternity records of Benedictine Hospital were used to establish the actual numbers of fresh stillbirths (FSBs), macerated stillbirths (MSBs), and early neonatal deaths (ENNDs). The mortuary records undercounted the number of stillbirths, fresh and macerated, when compared with the maternity records for each year. The inclusion of data from the maternity register allowed the calculation of a more accurate perinatal mortality rate. Only neonatal deaths were tabulated from the mortuary register, therefore early neonatal deaths as recorded in the maternity records when subtracted from total neonatal deaths as recorded in the mortuary register allowed for the establishment of subcategories for early and late neonatal deaths. This permitted the calculation of the Early Neonatal Mortality Rate (ENNMR) and the Late Neonatal Mortality Rate (LNNMR) as subsets of the Neonatal Mortality Rate (NNMR).

The second additional source will be the mortuary register of the district surgeon police mortuary in the Nongoma Magisterial District. A study into the causes of death due to trauma which was done from this register for the three years 1999-2002 will be utilized to supplement the causes of death due to trauma (Kaufmann 2002). In order to not double count the number of deaths, trauma from the hospital mortuary was only counted if the numbers for a specific cause exceeded those of the deaths due to that cause as determined by postmortem done by the district surgeon. This approach was taken because trauma which ends in death in the hospital should be referred the district surgeon as an unnatural cause of death. The district surgeons' deaths do not equal the trauma deaths for 1999 through 2001 therefore as there was an occasional category of death, such as burns, which had more deaths in the hospital than in the police mortuary. It is realized that an under count might also occur. Inclusion of data from the police mortuary register was only utilized in the causes of death portion of this study. The study had not analyzed age and sex of the deceased, and age was rarely recorded. Inclusion of data from the police mortuary register will give a more complete and accurate picture of deaths secondary to trauma in the district.

2.2.1 Measurement – *Age Specific Mortality Rate*

The measurements used will be standard ones which are used in demography. First all deaths will be classified according to sex. Secondly all deaths will be classified according to age at death, as recorded in the mortuary register, linked with sex. These will be grouped according to decade groups in the adults: third decade (20-29 years old male

and female), fourth decade (30-39 years old), fifth decade (40-49 years old), sixth decade (50-59 years old), and finally a group with a boundless upper limit, the seventh decade and above (60 years and older). The groups for those under the age of 20 years will be: under one year old, one year through four years old, five through nine years old, 10 through 14 years old, and 15 through 19 years old. There will also be a sub group of less than one month old.

It will be assumed that most of the deaths occur at Benedictine Hospital as it is the only health facility which handles severe illness in the Nongoma Local Municipality. Benedictine Hospital lies centrally in the Nongoma Local Municipality, all roads lead to Nongoma and the population of Nongoma can be equated with the drainage area and the catchment population of Benedictine Hospital. Therefore the number of deaths within the hospital and the population of Nongoma will be used to calculate proxy Age Specific and Cause Specific Mortality Rates. The number of deaths in each of these groups will be used to determine sex and age specific mortality rates for each of these groups in the Nongoma Local Municipality. Age specific mortality rates were calculated by putting the number of deaths for the group in the numerator and the appropriate mid-year population figures for that group in the denominator. Population figures utilized were the mid-year estimates as provided by StatsSA through the HISP programme (HISP 2001) for the Nongoma Local Municipality (Appendix I).

2.2.2 Measurement – *Cause of Death*

The cause of death will be taken from the cause of death as recorded in the mortuary register. These causes have been taken from the clinical charts as the signed out discharge diagnosis or cause of death. The death certificates will not be utilized as they are not available for most of the years. Only one cause of death, the most significant as determined by the investigator, will be recorded. The only exception will be if AIDS or its equivalent such as, immune compromised, retro-viral, or HIV is recorded, then any one other significant diagnosis if provided will also be recorded. This was done because so few death entries listed AIDS as a cause and there was an interest in seeing if the trend to list AIDS changed over time. Trend analysis of the causes of death will be done.

2.2.3 Measurement – *Burden of Disease*

Causes of death will also be analyzed according to burden of disease. Analysis by burden of disease allows for evaluation as to where a society is in the epidemiological transition. It also allows for comparison of the health status of one society with another. It further allows for comparison of a society's burden of disease with other studies. The Burden of Disease List groups diseases into four broad categories: type 1, infectious diseases, respiratory infections, maternal and perinatal conditions, and malnutrition (pre-transitional causes); type 2, non-communicable diseases; type 3, injuries, including both unintentional and intentional; and type 4, ill-defined natural causes (Bradshaw et al 2002a:619). For purposes of comparison with other studies, the type 1 infectious diseases sub-category will be further subdivided into tuberculosis,

gastroenteritis, and other infectious diseases. The type 2 category will be subdivided into three groups: cardiovascular, cancer, and other.

2.2.4 Measurement – *Cause Specific Mortality Rate*

To determine the CSMRs the number of deaths for each disease will be utilized in the numerator while the appropriate mid-year population figures for the Nongoma Local Municipality as provided by StatsSA through the HISP programme (HISP 2001) will be utilized in the denominator.

2.3 Definitions of terms

Standard demographic definitions will be utilized as defined below.

Age Specific Mortality Rate is the number of deaths per annum per thousand for a specific age group. This is useful for comparison of health status between different population groups.

Child Mortality Rate is the number of deaths which occur after the age of one year and before the age of five years per annum per thousand children between the ages of one and five years. This measurement reflects the quality of health service provision, nutrition, and socioeconomic development.

Crude Death Rate is the numbers of deaths per annum per thousand population.

An early neonatal death is a death which occurs in the first seven days of life.

Early Neonatal Mortality Rate is the number of deaths which occur in the first seven days of life per annum per thousand live births per annum.

An infant death is a death which occurs in the first year of life.

Infant Mortality Rate is the number of deaths which occur in the first year of life per annum per thousand live births per annum. Post neonatal mortality and infant mortality rates are used to reflect on the health status of the whole population. They also reflect on the quality of health care services particularly those pertaining to infants such as immunization services.

A late neonatal death is a death which occurs between seven and twenty-eight days after birth.

Late Neonatal Mortality Rate is the number of deaths which occur between seven and twenty-eight days after birth per annum per thousand live births per annum.

A neonatal death is a death which occurs in the first twenty-eight days of life.

Neonatal Mortality Rate is the number of deaths which occur in the first twenty-eight days of life per annum per thousand live births per annum.

Perinatal Mortality Rate is the number of stillbirths, fresh and macerated, after twenty-eight weeks gestational age, plus the number of early neonatal deaths, deaths which occur within the first seven days of life, per annum per thousand live births per annum. Perinatal and neonatal mortality rates reflect on the quality of antenatal and intra partum health care.

A post neonatal death is a death which occurs within the first year of life after twenty-eight days of life.

Post Neonatal Mortality Rate is the number of deaths which occur between twenty-eight days of life and one year of age per annum per thousand live births per annum.

Under Five Mortality Rate is the number of deaths which occur below the age of five years per annum per thousand children under the age of five years. This measurement reflects more on the status of nutrition, and socioeconomic development.

In looking at the definition of terms most of the terms are straight forward. However some clarity will be given on how they have been implemented. Most of the age groups are easy to understand. Depending on the age recorded, it was entered into the group. However for children there was some problem as sometimes it was recorded "one month" or "one year" or "12 months". "One month" was entered into the one month to one year old group. Only if it was written "four weeks" or less than "31 days" was it entered into the less than one month old group. Likewise if it was written "one year" or "12 months" it was entered into the one year to 4 years old group. Only if it was written "11 months" or "less than 12 months" was it entered into the one month to one year old group.

2.4 Data management and analysis

Initially the study was only going to look at age specific mortality rates so only age and sex data were entered into tally sheets. This was entered by the researcher with some help from a research assistant.

After starting the study it was realized that the cause of death was also recorded in the mortuary register. It was decided to extend the study and the cause of death was entered into separate tally sheets. The cause of death data was only entered by the researcher. The fact that the age and sex data was collected separately from the cause of death data meant that the numbers of deaths did not exactly correlate with the causes of death. Furthermore in determining the cause of death, if there was more than one cause of death listed the investigator chose the most significant disease mentioned. Only if AIDS or a corresponding disease was mentioned was a second significant disease also listed. This meant that some people had two causes of death. Also trauma deaths were supplemented from the district surgeon's mortuary register so the number of causes of death did not equal the numbers of deaths.

The tally sheets were totalled by months and entered into spreadsheets in Quattro Pro on the computer. Formulae were used to calculate all annual totals for each age specific, and cause specific diseases groups. Population data was entered into spreadsheets and formulae were used to calculate all age specific mortality rates, cause specific mortality rates, and other ratios which were developed for the study. This allowed for the presentation of the information in tables and graphs. However trend analysis was done by hand calculating the percentage change between the first and last years of the study.

2.5 Ethical Approval

Permission to conduct research according to the research proposal was sought and granted from the hospital manager of Benedictine Hospital and the acting district manager

of Zululand District Health Office. Ethical approval was asked and received from the Faculty of Medicine Ethics Committee.

Chapter Three – Results

3.1 Numbers of Deaths

The overall deaths at Benedictine Hospital increased from 867 in 1995 to 1552 in 2001 (Table III-1, Figure III-1). This is an overall increase of 79% in six years at an average of 13% per annum. The increase was only 6.7% in 1996 but it gradually increased to 17% per annum in the last two years.

Table III-1 – Annual Deaths from Mortuary Register

ANNUAL DEATHS FOR BENEDICTINE HOSPITAL FOR THE YEARS 1995 - 2001									
AGE RANGE		1995	1996	1997	1998	1999	2000	2001	TOTAL
MSB	F/M	33	46	28	26	9	30	56	228
FSB	F/M	24	26	11	12	9	13	26	121
< 28/365	F	94	73	87	81	60	48	42	483
	M	94	92	86	84	69	56	37	518
1/12 - 1	F	59	52	55	51	58	61	67	403
	M	44	49	61	76	73	58	72	433
1 - 4	F	20	30	26	37	24	27	48	212
	M	26	24	41	47	24	44	50	256
5 - 9	F	15	12	13	9	14	21	32	116
	M	8	16	5	11	16	22	21	99
10 - 14	F	0	0	0	3	1	0	0	4
	M	0	1	1	5	4	0	0	11
15 - 19	F	8	5	4	6	8	5	10	46
	M	2	6	4	2	3	3	8	28
20 - 29	F	39	64	54	77	114	121	127	596
	M	32	37	34	59	67	109	101	439
30 - 39	F	26	35	49	60	65	106	133	474
	M	48	65	64	99	101	108	179	664
40 - 49	F	24	26	30	47	41	81	95	344
	M	34	48	67	81	72	78	120	500
50 - 59	F	29	17	34	33	32	65	53	263
	M	39	39	62	39	52	82	73	386
60+	F	123	138	132	116	126	124	145	904
	M	103	106	103	115	105	109	139	780
Total		**867**	**935**	**1012**	**1138**	**1129**	**1326**	**1552**	**7959**

Macerated and fresh stillbirths, although technically not deaths, are along with early neonatal deaths, an essential component of the calculation of the perinatal mortality rate; and are therefore included in this study. The numbers of stillbirths and early neonatal deaths as recorded in the maternity register of Benedictine Hospital were utilized for this study (Table III-2). Macerated stillbirths (MSBs) were constant throughout the period of the study. However fresh stillbirths (FSBs) have shown a steady decline from 55 in 1995 to 35 in 2001, a 36% overall decline in six years.

Table III-2 Mortality Statistics from the Maternity Records 1995-2001

	1995	1996	1997	1998	1999	2000	2001
MSB	65	62	71	60	32	63	66
FSB	55	54	45	48	26	38	35
Subtotal SB	**120**	**116**	**116**	**108**	**58**	**101**	**101**
ENND	78	67	57	87	70	50	51
Total PNDs	**198**	**183**	**173**	**195**	**128**	**151**	**152**
Maternal Deaths	0	6	1	2	7	2	2
Deliveries	3286	2991	3769	3919	4033	3488	3562
PNMR (per 1000)	60.26	61.18	45.90	49.76	31.74	43.29	42.67

Neonatal deaths comprise the two subsets, early and late neonatal deaths. Neonatal deaths are themselves a subset of infant deaths. Neonatal deaths showed significant decline in both the male and female groups. From 94 deaths each in 1995 they each declined progressively to less than 50% of 1995 levels in 2001. Female deaths fell to 42 in 2001, a 55% decline overall; while male deaths fell to 37, a 61% overall decline. This was the only group in which deaths actually declined (Table III-1, Figure III-2).

Early neonatal deaths were derived from the maternity records and ranged from one-third to three-fifths of the neonatal deaths as recorded in the mortuary register. They showed a steady decline from 78 in 1995 to 51 in 2001, a 35% decline overall.

Late neonatal deaths were derived by subtracting the early neonatal deaths from neonatal deaths. They showed a steady decline from 110 in 1995 to 28 in 2001, a 75% overall decline.

Infant deaths include two subsets, neonatal and post neonatal deaths. Infant deaths including the deaths in the neonatal period, were steady from 1995 through 1998. Beginning in 1999 infant deaths showed a decrease dropping from 291 in 1995 to 218 in

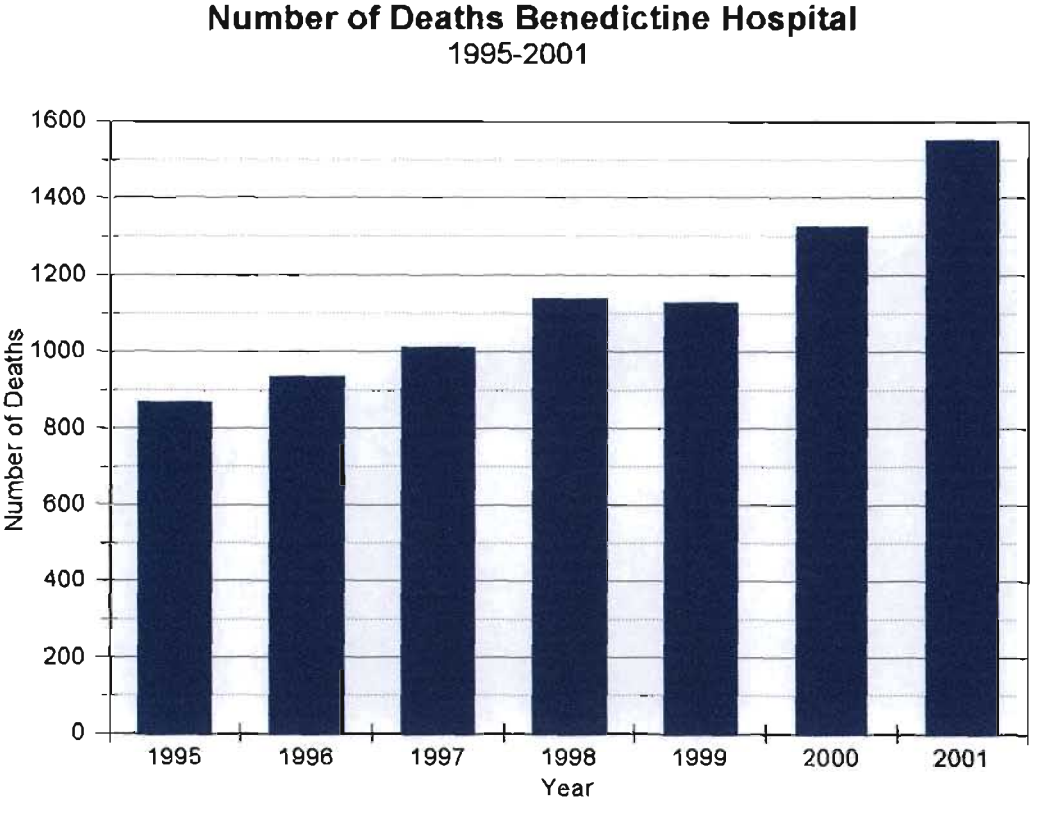

Figure III-1 – Annual Number of Deaths

2001. This was an overall 25% decrease between 1995 and 2001. However all of the improvement was in the neonatal period, as the post neonatal subset of the infant group increased 35% overall, as post neonatal deaths increased from 103 in 1995 to 139 in 2001 (Table III-1, Figure III-2).

Deaths have more than doubled in the one year old to four years old group during this period. Female deaths increased, 140% overall, from 20 in 1995 to 48 in 2001. Male deaths increased from 26 in 1995 to 50 in 2001, an overall increase of 92% (Table III-1, Figure III-2).

Under five mortality showed a small decline over the seven years of the study. Female deaths fell from 173 in 1995 to 147 in 2001, an overall decline of 15%. Male deaths fell slightly from 164 in 1995 to 159 in 2001, a decline of 3.0%. However again all of the improvement was in the neonatal period, as the number of deaths outside of the neonatal period increased 59% overall, from 149 deaths in 1995 to 237 deaths in 2001.

Even the five to nine years old group showed an increase in numbers of death. Females while steady from 1995 until 1999 at 15 increased to 32 in 2001, an increase of 113%. Males showed a fairly steady increase through the years from 8 in 1995 to 21 in 2001, an increase of 163% (Table III-1, Figure III-2).

The number of deaths in the ten to fourteen years old group are so few that they will not be significant for interpretation. Many years, eight groups out of a possible fourteen, the number of deaths was zero (Table III-1, Figure III-2).

The fifteen years to nineteen years old group was constant throughout until 2001. Starting at 10 in 1995, it was still 8 in 2000, but increased to 18 in 2001, an increase of

80%. Female deaths went from 8 in 1995 to 10 in 2001, while male deaths went from 2 in 1995 to 8 in 2001. The highest numbers of deaths for both sexes occurred in 2001 (Table III-1, Figure III-2).

The 20 to 29 years old decade group recorded their lowest number of deaths in 1995, 39 female deaths and 32 male deaths occurred. Female deaths increased quickly to 64 in 1996 and on up to 127 in 2001, an overall increase of 226%. Male deaths increased more slowly staying in the 30s till 1998 when they increased to 59 and up 101 in 2001, also a large increase of 216% (Table III-1, Figure III-2).

The 30 to 39 years old decade group also increased steadily each year from a low in 1995 of 26 deaths in females and 48 in males to 133 deaths for females in 2001 and 179 for males. This is an overall increase of 412% in deaths in this decade group for females, and a 273% increase in deaths for males. 179 male deaths are the largest numbers of deaths in any group, and 133 female deaths are exceeded only by a couple of female groups and a male group in the more than 60 years old group (Table III-1, Figure III-2).

The 40 to 49 years old decade group also steadily increased from a low in 1995 of 24 female deaths and 34 male deaths to 95 deaths in females during 2001, a 296% increase, and 120 in males, a 253% increase (Table III-1, Figure III-2).

The number of deaths for 50 to 59 years old decade group was erratic although the trend was a steady increase. The numbers of female deaths were fairly steady between 1995 and 1999. However the number doubled from 29 in 1995 to 65 in 2000 before declining again to 53 in 2001, an overall increase of 83%. The number of male deaths also

doubled from a low of 39 in 1995 to a high of 82 in 2000 before decreasing to 73 in 2001, an overall increase of 87% (Table III-1, Figure III-2).

The number of deaths in the 60 years old and above group was fairly level until 2001. Female deaths were 123 in 1995 and 124 in 2000. However they increased to 145 in 2001, an increase of 17.9%. Male deaths were at a low with 103 in 1995 and again fairly steady with only 109 in 2000. However they increased 35% to 139 in 2001 (Table III-1, Figure III-2).

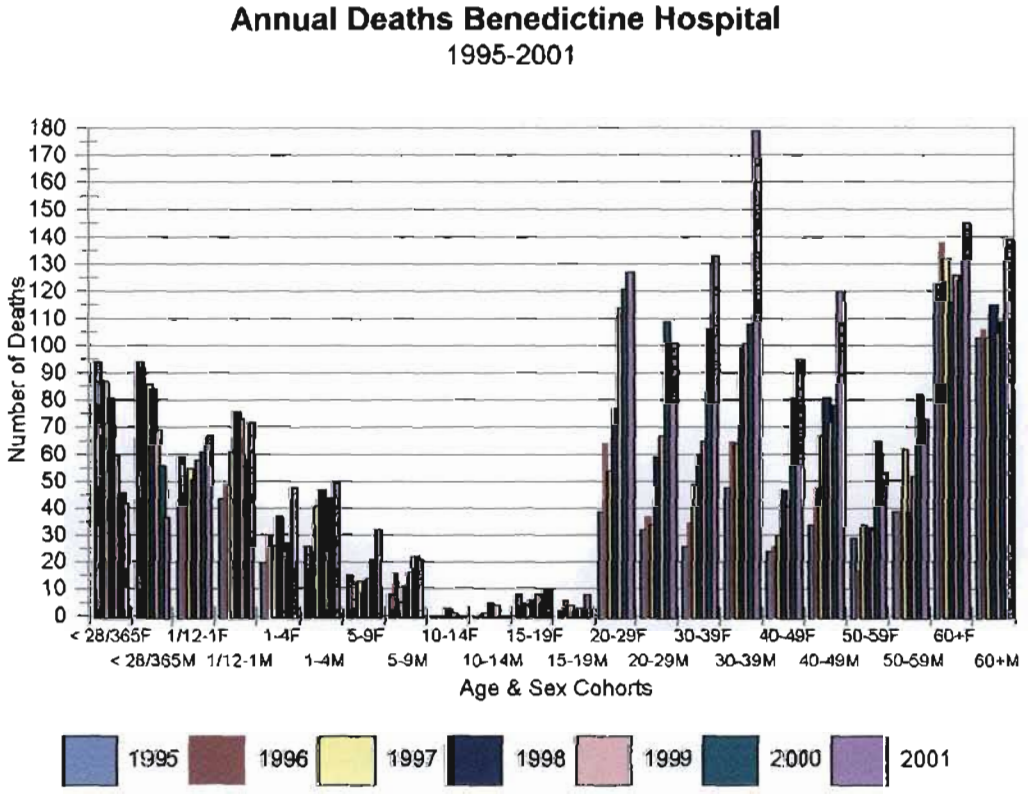

Figure III-2 – Annual Deaths per Age & Sex Groups

In conclusion the number of deaths has increased by 79%. Although every group, except for the neonatal group showed an increase, 70% of the increase was attributed to the young adult age groups. The 30-39 year's old groups contributed 30% of the increase, while the 20-29 years old and 40-49 years old groups each contributed 20%. The females were slightly predominating in the 20-29 years old and 30-39 years old groups, while the males predominated in the older 30-39 years old and 40-49 years old group (Figure III-3).

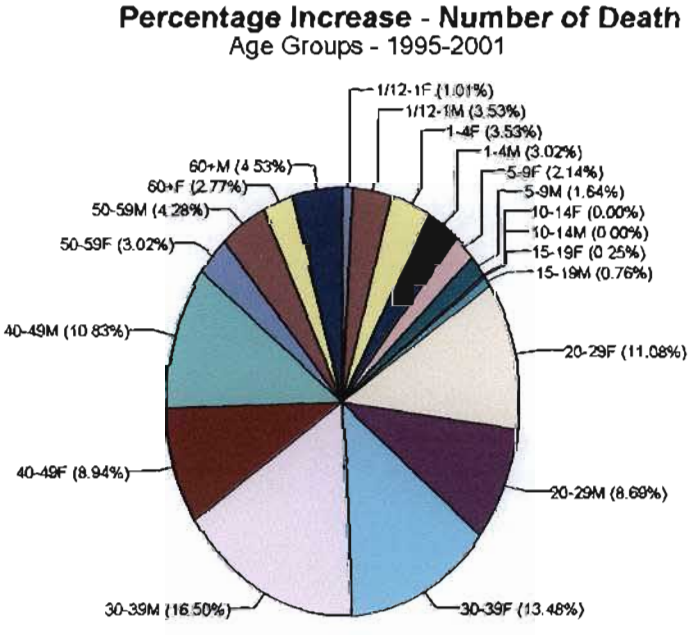

Figure III-3 Age groups percentage contribution to overall increase in number of deaths

3.2 Age Specific Mortality Rates (ASMRs)

One of the major purposes of this study is to establish a baseline of standard mortality rates. Mortality rates, while reflecting similar trends as the numbers of deaths, allow for more accurate and equitable health planning as decisions are based on population related data. They permit a more accurate evaluation of health care service and a more equitable distribution and provision of health care. Mortality rates also allow for comparison of health status with other health districts and mortality studies.

The Crude Death Rate increased steadily from a low of 4.68 per thousand in 1995 to 7.62 in 2001 (Table III-3).

The Perinatal Mortality Rate, which includes stillbirths and early neonatal deaths, fell progressively from 60.26 in 1995 to 42.67 in 2001. It recorded its lowest rate of 31.74 in 1999 when the fewest perinatal deaths, 128, were recorded and the most deliveries, 4033, were done (Table III-2).

The Neonatal Mortality Rate (NNMR) fell progressively throughout this study from 42.54 in 1995 to 16.25 in 2001.

The ASMR for under one year olds, that is the Infant Mortality Rate (IMR), was 65.81 in 1995 and held steady through 1998 at 62.96, but then fell progressively to 55.18 in 1999 and 46.17 in 2000 and 44.83 in 2001. However this decrease was due to the decrease in the neonatal portion of the infant mortality rate as the post neonatal mortality portion of the IMR actually rose by 23% from 23.29 in 1995 to 28.58 in 2001.

Child mortality, the one year to four years old group, rose by almost double from a low of 2.08 in 1995 to 4.03 in 2001.

Table III-3 – Age Specific Mortality Rates Nongoma Local Municipality 1995-2001

Age Stratum	1995	1996	1997	1998	1999	2000	2001
<28/365 (NNMR)	42.51	36.72	37.9	35.58	27.38	21.31	16.25
1/12 - 1	23.29	22.48	25.41	27.38	27.80	24.86	28.58
0 - 1 (IMR)	65.81	59.20	63.31	62.96	55.18	46.17	44.83
1 - 4 (CMR)	2.08	2.40	2.93	3.62	2.04	2.96	4.03
0 - 4 (U5MR)	12.69	11.86	12.99	13.5	10.89	10.16	10.82
5 - 14	0.39	0.48	0.31	0.45	0.56	0.67	0.81
15 - 19	0.41	0.45	0.32	0.31	0.43	0.30	0.67
20 - 29	2.49	3.49	2.99	4.55	5.96	7.45	7.27
30 - 39	4.49	5.97	6.64	9.20	9.45	11.99	17.21
40 - 49	5.23	6.57	8.48	11.07	9.57	13.26	17.65
50 - 59	9.07	7.35	12.40	9.15	10.51	18.11	15.28
60 +	19.51	20.73	19.66	19.02	18.72	18.58	22.3
Total (CDR)	4.68	4.97	5.29	5.86	5.72	6.62	7.62

The Under Five Mortality Rate fell slightly from 12.69 in 1995 to 10.82 in 2001. The decrease in the U5MR was entirely due to the decrease in the NNMR, as the Child Mortality Rate and the Post Neonatal Mortality Rate actually increased.

The ASMR in the five to 14 years old group increased steadily from 0.39 in 1995 to 0.81 in 2001. All of the increase was in the five to nine years old group.

The ASMR in the 15 to 19 years old group was fairly steady from 0.41 in 1995 to a low of 0.30 in 2000 but then increased dramatically by 63% to reach its high of 0.67 in 2001.

The ASMRs prior to the adult years did not vary much between male and female. But the groups from 20 years and upwards began to show large variations between the male and the female ASMRs with the male ASMRs being higher (Table III-4, Figures III-3-5, & Appendices II & III). In the 20 to 29 years old decade group the total ASMR increased steadily from a low of 2.49 in 1995 to a high of 7.45 in 2000, ending slightly lower at 7.27 in 2001. The male ASMR rose from 2.88 in 1995 to 8.25 in 2001 with a high of 9.05 in 2000; while the female rose from 2.24 in 1995 to 6.64 in 2001.

Table III-4 – Adult Total, Male & Female ASMR

Age group	Total ASMR						
	1995	1996	1997	1998	1999	2000	2001
20-29	2.49	3.49	2.99	4.55	5.96	7.45	7.27
30-39	4.49	5.97	6.64	9.20	9.45	11.99	17.21
40-49	5.23	6.57	8.48	11.07	9.57	13.26	17.65
50-59	9.07	7.35	12.40	9.15	10.51	18.11	15.28
60+	19.51	20.73	19.66	19.02	18.72	18.58	22.30
	Male ASMR						
	1995	1996	1997	1998	1999	2000	2001
20-29	2.88	3.28	2.96	5.06	5.65	9.05	8.25
30-39	8.07	10.76	10.42	15.87	15.93	16.76	27.34
40-49	8.22	11.43	15.69	18.68	16.34	17.42	26.37
50-59	13.46	13.24	20.72	12.82	16.63	26.11	22.88
60+	26.26	26.60	25.43	27.94	25.10	25.65	32.19
	Female ASMR						
	1995	1996	1997	1998	1999	2000	2001
20-29	2.24	3.62	3.01	4.22	6.15	6.43	6.64
30-39	2.47	3.27	4.51	5.43	5.79	9.30	11.49
40-49	3.45	3.68	4.18	6.51	5.54	10.78	12.45
50-59	6.30	3.64	7.16	6.84	6.53	13.06	10.48
60+	16.05	17.73	16.70	14.44	15.44	14.96	17.22

[1] The high ASMR is marked with blue and the low is marked with red.

The total ASMR of the 30 to 39 years old decade group increased steadily from its low of 4.49 in 1995 to a high of 17.21 in 2001. The male ASMR rose over three times from a higher base of 8.07 in 1995 to 27.34 in 2001; while the female ASMR rose over four times from a lower base of 2.47 in 1995 to 11.49 in 2001.

In the 40 to 49 years old decade group the total ASMR steadily rose from a low of 5.23 in 1995 to a high of 17.65 in 2001. The male ASMR showed similar rates and a similar rise in this age group as to the 30 to 39 years old group rising over three times from 8.22 in 1995 to 26.37 in 2001. Likewise the female ASMR was similar to those of the 30 to 39 years old group rising over three times from 3.45 in 1995 to 12.45 in 2001.

The ASMR of the 50 to 59 years old decade group was fairly steady ranging from 9.07 in 1995 to 10.51 in 1999. However in 2000 it jumped dramatically to 18.11 before dropping in 2001 to 15.28. The male ASMR continued to be almost twice that of females in this age group. It started from a low of 13.46 in 1995 and nearly doubled to a high of 26.11 in 2000, before falling to 22.88 in 2001. The female ASMR was 6.30 in 1995 and doubled to a high of 13.06 in 2000 before also falling in 2001 to 10.48.

The ASMR of the 60 years old and over group was fairly steady ranging from 19.51 in 1995 to 22.30 in 2001. Both male and female rates were fairly level in this age category; however the male rates were slightly higher beginning at 26.26 in 1995 and staying near that level until 2001 when it rose to 32.19. The female rate was 16.05 in 1995 and 17.22 in 2001.

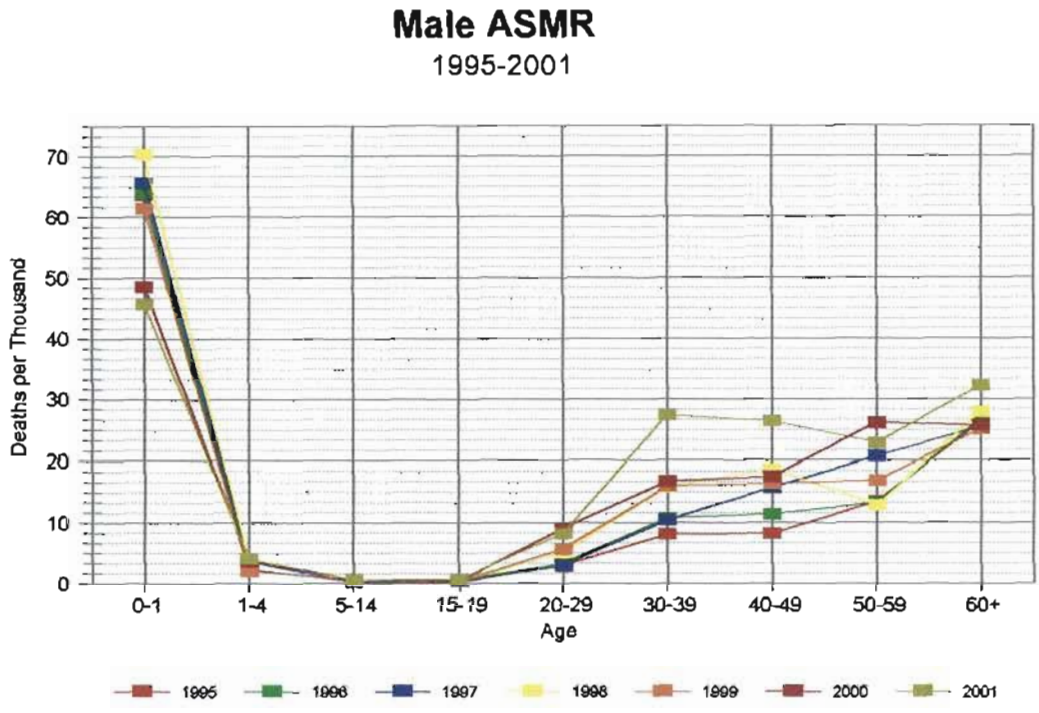

Figure III-3 – Male ASMR by Age Group

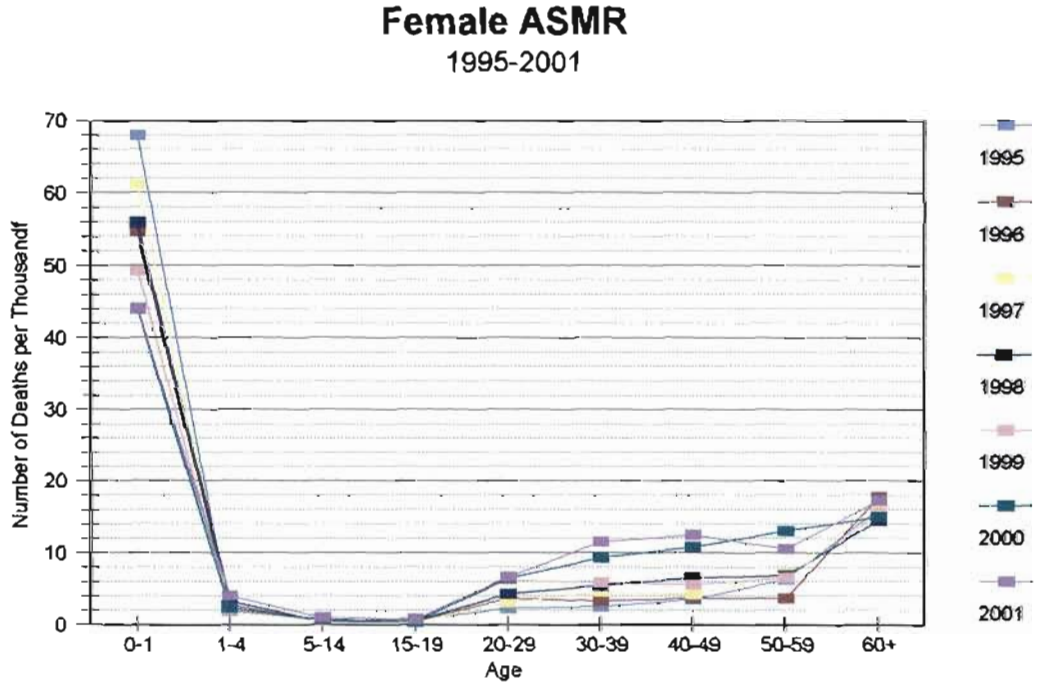

Figure III-4 – Female ASMR by Age Group

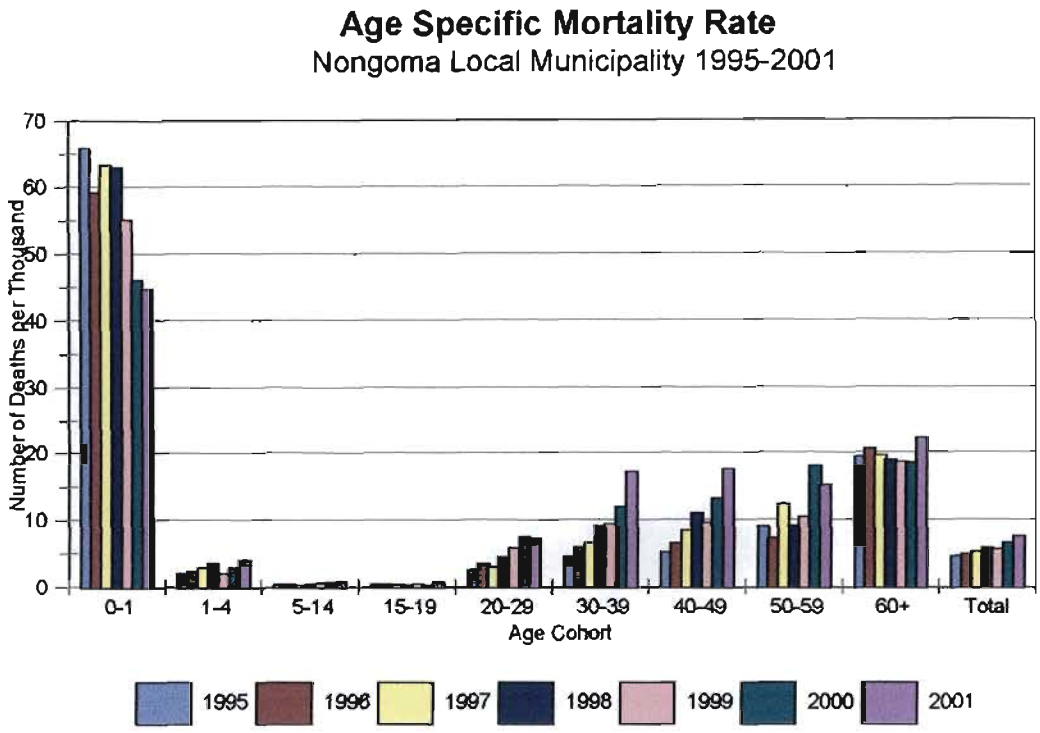

Figure III-5 – ASMR by Age Group

3.3.1 Causes of Death – *Top Twenty Causes by Number*

The distribution of the causes of mortality help to determine the health status of a community. They also can identify the health needs of a community and areas in which the health service can be improved.

Unknown or ill-defined causes accounted for the largest number of deaths, however this was due to the fact that in 1996 over 50% of the deaths and in 1997 over 67% of the deaths had no cause recorded. If those years had been in line with the rest of the study, unknown causes would have been behind pulmonary tuberculosis and

pneumonia. In most years other than 1996 and 1997, unknown causes ranged around 10% with the exception of 2000 when they were 17%.

The twenty leading causes of death are listed in Table III-5 according to overall rank. The table also includes their overall percentage, their ranking and percentage in the first and last years of the study, as well as the numerical and percentage increase in mortality due to each cause. The leading causes of death which showed the largest numerical change are graphed in Figure III-6, while the percentage change in the number of deaths is graphed in Figure III-7. A full list of causes is found in Appendix IV. Further tables and graphs can be found in Appendix V.

The number one overall cause of death was pulmonary tuberculosis with 1059 deaths. In 1995 it was clustered with the top four causes, causing 8.7% of all deaths, but increased steadily and dramatically by over five times causing 20.5% of all deaths in 2001.

The second leading cause of death overall was pneumonia with 805 deaths. With pulmonary tuberculosis it was clustered in the top four causes in 1995. It also increased steadily and dramatically by about three and one-half times causing about 14.5% of deaths in 2001.

Trauma was a relatively minor cause of death ranking number twelve overall from the Benedictine Hospital mortuary records. However when an analysis of police postmortems for the Nongoma Local Municipality (Kaufmann 2002) made for the three years 1999-2002 (Table III-6) is included in the trauma totals it moves up to number three overall, 604 deaths, accounting for 7.3% of all deaths. The analysis including police postmortems put trauma as the second leading cause in 1999 with 197 deaths, 15,5% of

deaths. It was the third leading cause in 2000 and 2001 with 149 and 141 deaths respectively. If trauma figures from the police mortuary were available for the four years 1995 to 1998 trauma would have come in an higher rank, possibly even first. However, the number of trauma deaths declined over the three years which included the police postmortems and ended up accounting for only 8.3% of deaths.

Table III-5 – Leading Causes of Death Nongoma Local Municipality 1995-2001

Cause of Death Overall Rank	1995 rank	1995 %	1995	1998	1999	2000	2001	2001 rank	2001 %	Total	Total %	Total Numerical Increase	Total % increase
1. PTb	3	8.7	71	118	195	206	353	1	20.5	1059	12.8	282	397.2%
2. Pneumonia	4	8.3	68	117	111	181	250	2	14.5	805	9.7	182	267.7%
3. Trauma [1]	10	3.9	32	43	197	149	141	3	8.2	604	7.3	(-56)	(-28.4%)
4. Gastroenteritis	2	8.8	72	114	122	103	125	4	7.3	602	7.3	53	73.6%
5. Malnutrition	6	5.9	48	79	53	60	52	9	3.0	339	4.1	4	8.3%
6. CVA	7	5.3	43	39	42	47	54	8	3.1	280	3.4	11	25.6%
7. CCF	5	6.3	52	46	42	38	50	10	2.9	277	3.3	(-2)	(-3.9%)
8. Prematurity	1	9.0	74	60	46	20	36	13	2.1	275	3.3	(-38)	(-51.6%)
9. Cancer	9	4.2	34	41	42	38	40	12	2.3	219	2.6	6	17.7%
10. Meningitis	17	1.5	12	32	34	47	59	7	3.4	217	2.6	47	391.7%
11. Retroviral	=11	3.2	26	13	25	48	66	6	3.8	213	2.6	40	153.9%
12. Chr GE	16	2.0	16	35	22	51	78	5	4.5	208	2.5	62	387.5%
(12.) Trauma [2]	10	3.9	32	43	31	14	21	15	1.2	183	2.2	(-11)	(-34.7%)
13. Septicaemia	13	2.6	21	45	28	26	31	=14	1.8	182	2.2	10	47.6%
14. Low Apgar	8	5.0	41	22	33	20	17	17	1.0	160	1.9	(-24)	(-58.5%)
15. Herbal Enema	20	1.0	8	33	21	13	48	11	2.8	130	1.6	40	500.0%
16. Hepatic Failure	=11	3.2	26	25	19	19	16	18	0.9	121	1.5	(-10)	(-38.5%)
17. D Mellitus	14	2.3	19	17	24	14	31	=14	1.8	114	1.4	12	63.2%
18. Epilepsy	21	0.9	7	16	22	19	20	16	1.2	92	1.1	13	185.7%
19. Renal Failure	15	2.1	17	7	10	9	13	19	0.8	68	0.8	(-4)	(-23.5%)
20. Hypertension	18	1.2	10	7	13	5	7	24	0.4	48	0.6	(-3)	(-30.0%)
Unknown		8.4	69	150	86	245	154		8.9	1857	22.4	85	123.2%
TOTAL			819	1118	1269	1418	1722			8284		903	110.3%

[1] The change in the trauma totals was calculated between 1999 and 2001, as those are the years which reflect a more accurate picture for trauma as they include data from the district surgeon.

[2] Trauma data for Benedictine Hospital only.

Table III-6 – Unnatural Causes of Death Nongoma 1999-2002 (Kaufmann 2002)

Diagnosis	1999-2000	2000-2001	2001-2002
Motor Vehicle Accident	50	33	32
Gun Shot Wound	58	49	44
Blunt Trauma	14	8	16
Knife Wound	21	15	15
Trauma	4	9	5
SD / IC Haemorrhage	3	2	0
Strangulation	13	12	11
Electrocution / (Lightning)	10	1	1
Drowning	8	8	5
Asphyxia	2	2	3
Environmental Exposure	2	3	3
Burns	1	4	5
Other	6	2	0
TOTAL	192	148	140

Grouped together at number three with trauma is gastroenteritis with 602 deaths. It was clustered with the top four causes in 1995 and increased steadily, by 74% overall, but more slowly to end in fourth place in 2001.

Malnutrition ranked as the fifth overall cause of death with 339 deaths, 4.1% of all deaths. Deaths attributed to malnutrition were fairly stable. Malnutrition caused 48 deaths in 1995 and accounted for 52 deaths in 2001.

Grouped together behind the top five causes of death is a group of three diseases, cerebral vascular accident (280 deaths), congestive cardiac failure (277), and prematurity (275). The numbers of deaths due to CVA and CCF were fairly steady during the study. However prematurity, which was the number one cause of death in 1995, was one cause of mortality which has decreased significantly falling by 51% overall from 74 deaths in 1995 to 36 deaths in 2001 and 13th place.

Another group of four diseases is clustered together in ninth place, cancer (219 deaths), meningitis (217), retro-viral disease (213), and chronic diarrhea (208). Cancer was basically steady during the study. However each of the other diseases in this cluster increased steadily and sharply. Meningitis and chronic diarrhoea increased by almost five times, while retro-viral disease increase by two and one-half times.

Deaths due to septicaemia, in thirteenth place overall, increased slightly by 48% over the seven years of the study.

Low apgar showed the largest percentage decline of any disease in the study. Ranking fourteenth overall, low apgar was responsible for 160 deaths. It was the eighth leading cause of death in 1995, but decreased markedly by 59% overall, and ended in 17th place in 2001.

Two other diseases in the top twenty causes of death, which showed large increases, were herbal enema and epilepsy. Deaths due to herbal enema (130 deaths), in fifteenth place overall, increased six times; while deaths caused by epilepsy (92 deaths), in eighteenth place overall, increased almost three times.

The remaining diseases in the top twenty causes of death were relatively stable. Deaths due to hepatic failure, renal failure, and hypertension decreased slightly over the course of the study, while deaths due to diabetes mellitus increased slightly.

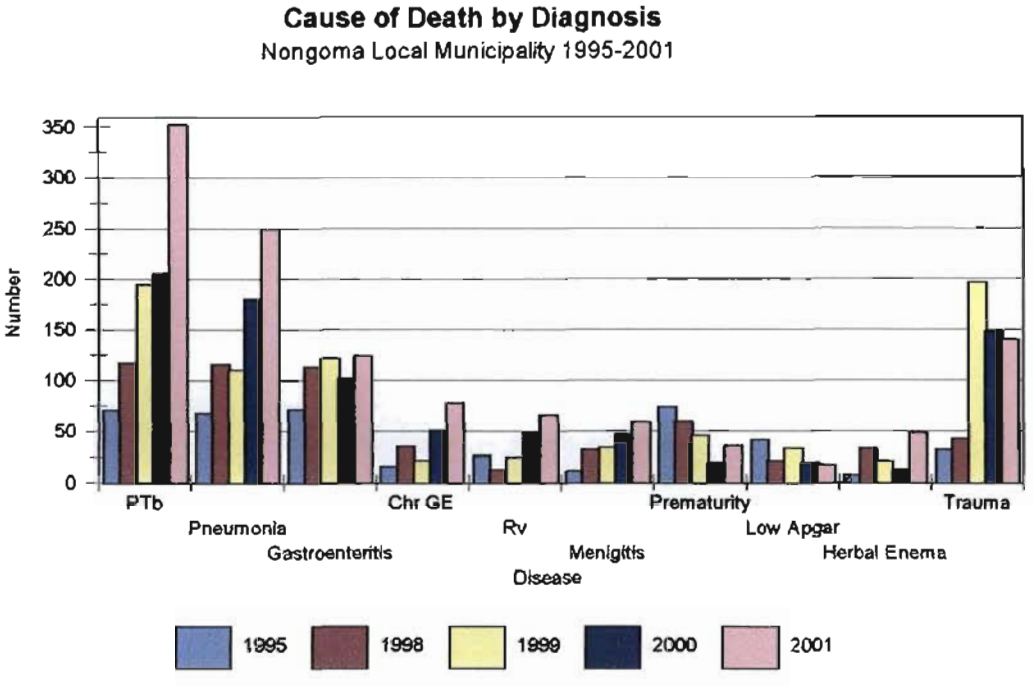

Figure III-6 – Leading Causes of Death which showed the most change in numbers

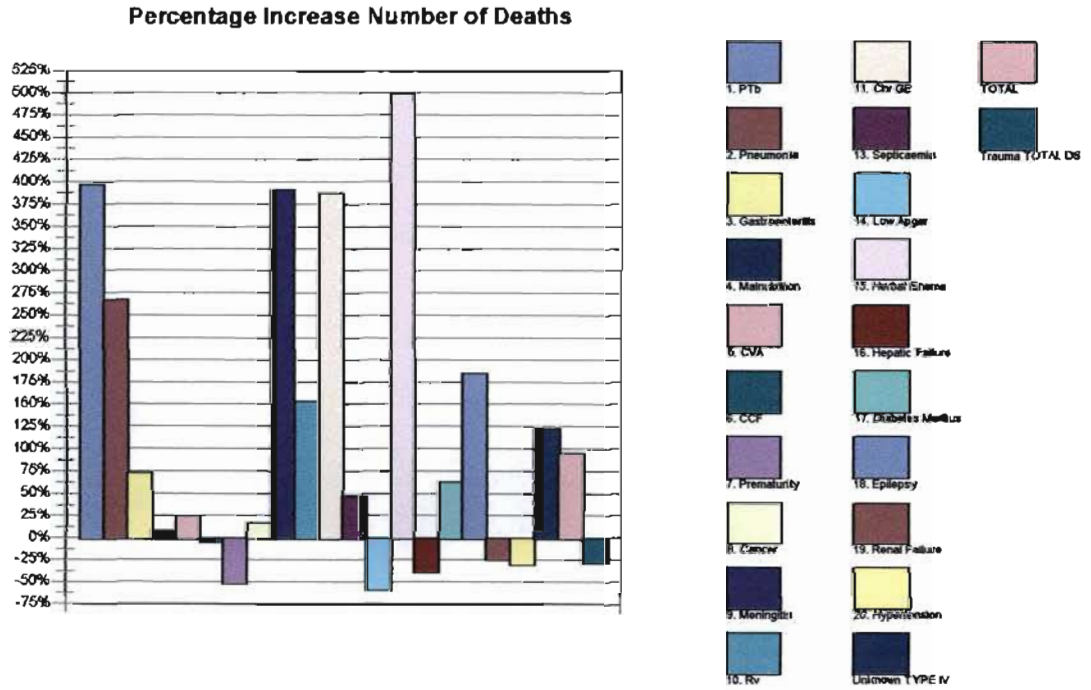

Figure III-7 Percentage Increase / Decrease in numbers for causes of death

3.3.2 Cause of Death – *Burden of Disease*

Another way of analyzing the cause of death is to group the causes according to the Burden of Disease list. Analysis by burden of disease allows for evaluation as to where a society is in the epidemiological transition. It also allows for comparison of the health status of one society with another. It further allows for comparison of a society's burden of disease with other studies. The broad categories of cause of death by burden of disease at Benedictine Hospital can be seen in Table III-7. A full list can be seen in Appendix IV along with the South African Burden of Disease list in Appendix VI.

The largest sub-category of the Type I infectious diseases sub-category is infectious and parasitic illnesses. For purposes of comparison with other studies, I have divided this into three further sub-categories: tuberculosis, diarrhoeal diseases, and other infectious diseases. In 1995 diarrhoeal diseases accounted for 88 deaths representing 10.74% of the burden of disease and was the largest of these sub-categories. Deaths caused by acute and chronic diarrhoea increased by 131% to 203 deaths in 2001. But this large numerical was only a 1% increase in the burden of disease to 11.79% (Figures III-8 through III-10).

A second large sub-category is tuberculosis. In 1995 these diagnoses accounted for 77 deaths, 9.40% of all causes. The numbers of deaths caused by tuberculosis increased by 377% to 367 deaths in 2001. This caused a large increase of almost 12 percentage points in the burden of disease to 21.31% .

The third sub-category which falls into this sub-category is other infectious diseases. The major diagnoses being retro-viral disease, meningitis, septicaemia, and

malaria. Retro-viral disease and meningitis were the major contributors which caused an increase in this sub-category. Deaths increased by 161% from 62 deaths in 1995 representing 7.57% of the burden of disease, to 162 deaths accounting for 9.41% of the burden of disease in 2001. The burden of disease of this sub-category, other infectious diseases, increased by 1.84%.

The total burden for infectious disease sub-category of Type I deaths increased substantially, both in numbers by 209% and as a percentage of the total burden of disease, from 237 deaths in 1995 representing 27.71% of the burden, to 732 deaths in 2001 representing 42.51% of the burden of disease.

A second sub-category in the Type I causes of death is deaths due to respiratory infections, pneumonia. The number of deaths caused by pneumonia increased over three times, by 268%, from 68 deaths in 1995 to 250 deaths in 2001. The burden of disease increased over 6 % from 8.30% in 1995 to 14.52% in 2001.

The third sub-category in Type I causes of death is maternal and perinatal causes. These deaths showed a decrease both in numbers and in percentage. They decreased by 51% from 118 deaths in 1995 representing 14.04% of the burden of disease, to 58 deaths in 2001 representing 3.14% of all deaths. Over 95% of these deaths are attributed to perinatal causes as only 22 deaths, 4.55%, overall were attributed to maternal causes.

The last sub-category in Type I diseases is malnutrition. This sub-category remained substantially stable as to numbers, while the burden of disease decreased by 2.26%. Malnutrition accounted for 54 deaths in 1995 representing 5.86% of the burden of disease, and ending with 62 deaths in 2001, 3.60% of all deaths that year.

Type I causes overall increased by 137% from 464 deaths in 1995 representing 56.64% of the burden, to 1098 deaths in 2001 accounting for 63.77% of the burden of disease. All of this increase was in the infectious disease sub-category as the perinatal, maternal and malnutrition sub-categories showed decreases in their responsibility for the burden of disease.

Type II non-communicable diseases have been divided into three sub-categories: cardiovascular, cancer and other. The burden of disease due to the cardiovascular diseases sub-category decreased substantially. The number of deaths was relatively stable recording 108 deaths in 1995, and rising only slightly, 6.48% over six years, to 115 deaths in 2001. However this was a substantial decrease in burden of disease from 13.19% in 1995 to only 6.68% of all deaths in 2001.

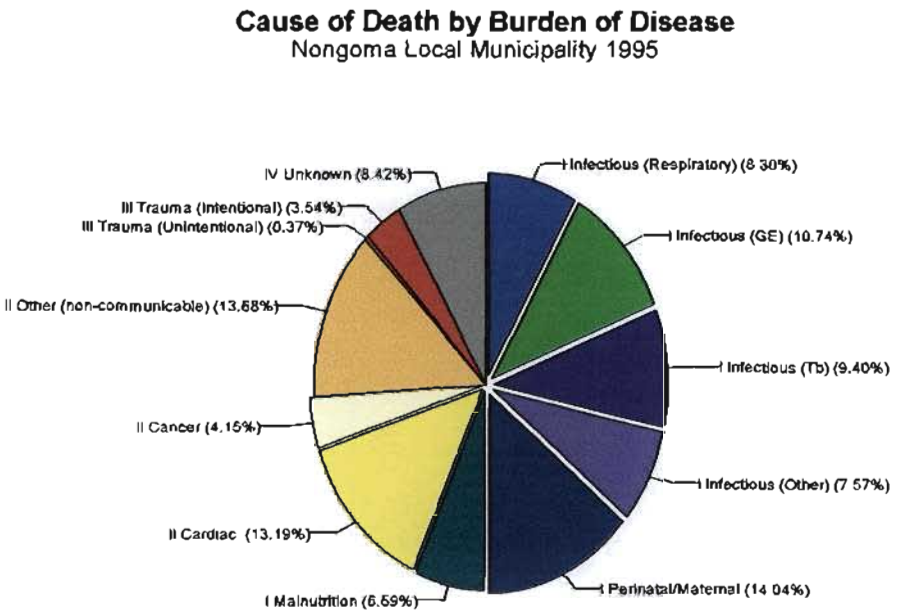

Figure III-8 Burden of Disease 1995 – Nongoma Local Municipality

Cause of Death by Burden of Disease
Nongoma Local Municipality 1999

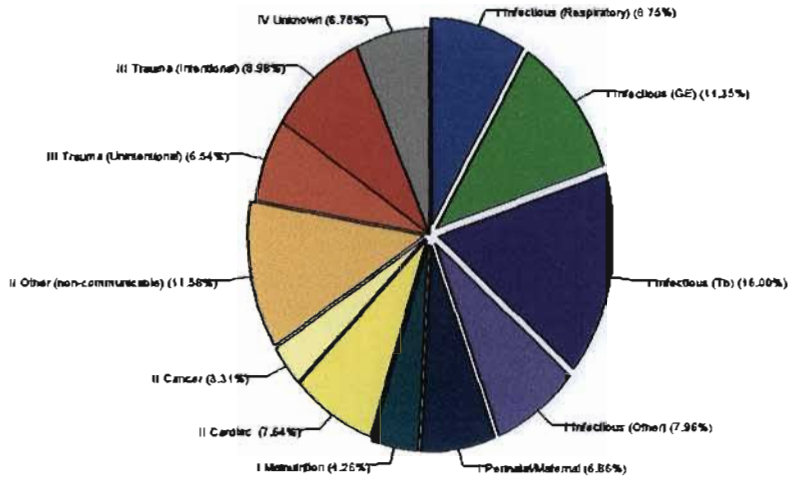

Figure III-9 Burden of Disease 1999 – Nongoma Local Municipality

Cancer as a sub-category also showed a decrease of its share of the burden of disease. The number of deaths was relatively stable increasing slightly, 17.65% over six years, from 34 deaths in 1995 to 40 deaths in 2001. The burden of disease decreased from 4.15% in 1995 to 2.32% in 2001.

The sub-category other communicable diseases also showed a decrease in their amount of the burden of disease. The number of deaths increased by over 55% from 112 deaths in 1995 to 174 deaths in 2001, but the burden of disease decreased from 13.68% to 10.10% respectively.

Overall deaths due to Type II diseases increased by 29.53% from 254 deaths in 1995 to 329 deaths in 2001. However the burden of disease decreased from 31.02% in 1995 to 19.10% in 2001.

The change in the burden of disease due to Type III causes is difficult to judge as the numbers in the hospital were fairly small accounting for 32 deaths in 1995, 3.91% of the burden of disease, and only 21 deaths in 2001 representing 1.35% of hospital deaths. However when district surgeon postmortems are included in the totals, which are available for 1999 through 2001, the number of deaths due to trauma is 191 deaths in 1999, 15.52% of the burden of disease, decreasing to 140 deaths accounting for 8.18% of the burden of disease in 2001. The burden of disease caused by unintentional causes, such as motor vehicle accidents, in 1999 was 6.54% and decreased to 2.90% in 2001. Even the burden of disease caused by intentional trauma, homicide and suicide, decreased from 8.98% in 1999 to 5.28% in 2001.

Type IV causes are ill-defined or unknown causes. These were fairly stable in our study starting with 69 deaths in 1995, 8.4% of deaths and accounting for 154 deaths, 8.95% of the burden in 2001. Unknown causes were particularly high in 1996 and 1997 with 48.22% and 70.50% respectively making it difficult in those years to evaluate the causes of death and the burden of disease. Unknown causes in 1998 were slightly high accounting for 13.42%. 2000 as well recorded high for unknown causes with 17.28%. However if the two extremely high years of 1996 and 1997 are removed from the study the unknown causes accounted for 10.94% overall.

Therefore overall Type I pre-transitional causes have increased their share of the burden of disease from 56.64% in 1995 to 63.77% in 2001. Type II non-communicable causes have decreased from 31.02% in 1995 to 19.10% in 2001. Type III trauma causes were 3.91% in 1995 and underestimated; however corrected figures decreased from 15.52% in 1999 to 8.18% in 2001. Type IV unknown causes were stable at about 9% of the burden of disease.

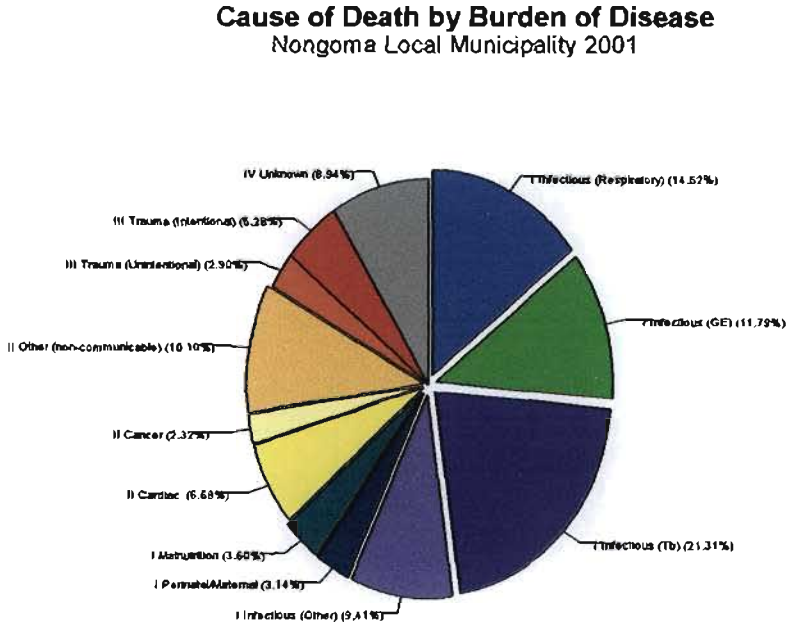

Figure III-10 Burden of Disease 2001 – Nongoma Local Municipality

Table III-7 – Cause of Death by Burden of Disease

Cause of Death \ Year	1995	1996	1997	1998	1999	2000	2001	TOTAL
I Infectious (Respiratory) sub-category	68	43	35	117	111	181	250	805
I Infectious (GE) sub-category	88	42	30	149	144	154	203	810
I Infectious (Tb) sub-category	77	68	55	122	203	208	367	1100
I Infectious (Other) sub-category	62	70	39	94	101	133	162	661
TYPE I Infectious Subtotal	295	224	159	482	559	676	982	3377
I Maternal sub-category	0	8	2	2	8	1	1	22
I Perinatal sub-category	115	43	23	82	79	40	53	435
TYPE I Perinatal/Maternal Subtotal	115	51	25	84	87	41	54	457
TYPE I Malnutrition Subtotal	54	40	11	82	54	63	62	366
TYPE I (Pre-transitional) Total	464	315	195	648	700	780	1098	4200
II Cardiac sub-category	108	69	41	92	97	93	115	615
II Cancer sub-category	34	16	8	41	42	38	40	219
II Other (non-communicable) sub-category	112	67	32	144	147	113	174	789
TYPE II (non-communicable) Total	254	152	81	277	286	244	329	1623
III Benedictine (trauma)	32	28	14	43	31	14	21	183
District Surgeon Post Mortems [1]								
District Surgeon TOTAL					192	148	140	480
III Trauma (Unintentional) Sub	3	7	1	9	83	52	50	205
III Trauma (Intentional) Sub	29	21	13	34	114	97	91	399
TYPE III Trauma Total	32	28	14	43	197	149	141	604
TYPE IV Unknown Total	69	460	693	150	86	245	154	1857
TOTAL CAUSES OF DEATH [2]	819	955	983	1,118	1,269	1418	1,722	8284

[1] Trauma from the hospital mortuary register was only counted if the numbers exceeded those of post mortems done by the district surgeon. This was because trauma which ends in death in the hospital should be referred to the district surgeon as an unnatural cause of death. This was an attempt to avoid double counting; however it is realized that an under count might also occur.

[2] Total causes of death do not match the number of deaths as they were counted at different times, AIDS was double counted, and adjustments as per footnote one made for trauma.

3.3.3 Cause (Disease) Specific Mortality Rates (CSMR)

The Crude Death Rate at Benedictine Hospital rose from 468.17 per 100,000 in 1995 to 762.19 in 2001. If the deaths from the postmortems done by the district surgeon are included it rose to 821.13 (Table III-8). Cause specific mortality rates give the portion which each disease contributes to the overall death rate. They give a more accurate picture of the effect of different diseases on societies than just raw numbers. In determining the highest and lowest CSMRs the years 1996 and 1997 will not be considered as the extremely high proportion of unknown causes of death make the CSMRs for those years relatively meaningless (Table III-8, Figures III-10 and III-11, and Appendices VII and VIII).

Among the top twenty causes of death a group of six infectious diseases caused the largest CSMRs and also showed most of the largest increases in CSMRs. Pulmonary tuberculosis had the highest disease specific mortality rate. It started in 1995 at 38.34 per 100,000, but rose steadily to end at 173.36, four and a half times higher than in 1995. Pneumonia rose steadily over three and a third times from a mortality rate of 36.72 in 1995 to the second highest rate at 122.78 in 2001. The increase in mortality rate for gastroenteritis, while not as dramatic as those of pulmonary tuberculosis and pneumonia, was still large. It increased from 38.88 in 1995 to 61.39 in 2001, an increase of almost 60%. The mortality rate for chronic gastroenteritis increased steadily, almost four and one-half times, from 8.64 in 1995 to 38.31 in 2001. If acute and chronic gastroenteritis are combined their rate in 2001 is 99.70. Retro-viral disease started with a CSMR of 14.04

in1995, and rose steadily by 131% to peak at 32.41 in 2001. The CSMR for meningitis rose steadily by 347% from 6.48 in 1995 to 28.98 in 2001.

Two further diseases showed dramatic increases but off of relatively low bases. The death rate caused by herbal enema rose over five times, from 4.32 in 1995 to 23.57 in 2001. The CSMR for epilepsy increased over two and one-half times from 3.78 in 1995 to 9.82 in 2001.

Another group of six diseases, none of which are infectious, showed a decrease in CSMRs. During the last three years of the study, when the district surgeon deaths are included in the analysis of trauma, trauma produced the third highest annual CSMR in 1999 of 99.85. This rate then fell over the last two years of the study to 69.25 in 2001. Prematurity caused the highest CSMR in 1995 at 39.96, but the rate fell steadily over the

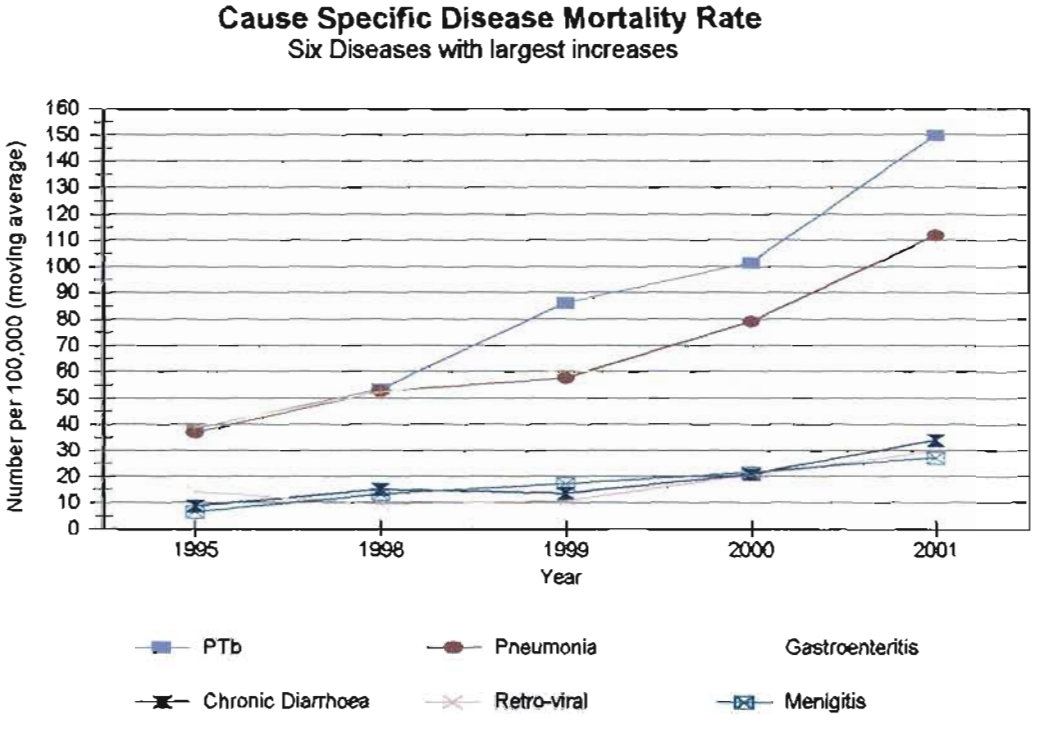

Figure III-10 Six Diseases showing largest CSMRs and the largest increases in CSMRs

years in the study to end at 17.68 in 2001. The CSMR for low apgar fell by 62% from a high of 22.14 in 1995 to a low of 8.35 in 2001. Hepatic failure, renal failure and hypertension also showed decreases.

A further group of six diseases produced CSMRs which were relatively stable. Malnutrition, CCF, CVA, Septicaemia, Cancer, and Diabetes Mellitus.

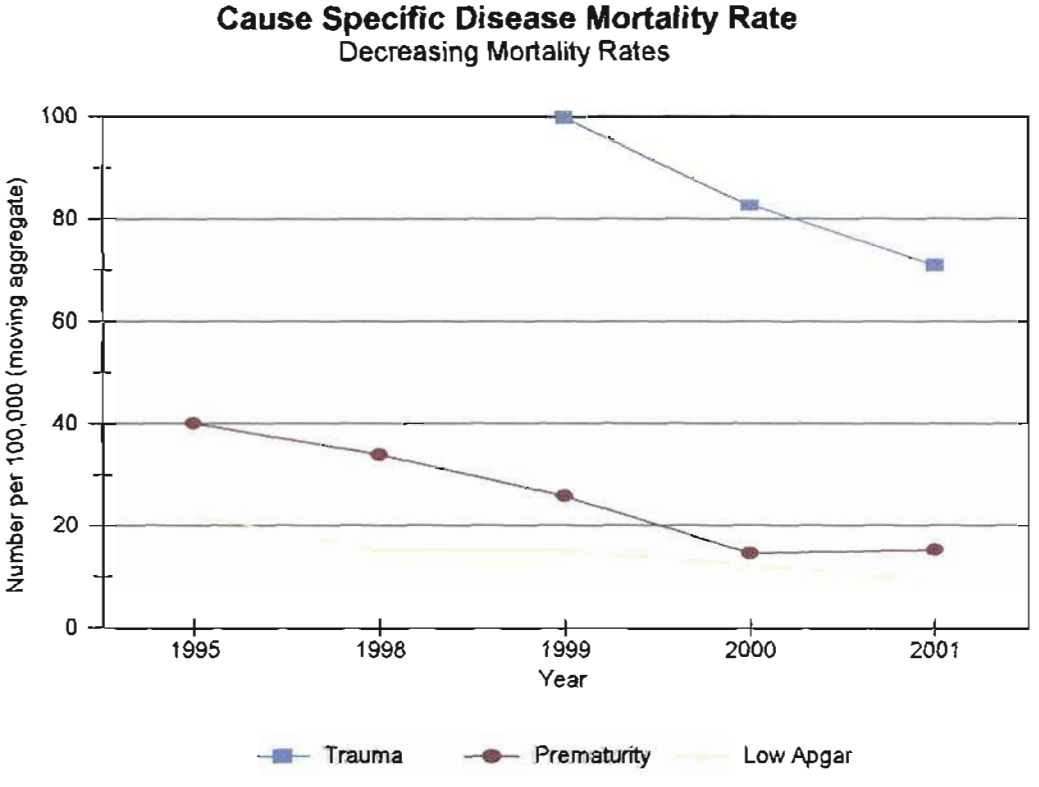

Figure III-11 Three Diseases showing the largest decreases in CSMRs

Table III-8 – Cause Specific Mortality Rate per 100,000

Cause of Death	1995	1998	1999	2000	2001	Ratio 2001:1995
1. PTb	38.3	60.8	98.8	102.8	173.4	4.5
2. Pneumonia	36.7	60.3	56.3	90.3	122.8	3.3
Trauma – Unintentional	1.6	4.6	42.1	25.9	24.6	0.6
Trauma – Intentional	15.7	17.5	57.8	48.4	44.7	0.8
3. Trauma –total	17.3	22.2	99.9	74.3	69.3	0.7
4. Gastroenteritis	38.9	58.7	61.8	51.4	61.4	1.6
5. Malnutrition	25.9	40.7	26.9	29.9	25.5	1.0
6. Prematurity	40.0	30.9	23.3	10.0	17.7	0.4
7. Chr Diarrhoea	8.6	18.0	11.2	25.5	38.3	4.4
8. Retro-viral	14.0	6.7	12.7	24.0	32.4	2.3
9. Meningitis	6.5	16.5	17.2	23.5	29.0	4.5
10. CCF	28.1	23.7	21.3	19.0	24.6	0.9
11. CVA	23.2	20.1	21.3	23.5	26.5	1.1
12. Herbal Enema	4.3	17.0	10.6	6.5	23.6	5.5
13. Septicaemia	11.3	23.2	14.2	13.0	15.2	1.3
14. Low Apgar	22.1	11.3	16.7	10.0	8.4	0.4
15. Cancer	18.4	21.1	21.3	19.0	19.6	1.1
16. Diabetes Mellitus	10.3	8.8	12.2	7.0	15.2	1.5
17. Hepatic Failure	14.0	12.9	9.6	9.5	7.9	0.6
18. Epilepsy	3.8	8.2	11.2	9.5	9.8	2.6
19. Renal Failure	9.2	3.6	5.1	4.5	6.4	0.7
20. Hypertension	5.4	3.6	6.6	2.5	3.4	0.6
CDR (inc District Surgeon)	468.2	586.2	656.4	728.9	821.1	1.8

[1] The high CSMR is marked with blue and the low is marked with red. 1996 and 1997 were not considered as the unknown portion of diagnoses was extremely high.

[2] The trauma ratio was calculated between 1999 and 2001 as those were the years when the district surgeon's data was included.

Chapter Four – Discussion

4.1 Change in pattern of the Number of Deaths

The distribution of the number of deaths by age and sex is function of the age specific mortality rates and the age structure of the population (Dorrington et al 2001:10). Normally the highest number of deaths are at each end of the spectrum, in the under one year old and in the oldest age groups. The lowest numbers are in the age group for children from the ages of 5 through 14, increasing thereafter with increasing age (Katzenellenbogen et al 1997:187). In South Africa during the decade from 1988 through 1996, deaths in females gradually increased in each age group to peak at old age, over 65 years old, giving a concave pattern; while in males higher deaths in the younger age groups, secondary to trauma, give a convex pattern still peaking at old age (Dorrington et al 2001:10).

4.1.1.1 Change in pattern of the Number of Deaths – *Female*

Figure IV-1 shows the number of deaths at Benedictine Hospital for females according to each age group for each year from 1995 through 2001. Figures in Appendix III show the number of deaths and the ASMR for each year. In 1995 this pattern resembled that described for females with the under one year old and the sixty years old and over being the two highest categories. The number of deaths decreased to being the lowest in the 15 through 19 year old group. However in 1995 there was not a true concave pattern as there was already developing a second peak in the 20 through 29 year

old group. This second peak increased each year creating a bimodal picture. In 1999 the number of deaths in the 20 through 29 year old group almost equalled the infant and the old age groups. By 2000 the second peak included the 30 through 39 year old group as well as the 20 through 29 year old group, and each of these groups equalled or exceeded the infant group and was only exceeded by the old age group. By 2000 and 2001 deaths were even increasing in the 40 through 49 and 50 through 59 year old groups although the overall picture was still bimodal with the peaks in young adult and old age with a trough in the middle age groups.

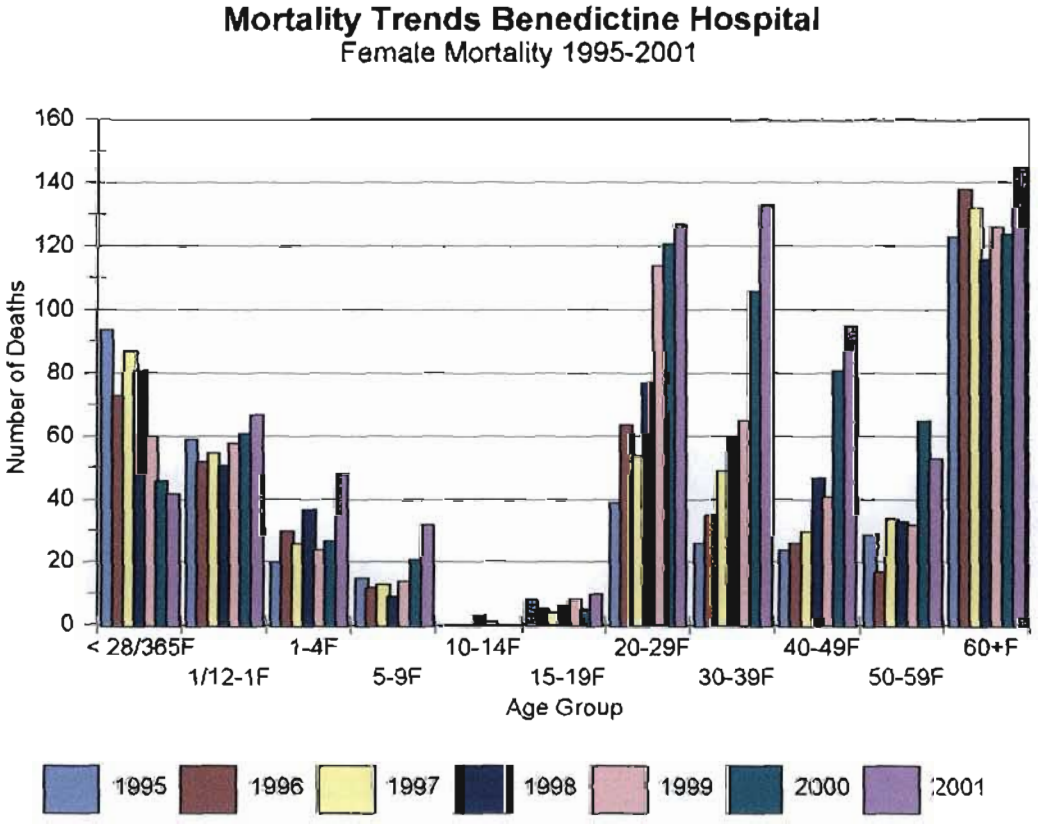

Figure IV-1 Annual Number of Deaths for each Female Age Group

4.1.1.2 Change in pattern in Number of Deaths – *Young / old Ratio*

Dorrington et al present the ratio between young adult deaths and older adult deaths as a simple summary index (2001:17). This is achieved by comparing the total deaths for those aged 15 to 49 with those over the age of 50 (Figures IV-2 & IV-3). The young to old ratio of female mortality for South Africa was about one half that of Benedictine Hospital. The figure for South Africa was 0.37 in 1993 compared with 0.64 in 1995 at Benedictine Hospital; the ratio rose to 0.78 in 1999/2000 compared to 1.44 for Benedictine Hospital in 1999 (Ibid). Dorrington et al state the figure had been fairly static at 0.31 prior to 1990. Benedictine Hospital's ratio continued to rise and was 1.84 in 2001. This is almost six times the South African ratio in 1990. This shift in the pattern of the number of deaths confirms an affirmative answer to our first research question. The increase in the number of deaths in the young adult age groups confirms a change in the age distribution of deaths.

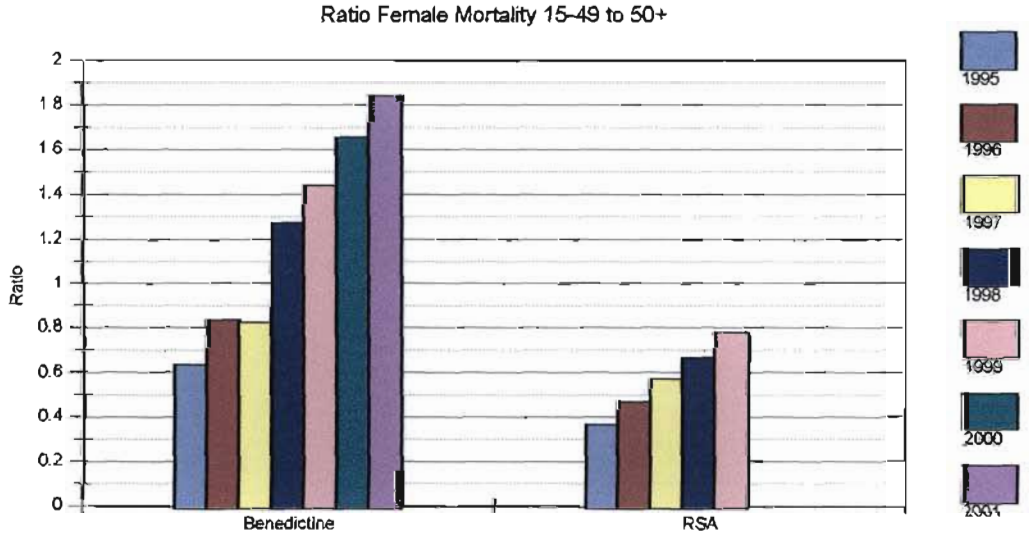

Figure IV-2 Ratio Female Adult Mortality – Benedictine Hospital & RSA

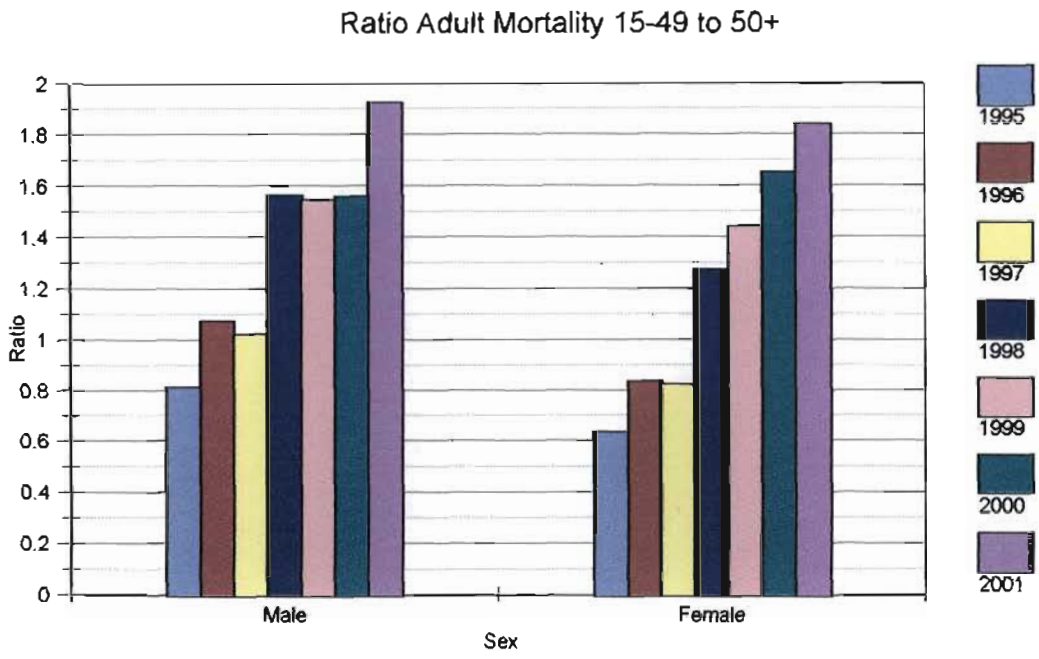

Figure IV-3 Ratio Adult Mortality Male & Female – Benedictine Hospital

4.1.2.1 Number of Deaths – *Male*

The number of deaths for males at Benedictine Hospital for each age group for the years 1995 through 2001 are shown in Figure IV-4. Further graphs in Appendix III show the number of deaths and the ASMR for each year. Males have higher deaths in the young adult age groups, secondary to trauma, which gives rise to a convex pattern which still has peaks in infancy and old age. The 1995 pattern somewhat resembled that described for males with the under one year old and the sixty year old and over age groups being the two highest categories. The number of deaths decreased to being the lowest in the 15 through 19 year old group. However in 1995 there was not a true convex pattern as there

was already developing a second peak in the 30 through 39 year old group. This second peak increased each year creating a bimodal picture. In 1999 the number of deaths in the 30 through 39 year old group almost equalled the old age group. By 2000 the second peak included the 20 through 29 year old group as well as the 30 through 39 year old group, and each of these groups almost equalled or exceeded the infant and old age groups. By 2001 the 40 through 49 year old age group was part of the young adult peak and deaths in the 30 through 39 year old age group exceeded by far any other group. By 2000 the number of deaths in the 50 through 59 year old age group was increasing although the overall picture was still bimodal with the peaks in young adult and old age with a trough in this group.

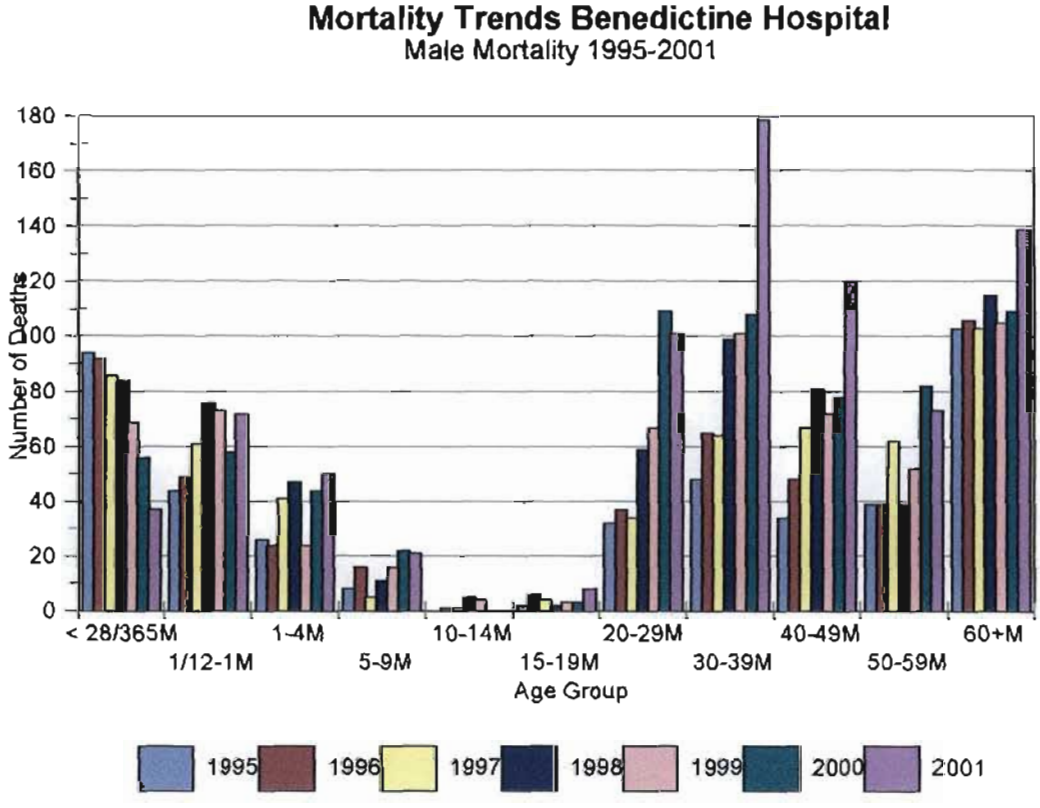

Figure IV-4 Annual Number of Deaths for each Male Age Group

4.1.2.2 Change in pattern in Number of Deaths – *Young / old Ratio*

Again the young to old mortality ratio provides some information as to what is happening with mortality. In males the ratio is higher because of the higher mortality rates of young men secondary to their increased incidence of being involved in mortal traumatic events. Dorrington et al state the ratio for males had been fairly static at 0.66 prior to 1990. In 1995 Benedictine Hospital's ratio of 0.82 was only slightly higher than this and South Africa's ratio for 1993 of 0.73. Both male ratios rise; South Africa's rises steadily to 1.00 in 1999/2000; while Benedictine Hospital's rises to 1.55 in 1999 and by 2001 has more than doubled to 1.92. This is almost three times the South African ratio in 1990. As with the pattern of the number of female deaths, this shift in the pattern of the number of deaths among males answers our first research question. There has been a change in the age distribution of death.

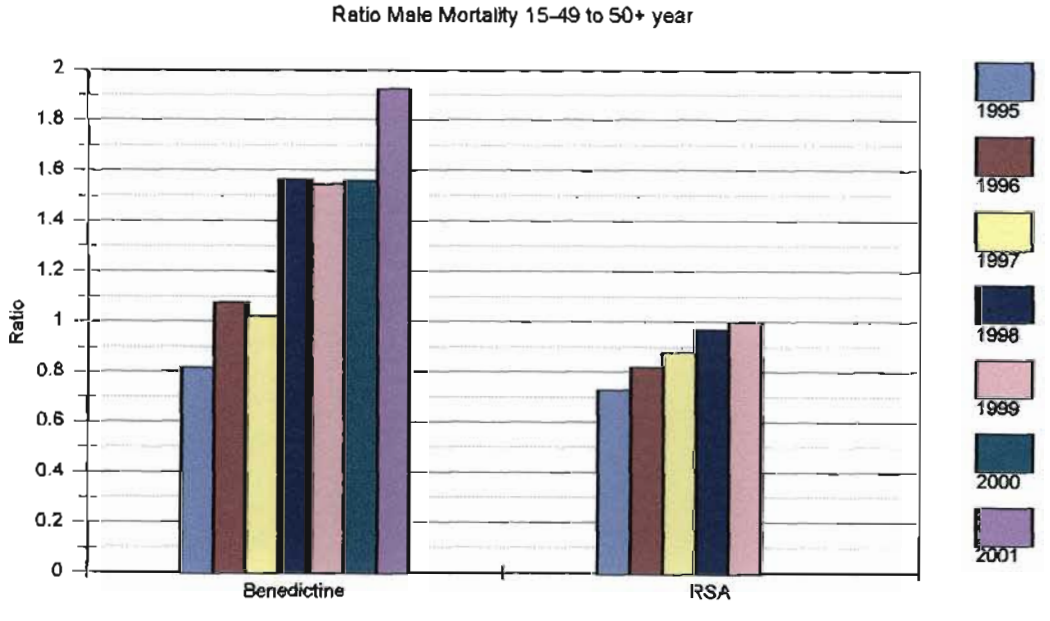

Figure IV-5 Ratio Male Adult Mortality – Benedictine Hospital & RSA

4.1.3 Change in pattern in Number of Deaths – *Under Five Mortality*

Besides the increase in mortality which occurred in almost all groups, but predominately in young adults, the changes in mortality in children are also significant. Both post neonatal mortality at 35% and child mortality at 113% increased during the study. However the declines in perinatal mortality by 23% and neonatal mortality by 58% were large. Improvement in mortality rates should be expected in a society which is developing. This should follow the improvements in health care and socio-economic status. The fact that the perinatal and neonatal mortality rates are improving would indicate that the quality of health care is improving. However the increase in post neonatal and child mortality suggests that socio-economic development is lagging behind. Also the increase in post neonatal mortality and particularly child mortality would be expected if the increase in young adult female mortality is due to AIDS, as many children would be infected by vertical mother to child transmission. These changes in neonatal, post neonatal, and child mortality rates help to answer the first research question that there has been a change in the age distribution of death.

4.2.1 ASMRs – *Change in age & sex pattern*

Societies, such as South Africa, which are moving from developing towards developed status should be experiencing a decrease in their mortality rates and an increase in their life expectancy. However in Nongoma the Crude Mortality Rate rose from 4.68 per thousand in 1995 to 7.62 in 2001. Our 1995 rate compares favourably with the CMR of 3.97 per thousand calculated from the data reported in a recent study done during 1992-

1995 in Agincourt in South Africa's rural northeast (Kahn et al 1999:434-5) and with the CMR of 4.23 reported for whites in RSA during 1968-1977, however our rate is moving in the wrong direction as our rate for 2001 of 7.62 is approaching that reported for coloureds of 8.46 per thousand in 1968-1977 (Wyndham 1984b:946).

The only mortality rates which are decreasing are the perinatal, infant and under five mortality rates. The perinatal mortality rate has decreased from 60.26 in 1995 to 42.67 per thousand in 2001. Infant mortality rate has decreased from 65.81 per thousand in 1995 to 44.83 in 2001. This is moving in the right direction. However there is cause for concern as all of the improvement is in the neonatal period, which decreased from 42.51 in 1995 to 16.25 in 2001; while the post neonatal mortality increased from 23.29 in 1995 to 28.58 in 2001. Furthermore Hoque reported an IMR of 100 per thousand in 2001 for Zululand District of which Nongoma is a part (2001:13). This large discrepancy would suggest that further studies need to be undertaken to confirm the actual position. The 44.83 reported by our study does compare favourably with the SADHS – 98 survey which reported an IMR of 45.4 for South Africa as a whole and 52.1 for the KZN province (NDoH 1998:100,102), and also with the IMR of 59 estimated for the year 2000 as reported in the South African national burden of disease (Bradshaw et al 2003:2). Our result is also much better than the IMR of 142 reported in a study done in Gambia during 1982-3 (Greenwood et al 87:93) and the IMR of 130 reported for the Transkei in 1980 (Irwig & Ingle 1984:608-613 quoted in Herman & Wyndham 1985:217). However there is room for further improvement as the rate for whites improved from 17.36 per thousand in 1970 to 12.57 in 1983 while that for blacks in Soweto improved from 81.39 in 1970 to 25.5 in

1983 (Herman & Wyndham 1985:217). Also the SADHS – 98 survey report IMRs of 18.8 for coloureds and 11.4 for whites and a rate of 8.4 in the Western Cape province (NDoH 1998:102).

Under five mortality rate decreased from 67.89 in 1995 to 48.86 in 2001, which is much better than the 145 per thousand reported by Hoque in 2001 (2001:13). Again this discrepancy would need further study to confirm the actual position. The under five mortality rate of 48.86 found in our study is again much less than that of 185 per thousand calculated from the study done in Gambia two decades ago (Greenwood et al 87:93). It is also less than the WHO estimate for RSA for 1999 of a childhood mortality rate of 76 per thousand (Dorrington et al 2001:25), and half of the South African national burden of disease estimate for 2000 of 95 (Bradshaw et al 2003:2). The under five mortality is also much less than that reported in the SADHS – 98 survey of 59.4 for South Africa and 74.5 for KZN (NDoH 1998:100,102). However the infant and under five mortality rates in our study are only decreasing because the neonatal mortality rate is decreasing. The post neonatal and child mortality rates are actually increasing.

The over 60 years old age specific mortality rate was the only other rate which did not really rise. It held steady at 19.51 in 1995 and 18.58 in 2000, before rising slightly in 2001 to 22.30 per thousand. All of the other rates rose in the seven years of the study.

The 5 to 14 years old and the 15 to 19 years old groups increased by double. However these rises were from very low bases. The rates for the 15 to 19 years old group, 0.33 for males and 0.31 for females in 1997, are much lower than those of a comparable

period as determined in the SADHS – 98 study, 2.32 for males and 1.43 for females (NDoH 1998:166). Even the 2001 rates in our study are lower than the SADHS rates.

The ASMRs of all the adult age groups from 20 to 59 years old rose over the course of the study. The 20 to 29 years old group increased by nearly three times from 2.49 per thousand in 1995 to 7.27 in 2001. The 1997 female rate of 3.01 compares favourably with that calculated from data in the SADHS study of 3.60, but the male rate of 2.96 is still low compared to the SADHS of 5.79 for males (ibid). However in 1998 it was comparable at 5.06.

The 30 to 39 years old group rose almost four times from 4.49 in 1995 to 17.21 in 2001. Again the results of this study, 10.42 for males and 4.51 for females in 1997, compare favourably with the SADHS survey results of 8.46 for males and 4.28 for females (ibid).

The 40 to 49 years old age group also increased over three times from 5.23 in 1995 to 17.65 in 2001. The 1997 rate for males in our study at 15.69 was higher while the female rate at 4.18 was lower than the SADHS study, which reported a male rate of 12.64 and a female rate of 5.10 (ibid). In each of these groups the rates in our study rose to be almost double or even triple the SADHS rates by 2001. The fact that the rates reported in our study are comparable with those found in the SADHS –98 study would lend credence to their validity.

Even the 50 to 59 years old age group increased two times from 9.07 in 1995 to 18.11 in 2000 and then fell slightly to 15.28 per thousand in 2001.

The decrease in childhood mortality and the relativity stability of old age mortality along with the increases in the young adult ASMRs of three to four times answers the first research question by confirming that there has been a change in the age distribution of death.

4.2.2 ASMRs – *Comparison with 1995 as Baseline*

One way to see what is happening to ASMRs is to compare each year's ASMR with a reference ASMR used as a baseline (Dorrington et al 2001:27). We use 1995, the first year of the study, as the baseline.

In the male rates the only ones that remain close to baseline are the IMR and the over 60 years age group (Figure IV-6). The 5 to 14 years and 15 to 19 years old groups show an increase of two and a half to three and a half times baseline but that is over very low baseline rates in 1995. The 1 to 4 years old and 50 to 59 years old groups showed increases in their rates of one and a half to two times over 1995 baseline rates. However the 20 to 49 years old groups showed increased rates of three times and these groups had much higher rates in 1995 and should be groups which maintain low rates. These increases in the young adult groups exceed the increases documented by Dorrington et al. They reported increases in male mortality increasing by up to two times over a 1985 baseline (2001:5). These increases in ASMRs in the young male adult groups support the first research question that there is a change in the age distribution of deaths.

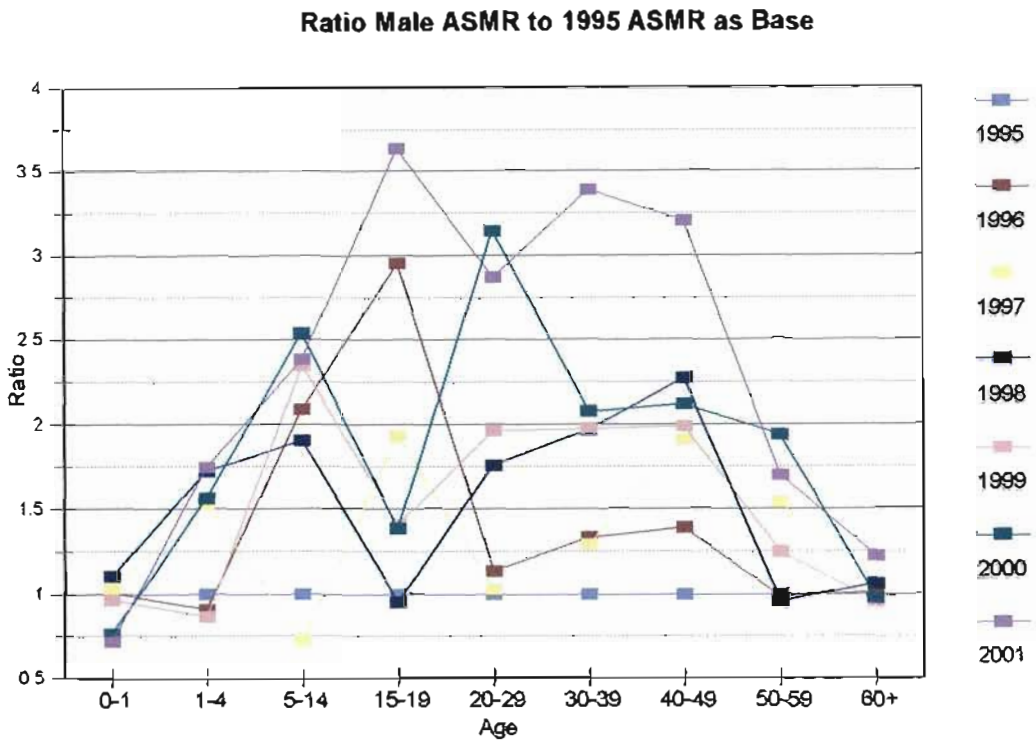

Figure IV-6 Ratio Male ASMR to 1995 ASMR as Base

In the female rates the only group rates that remain close to baseline are the IMR, the 15-19 years old, and the over 60 years old age group (Figure IV-7). The 1 to 4 years old, 5 to 14 years old, and 50 to 59 years old age groups show an increase of one and a half to two times baseline, but the 5 to 14 years old group is over very low baseline rates in 1995. However the 20 to 49 years old groups showed increased rates of three to four and a half times their baseline rates in 1995. These should also be groups which maintain low rates. These increases in ASMRs in the young female adult groups exceed those reported by Dorrington et al. They reported rate increases of two and a half to three and a half times in the young female adult age groups (2001:5). Theirs was over a baseline of

1985 which should give higher increases as the time frame was longer and was before the AIDS epidemic had started. Female deaths were already showing a young adult rise in 1995 so the 1995 baseline used in this study should give lower increases in mortality rates. The fact that these increases are so steep and exceed those of South Africa help to answer the first research question that since there has been an increase in the death rates, particularly of young adults, there has been a change in the age distribution of death. It is reasonable to link this increase in mortality to AIDS as Dorrington et al state that an increase in young adult mortality should be regarded as essentially a consequence of HIV/AIDS (2001:7).

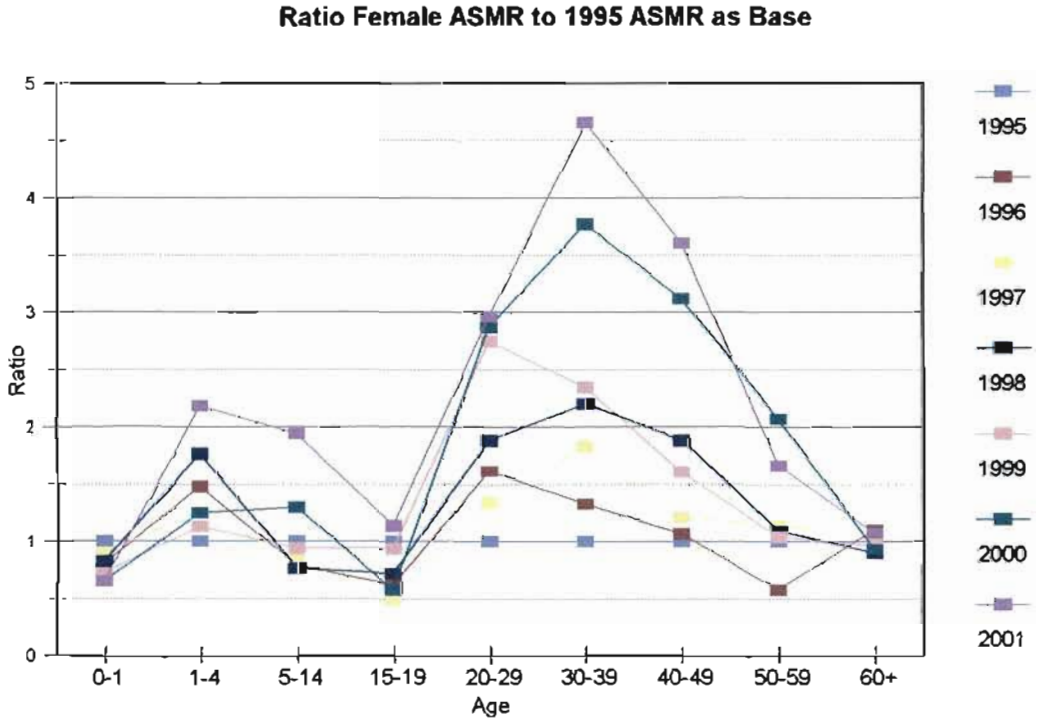

Figure IV-7 Ratio Female ASMR to 1995 ASMR as Base

4.3.1 Causes of Death – ***Change in pattern of Numbers of Deaths***

Societies, such as South Africa, which are moving through a demographic transition from developing towards developed status, should also be experiencing an epidemiological transition. There should be a decrease in the cause specific mortality rates of pre-transitional diseases, those due to infectious agents, maternal and perinatal conditions, and malnutrition. The post-transitional non-communicable diseases of lifestyle should be increasing and taking over a larger proportion of the burden of disease. However in this study the only diseases which reflect a decrease in numbers are those connected with the perinatal period and trauma. The diseases of lifestyle, cerebral vascular accident, congestive cardiac failure, cancer, diabetes mellitus, and hypertension, essentially caused the same numbers of deaths annually throughout the study. Malnutrition, a pre-transitional disease, also was fairly constant in its numbers of death. The main diseases which caused death are also the ones which increased substantially. These diseases comprise the infectious disease portion of pre-transitional diseases, pulmonary tuberculosis, pneumonia, gastroenteritis acute and chronic, meningitis, and retro-viral disease (Table III-5).

Six of the top seven causes of death are infectious. Only trauma at number three is a non-infectious cause. All of the infectious causes have increased or strengthened their position as a cause of death since 1995. The numerical increase in deaths caused by infectious diseases has increased by 687 deaths from 295 deaths in 1995 to 982 deaths in 2001, a 233% increase in the deaths caused by infectious diseases. Almost 75% of the increase in the total numbers of deaths were caused by these six infectious diseases

(Appendix V-Figure 2). This answers our second research question. There has been a change in the distribution of diseases which cause death. Although the major causes of death, tuberculosis, pneumonia, and gastroenteritis, have remained the same; the number of deaths, which they have caused, are increasing dramatically. Also other infectious diseases, such as chronic gastroenteritis, retro-viral disease and meningitis, have not only increased the number of deaths which they have caused but have moved into the top seven positions for the causes of death.

Two other diseases which increased their numbers of deaths substantially over the study were deaths due to herbal enema and epilepsy. However these were over low bases and thus contributed only a small proportion, about 6%, to the total increase. Deaths attributed to herbal enema are also difficult to interpret and could be connected with the infectious causes of death as herbal enemas are usually given to children sick with pneumonia or diarrhoea.

Two further diseases which were not in the top twenty but which increased their numbers over the course of the study were psychosis and confusion. Like herbal enema these are causes which are difficult to interpret but could be connected with the mental and neurological effects of AIDS.

Three diseases, trauma, prematurity and low apgar, were the only diseases which showed substantial reductions in the numbers of death (Appendix V-Figure 3). All other diseases in the top twenty causes of death remained relatively constant in their number of deaths.

In conclusion there has been a large increase in the number of deaths, almost all due to infectious diseases, which gives a positive answer to our second research question. Along with this increase in infectious diseases has been a decrease in perinatal and trauma deaths. The decrease in perinatal deaths could indicate that medical care is improving. The stability in deaths due to malnutrition and lifestyle diseases, could indicate that health care is adequate and the socio-economic development situation is not deteriorating. Therefore we could conclude that another cause should be found for the increase in deaths attributed to infectious diseases rather than inadequate health care and poor socio-economic status. As infectious diseases are diseases which would be associated with AIDS, it could be assumed that AIDS is underlying many of the deaths caused by infectious diseases.

4.3.2 Causes of Death – *Change in pattern of Burden of Disease*

Looking at the proportion of deaths caused according to the burden of disease list will not only shed further light on whether our second research question is being answered in the positive, but will also allow a comparison with other burden of disease studies and examination of where Nongoma is in reference to the epidemiological transition. We are interested in whether or not there has been any change in the distribution of the causes of death, particularly we are looking at whether the infectious disease portion of the burden of disease has increased. The infectious disease portion is divided into respiratory, and infectious sub-categories. The infectious sub-category has been further subdivided into tuberculosis, gastroenteritis and other infectious diseases.

The respiratory portion of the burden of disease, which is represented by pneumonia, increased from causing 8.3% of deaths in 1995 to causing 14.52% of deaths in 2001. This is higher than the 5% reported for South Africa as a whole in 1996, which is the latest data which is available (Bradshaw et al 2002a:619). A study done in Soweto in 1990-1991 also placed respiratory causes of death at 5.5% (Byarugaba and Kielkowski 1994:611). A study done on black deaths registered in the Republic of South Africa in 1978-1979 put respiratory deaths at 13% (Botha and Bradshaw 1985:977). This percentage is closer to the 14.52% for 2001 obtained from our study. This indicates that our population has retreated from a society in transition, 8.3% in 1995 was approaching the 5% of South Africa as a whole, and is returning towards a pre-transitional profile of disease. This increase in proportion of deaths caused by respiratory diseases answers our second research question positively confirming that there has been a substantial change in the proportion of deaths caused by respiratory diseases(Table IV-1, Figures IV-8 & Appendix IX).

The gastroenteritis portion of the burden of disease increased its share from 10.74% in 1995 to 11.79% in 2001. Chronic diarrhoea, which is associated with AIDS, increased its share from 1.95% in 1995 to 4.53% in 2001. This portion attributed to diarrhoeal diseases, 11.79%, is much larger than the 3% of deaths caused by diarrhoeal diseases reported for South Africa as a whole during 1996 (Bradshaw et al 2002a:619). Again this large proportion of the burden of disease contributed by a type I water bourne infectious illness shows that Nongoma is still in the pre-transitional phase of the epidemiological transition.

Tuberculosis is a type I infectious disease which already contributed a large portion of the burden of disease in 1995 with 9.40%, but its share increased over two times to 21.31% in 2001. Deaths caused by tuberculosis in South Africa were about 6% in 1996 (ibid) which is even lower than our proportion for 1995.

The other infectious diseases sub-category includes mainly retro-viral disease, meningitis, and septicaemia. Retro-viral disease increased its portion of the burden of disease slightly from 3.17% in 1995 to 3.84% in 2001. Meningitis more than doubled its share from 1.47% in 1995 to 3.43% in 2001. The increase in meningitis, as it includes the tuberculous and cryptococcal varieties, could indicate underlying AIDS. This sub-category as a whole increased its percentage from 7.57% in 1995 to 9.41% in 2001. This is more than double the percentages in South Africa, which in 1996 appear to be about 4% (ibid).

Infectious disease as a whole increased its proportion of the causes of death from 27.71% in 1995 to 42.51% in 2001. This is much larger than the 13% in South Africa as a whole in 1996 (ibid). Infectious causes accounting for 3.1% formed a very small part of the causes of death in the Soweto study done in the early 1990s (Byarugaba and Kielkowski 1994:611). The proportion from this study is also larger than the study done in the late 1970s which found infectious diseases accounting for 21% of all black deaths (Botha and Bradshaw 1985:977). This large increase in the burden of disease caused by infectious diseases strongly supports our second research question that there has been a change in the cause of mortality.

Maternal and perinatal causes of death, which are a further sub-category of type I pre-transitional diseases, showed a decrease in their share of the burden of disease from

14.04% in 1995 to 3.94% in 2001. This reflects the improvements which should occur in pre-transitional diseases as a society moves through the epidemiological transition.

Malnutrition is the final sub-category of type I diseases. It recorded fairly constant numbers of deaths over the course of the study. Since the total number of annual deaths almost doubled over the course of the study, malnutrition's share of the burden of disease decreased from 6.59% in 1995 to 3.60% in 2001.

Deaths caused by type II noncommunicable diseases increased slightly in numbers but their percentage of the burden of disease decreased over the course of the study. The slight increase in deaths caused by the cardiovascular sub-category meant that their percentage share of the burden of disease decreased by almost half from 13.19% in 1995 to 6.68% in 2001. This was initially about the same as the 15% found for black South Africans in the 1978-1979 study (Botha and Bradshaw 1985:979), but by the end of our study the percentage of deaths caused by cardiovascular diseases were less than half. The Soweto study found that cardiovascular diseases caused 9.9% of all deaths (Byarugaba and Kielkowski 1994:611). In 1996 for South Africa cardiovascular diseases caused 16.60% of male and 24.28% of female deaths, about 20% of deaths overall (Bradshaw et all 2002a:619). This is much higher than the share of deaths caused by cardiovascular diseases in Nongoma and indicates that the society is retreating from the epidemiological transition.

The cancer sub-category, whose deaths also increased slightly, saw its share of percentage decrease from 4.15% in 1995 to 2.32% in 2001. This is less than that found in South Africa as a whole in 1996 where cancer caused 9% of deaths (ibid). In 1978-1979

cancer caused 7% of deaths among black South Africans (Botha and Bradshaw 1985:979); while in Soweto in 1990-1991, cancer caused 6.1% of deaths (Byarugaba and Kielkowski 1994:611).

The all other type II diseases sub-category increased their number of deaths slightly, however their share of the burden of disease decreased from 13.68% in 1995 to 10.10% in 2001. This compares with other studies in South Africa. In 1996 other non-communicable diseases caused 9.3% of male deaths and 16.11% of female deaths, about 12% of deaths overall among all South Africans (Bradshaw et al 2002a:619). This was similar to the 14% share found among black South Africans in 1978-1979 (Botha and Bradshaw 1985:979). However the Soweto study was lower than any other study with 7.0% of deaths caused by other type II noncommunicable diseases (Byarugaba and Kielkowski 1994:611). Overall the proportion of the burden of disease contributed by type II diseases in Nongoma decreased from 31.02% in 1995 to 19.10% in 2001. This is much lower than that found in South Africa as a whole for 1996 where type II diseases caused over 42% of all deaths, 34% for males and almost 50% for females (Bradshaw et al 2002a:619). Among black South Africans in 1978-1979 type II diseases caused 36% of all deaths (Botha and Bradshaw 1985:979). Type II diseases caused 23% of deaths in Soweto in 1990-1991 (Byarugaba and Kielkowski 1994:611). The transition which looked like it was happening with about one third of deaths due to noncommunicable diseases in 1995 now looks like it is being reversed in Nongoma as type II diseases now account for less than one in five deaths.

The change in the burden of disease caused by type III diseases, unintentional and intentional trauma, is difficult to analyze as the deaths were undercounted until the last three years of the study when deaths from the police mortuary were included along with the hospital deaths. In 1995 trauma deaths accounted for 32 deaths, less than 4% of all deaths. In 1999 the first year that deaths from the police mortuary were included, trauma caused 197 deaths, 15.52% of all deaths, 114 deaths, 8.98%, were intentional and 83 deaths, 6.54%, were unintentional. However trauma deaths decreased in numbers to 141 deaths and the share of the burden of disease to 8.18% by 2001. Intentional deaths decreased to 91 deaths, 5.28% of all deaths, while unintentional deaths had also decreased to 50 deaths, 2.90%, in 2001. This share of the burden of disease is less than that reported for South Africa in 1996 when over 18% of all deaths were due to trauma, 25% of all male deaths and 10% of female deaths (Bradshaw et al 2002a:619). Trauma accounted for 28.5% of deaths in the Soweto study (Byarugaba and Kielkowski 1994:611). In 1978-1979 trauma was responsible for 12% of deaths (Botha and Bradshaw 1985:979). Trauma deaths in Nongoma are decreasing, as is their share of the burden of disease; this also supports our second research question that there is a change in the distribution of the causes of death.

Unknown or ill-defined causes accounted for about 9% of all deaths in our study. This was less than that recorded in any of the other studies. The Soweto study reported 40% as unknown causes (Byarugaba and Kielkowski 1994:611). In 1978-1979 20% of all black South Africans died of unknown causes (Botha and Bradshaw 1985:979). While in 1996, 14.7% of all South Africans died of unknown or ill-defined causes (Bradshaw et al

2002a:619). The higher the proportion of unknown deaths the more it affects the proportions of other causes, but the fact that in our study the unknown percentage is lower than in any other study means that our figures should be more reliable.

Nongoma in 1995 was a society in the epidemiological transition. Its burden of disease, particularly of respiratory infections and non-communicable diseases, was approaching that recorded for South Africa as a whole. However over the course of this study Nongoma has retreated to a pre-transitional position.

Table IV-1 Comparison – Cause of Mortality by Burden of Disease from Different Studies

Burden of Disease	Nongoma 1995	Nongoma 1999	Nongoma 2001	Bradshaw et al 1996	Soweto 1990-91	Botha & Bradshaw 78-79
I Respiratory	8.30%	8.75%	14.52%	5.00%	5.50%	13.00%
I GE	10.74%	11.35%	11.79%	3.00%		
I Tb	9.40%	16.00%	21.31%	6.00%		
I Other Infectious	7.57%	7.96%	9.41%	4.00%	3.10%	21.00%
I Infectious sub	36.01%	44.11%	56.03%	18.00%	8.60%	34.00%
II Cardiac	13.19%	7.64%	6.68%	Male – 16.6 % Female – 24,28% Total – +/- 20%	9.90%	15.00%
II Cancer	4.15%	3.31%	2.32%	9.00%	6.10%	7.00%
II Other non-communicable	13.68%	11.58%	10.10%	Male – 9.3% Female – 16.11% Total – +/- 12%	7.00%	14.00%
II Total Non-communicable	31.02%	22.53%	19.10%	Male – 34% Female – 50% Total – 42%	23.00%	36.00%
III Trauma – Intentional	3.54%	8.98 %	5.28%			
III Trauma – Unintentional	0.37%	6.54 %	2.90%			
III Trauma Total	3.91%	15.32 %	8.80%	Male – 25% Female – 10% Total – 18%	28.50%	12.00%
IV Ill-defined (Unknown)	8.42%	6.78 %	8.94%	14.70%	40.00%	20.00%

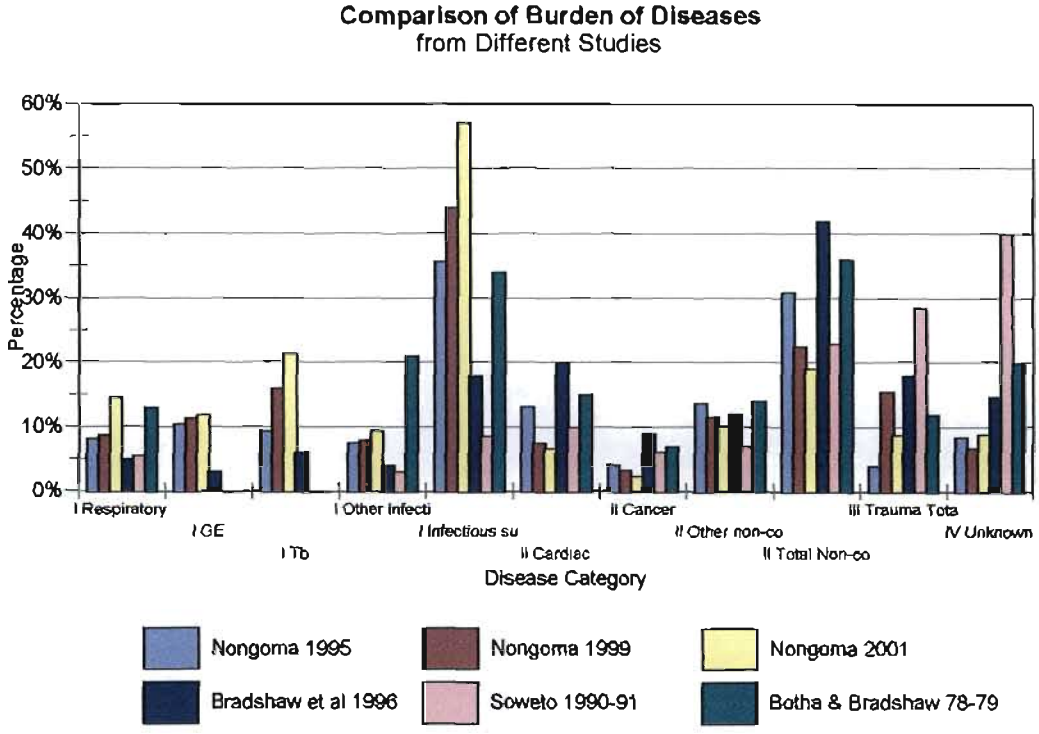

Figure IV-8 Comparison of Burden of Disease from Different Studies

4.3.3 Causes of Death – *Change in pattern of CSMRs*

Change in numbers and proportion of the burden of disease can give some indication as to what is happening with the change in mortality patterns, but cause specific mortality rates give us the most information because they relate those changes to the population affected. The Crude Mortality Rate increased from 468.17 in 1995 to 821.13 per 100,000 in 2001. Very little information is available to compare rates found in this study with similar populations.

Six of the top nine CSMRs are registered by infectious diseases. Five of them, all infectious diseases, have increased by more than the Crude Mortality Rate, which increased 1.75 times.

Pulmonary tuberculosis recorded the highest CSMR at 173.36 deaths per 100,000 in 2001 (Figure III-10). This is ten times greater than the 17.86 calculated from the data given in the Agincourt study from 1992-1995 (Kahn et al 1999:435). The rate for Nongoma in 1995 of 38.34 was twice that of Agincourt but better than that for KwaZulu-Natal which recorded 70.3 for males and 28.3 for females in 1995 (Kleinschmidt 1999:271). However during the seven years of this study the situation with pulmonary tuberculosis mortality worsened dramatically as its rate in 2001 was four times greater than that of 1995 (Table III-8, Figure IV-9, & Appendix VII & VIII).

The second highest CSMR recorded was 122.78 in 2001 for pneumonia (Figure III-10). This was over three times higher than the rate of 36.72 in 1995. It is also much higher than that calculated for Agincourt of 5.95 (Kahn et al 1999:435).

Chronic gastroenteritis recorded the seventh highest CSMR, 38.31 in 2001; which was over four times greater than the rate recorded in 1995 of 8.64. The rise in CSMR for acute gastroenteritis was slightly less than the increase in the CDR, rising to the fourth highest CSMR in 1999 of 61.84 from 38.88 in 1995 (Figure III-10). If both acute and chronic gastroenteritis had been considered as one, their rate would have 99.70 in 2001 essentially the same as trauma in 1999. This is much higher than that of 23.02 calculated from the Agincourt data (Ibid).

Retro-viral disease recorded the eighth highest CSMR at 32.41 in 2001, over two times greater than the 14.04 recorded in 1995 (Figure III-10), and much greater than the 8.3 calculated from the Agincourt data (Ibid). Meningitis increased every year from a low of 6.48 in 1995 to a high of 28.98 in 2001, the ninth highest CSMR. This increase was almost five times (Figure III-10).

Of the diseases which recorded the top nine CSMRs, the three which did not increase were not infectious. Trauma, when the data from the district surgeon is added to that of the hospital, recorded the third highest CSMR of 99.85 in 1999, however it declined to 69.25 in 2001 (Figure III-11). This compared to 56.35 calculated for Agincourt (Ibid). The CSMR for prematurity decreased by over half; while the CSMR for malnutrition essentially did not change.

Other diseases which had flat CSMRs were congestive cardiac failure, cerebral vascular accident, and cancer. CCF recorded the tenth highest CSMR of 28.08 in 1995 and declined slightly to 24.56 in 2001. Its lowest level was 18.96 in 2000, which was similar to that calculated for Agincourt of 17.06 (Ibid). CVA was also flat in eleventh position with a

CSMR of 26.52 in 2001 marginally up from the 23.22 recorded in 1995. Its lowest rate was 20.09 in 1998, which was similar to that of Agincourt of 21.83 (Ibid). The CSMR for cancer recorded its highest rate in 1999 of 21.29, was essentially stable throughout the study starting at 18.36 in 1995 and ending at 19.64 in 2001. This was essentially the same as that found for cancer in the Agincourt study, 21.43 (Ibid).

Another way to look at these changes is to compare the mortality rates for 2001 as a ratio with those of 1995 (Table III-8 & Figure IV-9). When this is done it can be seen that those which have increased the most are the infectious diseases. Pulmonary tuberculosis (4.52), pneumonia (3.34), chronic gastroenteritis (4.43), retro-viral disease (2.31), and meningitis (4.47) all had ratios greater than two and most greater than four times their rates in 1995. The only other diseases with ratios greater than two were herbal enema (5.46) and epilepsy (2.60). These changes in cause specific mortality rates answer the second research question by substantiating that there has been a change in the distribution of death.

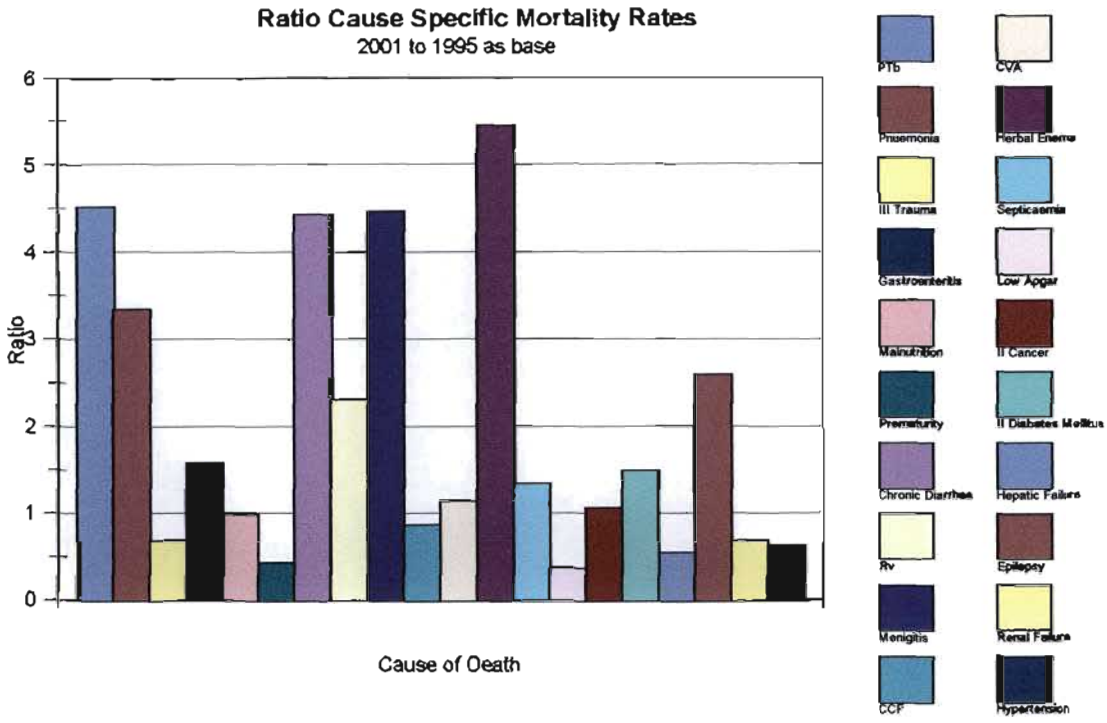

Figure IV-9 Ratio 2001 CSMRs to 1995 CSMRs as Base

Chapter Five – Interpretation

5.1 Introduction

This study to document mortality trends was begun with two purposes. First was a desire to provide information for management in the health district. This information has been developed and in chapter six recommendations will be made as to how it can be disseminated so that it is able to be utilized for management. The second intention was to establish the severity of the AIDS epidemic in this local municipality. Two research questions were proposed: 1) Has there been any change in the age distribution of death? 2) Has there been any change in the distribution of causes of death? This study has answered these questions. First there has been a large change in the age distribution of death. The numbers have increased dramatically and most of that increase has been in the young adult population, a segment of the population which normally contributes one of the smaller numbers of deaths is now contributing one of the largest if not the largest number of deaths. Second there has been a large change in the distribution of the causes of death. The infectious diseases, tuberculosis, pneumonia, and gastroenteritis, which cause the most number of deaths have maintained their position, however their numbers have increased dramatically. Also other infectious diseases, chronic gastroenteritis, retro-viral disease, and meningitis, which were in the second tier of diseases in 1995 are now ranked in the top seven causes of death. Only trauma in the top seven is not an infectious disease. Trauma has actually been decreasing in numbers as well as its share of the burden of disease. Perinatal diseases were another segment whose deaths actually decreased. The non-

communicable diseases only increased their numbers slightly and their share of the burden of disease declined dramatically. An attempt to interpret the meaning of these changes in the age distribution of death and the change in the distribution of the causes of death will be made.

5.2.1 Linking changes with AIDS – *Alternatives Refuted*

It is difficult to interpret the changes in mortality patterns as due to an AIDS epidemic when so few of the deaths are registered as caused by AIDS and there is no other way to accurately link the deaths with AIDS. As a result people have tried to explain the change in the mortality patterns in at least four alternative ways rather than attribute the changes to AIDS (Dorrington et al 2001:31).

The first explanation claimed that death registrations by including more rural South Africans as the death registration system has improved has changed the geographic distribution of the population and thus the mortality pattern. The second, which is similar to the first, claimed that as the registration has improved and more rural South Africans are included in the death registration, that the mortality patterns will change because the population and mortality pattern is different for the younger, more rural South Africans. The third claimed that the data for analysis was obtained from different sources between the earlier and later analyses. In this study these first three explanations do not explain the large changes observed in mortality patterns because the geography, the population, and the data sources were the same throughout our study.

The fourth explanation is that the changes were due to violence. This is not the explanation in our study as trauma actually declined during our study. Since these reasons do not explain the changes in mortality pattern, we will need to look at some additional evidence and some different interpretations which may support a link between the changing mortality patterns and AIDS.

5.2.2 Linking changes with AIDS – *Evidence to Link*

Because the emerging mortality pattern of young adult deaths matches the mortality pattern of AIDS deaths, it is reasonable to attribute the excess deaths to AIDS (Dorrington et al 2001:29). Unfortunately we did not match age and sex with our causes of death so we cannot look at our mortality pattern of deaths diagnosed as AIDS; however the age and sex mortality patterns for Nongoma match those of AIDS deaths for South Africa in 1996 (Compare Figures IV-1 & IV-4, & Appendix III with V-1).

Furthermore the changing mortality patterns of this study match those of Zimbabwe (Compare Table III-4, Figures III-3 & III-4 with Figure V-2). The ASMRs for South African males in the 30 through 39 and 40 through 49 years old groups reached 27.34 and 26.37 per thousand respectively by 2001. These rates exceed those of Zimbabwe in 1995 as well as those of South Africa in 1999/2000. The ASMRs of females in the same groups are 11.49 and 12.45 per thousand respectively which are less than those of Zimbabwe in 1995 but greater than those of South Africa for 1999/2000.The similarity of these patterns lends support to attributing the excess deaths to AIDS (ibid:36-7).

Figure 17: Age distribution of reported AIDS deaths, South Africa 1996 [12]

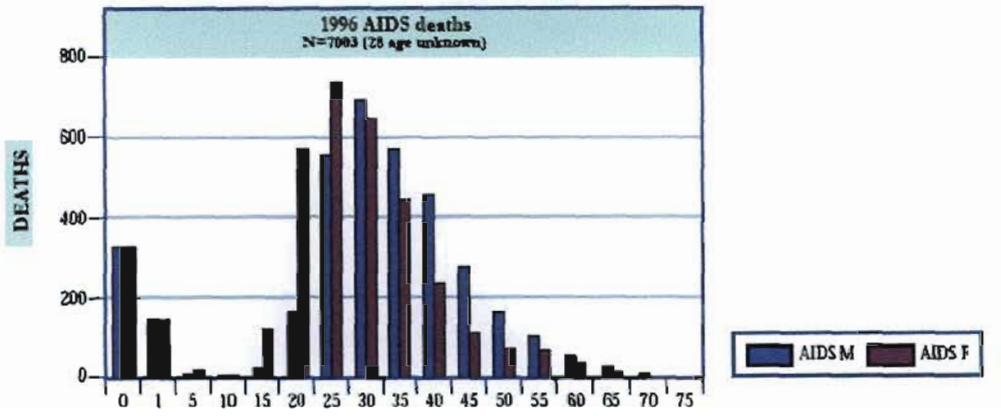

Figure V-1 (Dorrington et al 2001:35)

Not only do the mortality patterns which emerged in this study match those recorded in Zimbabwe and those of AIDS deaths in South Africa, but the rise in mortality has occurred in tandem with the rise in HIV prevalence. The HIV prevalence rate in KwaZulu-Natal has risen from almost zero in the early nineties to 33.5% in 2001 (Hoque et al 2002:2). The rate in Nongoma is one of the highest in KZN, 39.6% in 2000 (York 2002). Also the decrease in perinatal and neonatal mortality would indicate that it is not the lack of health care services, as the health care services must be improving for Nongoma to be able to record such large decreases in the perinatal and neonatal mortality rates. Another indication that health care services are not bad is the fact that tuberculous control programme (tbcp) is recording smear conversion rates and cure rates of about 85% (Kaufmann 2003:44-46). If health care services and the tbcp are reasonable, the question must be asked as to why the death rate is increasing in young adults, and why are the CSMRs of the infectious diseases increasing so much. Tuberculosis is our most significant

Figure 18: Comparison of corrected mortality rates, Zimbabwe 1986 to 1995 and South Africa 1990 to 2000[36,17]

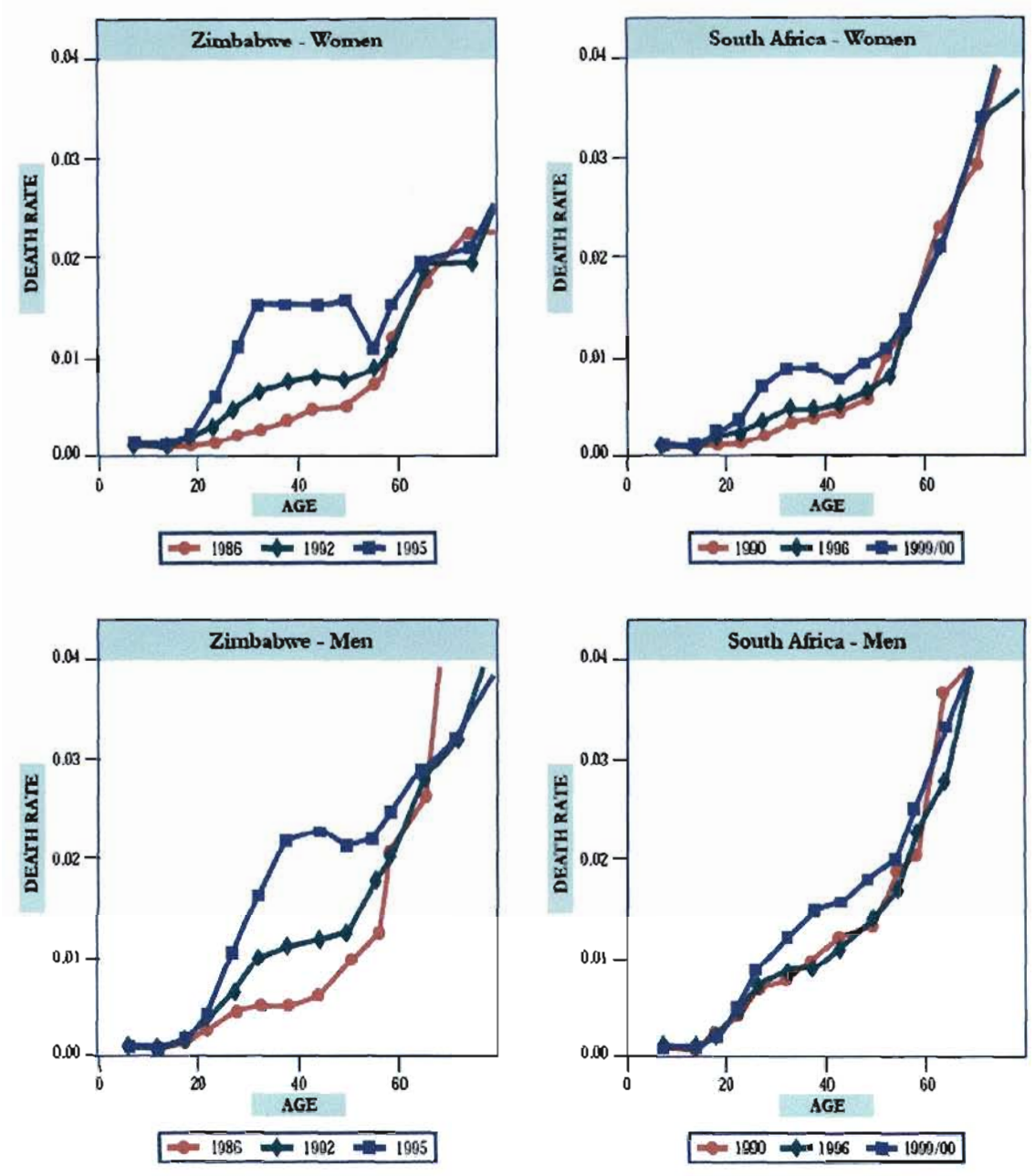

Figure V-2 (Dorrington et al 2001:36)

cause of mortality and has increased dramatically. Why is this in light of our good tbcp. A reasonable explanation would be that HIV is underlying the increase in young adult and infectious disease mortality.

5.3 Limitations

Before summarizing first let us take a look at the limitations of this study. One of the largest limitations is that this study only looks at deaths which were recorded in the mortuary registered at the hospital. For the last three years of the study the deaths recorded in the mortuary register of the district surgeon were also evaluated, which improved the picture of deaths secondary to trauma. However we do not know how many deaths occurred in the community, nor how this affected the cause of death profile. This undercounting of deaths could have an impact on the analysis of the data. However according to recent reports death registration for adults was at least 85% in 1996, reaching almost 90% by 1999 (Dorrington et al 2001:18), with registration of all deaths in 1996 reaching at least 80% (Bradshaw et al 2002:620). This means that undercounting is probably not as large of a problem as it has been previously.

A second limitation is the uncertainty of the population count. Estimates vary widely however we utilized the census estimates from Statistics South Africa (Stats SA) to calculate our population based indicators, as these would be the population figures available to everyone. This will enable this study to be compared to others done in South Africa which use Stats SA population data.

When comparisons were done with other South African data, the mortality rates in this study were always on the high side. This could have several different explanations. First it could indicate that most deaths were captured. Or secondly, that the population was undercounted. Thirdly it could indicate Nongoma is in the middle of a very severe epidemic. Finally all three could be contributing to the results of this study.

In spite of these limitations with data, one must not hesitate to start developing indicators, because only as information is developed can it be evaluated, the weaknesses identified, and means to improve the data on which it is based developed.

A third limitation of this study is a mistake made by the investigator. The data was collated manually and initially it was planned to only look at the age and sex. Later it was discovered that the cause of death was also recorded in the mortuary register, and it was decided to return and also look at the causes of death. These were also collated manually, but unfortunately they were not linked with the earlier recorded sex and age at death; therefore no accurate breakdown can be made of the causes of death per age and sex group. However in spite of these limitations, because of the large numbers of death and the large numbers caused by infectious diseases, an interpretation of the results will be made.

5.4 Conclusion

Young adults should not be dying so increased mortality among this age group could indicate a decrease in immunity as one possible explanation for increased deaths. The fact that it is the infectious disease portion of the burden of disease which is increasing also supports the fact that there may be something causing decreased immunity. Outside of

a reasonable alternative explanation then one could assume that AIDS is the cause of decreased immunity and increased mortality from infectious diseases which were more readily curable a decade ago. If the increase in the number of deaths caused by infectious diseases, 702 more deaths than in 1995, is attributed to AIDS then AIDS caused 44% of all deaths. This is more than the estimate of 40% of all young adult deaths being attributed to AIDS which was concluded by Dorrington et al in their study (2001:37). If 50% of all infectious diseases were attributed to AIDS then the number of deaths caused by AIDS would be about 513 or 32% of all deaths.

If the increase in young adult deaths, which is 560 more deaths than in 1995, is regarded as AIDS deaths, then AIDS caused 36% of all deaths. If the increase in children deaths over 1995 is included with AIDS deaths then there were another 118 deaths caused by AIDS, raising the total to 668 close to the increase in infectious diseases and 43% of all deaths. If mortality should be decreasing by 3% per annum (Dorrington et al 2001:19), then Nongoma should have experienced only 723 deaths in 2001 instead of the 1,552 which were recorded. This means an extra 829 deaths over what is expected, or 53% of all deaths, which could be attributed to AIDS.

When one considers that mortality should be decreasing by up to 3% per annum; and yet the number of deaths has increased by 80%; when the mortality increase is in the young adult age groups; when infectious diseases is responsible for most of the increase in deaths, and the epidemiological transition is being reversed; then it is not unreasonable to assume that AIDS may be responsible for these changes in age and cause specific mortality patterns, and may be the cause of up to 50% of all deaths in Nongoma.

5.5 Implications for Management

As stated earlier "mortality data should become a cornerstone of monitoring health status" (Katzenellenbogen et al 1997:193), and yet mortality data in rural populations in South Africa has been almost non-existent. However this study has demonstrated that mortality data, which is readily available in the hospital, and relatively easy to collate and analyze, can give a picture of the health status of a community. In this case it has given a picture of the reversal of the epidemiological transition, and of an emerging and severe infectious disease epidemic, which it is suggested can be attributed to AIDS.

The significance of the findings of this study, and the ease with which they should be able to be replicated in other settings, suggest that an effort should be made to at least set up sentinel sites where mortality studies could be done. The results derived would have an impact on planning health care delivery for the community studied and surrounding areas with a similar socioeconomic and health environment. These sites could be set up on a national basis so that the results obtained would apply not only to district level planning, but also to provincial and national planners.

Chapter Six – Recommendations

6.1 Reporting of results

One of the major purposes of this study was to create information for management. Now that the study has been completed and some information has been developed, a plan will also be developed for dissemination of this information to management. In order to facilitate dissemination and also to encourage utilization of this study, the results will be published in the form of a report.

After the report is printed, opportunities for an oral presentation will be organized, at which time this report will be presented firstly to the USuthu sub-District Health Management Team, and secondly to the district manager and the Zululand District Health Office. Through the district manager a presentation will be organized for the wider district management meeting. As all five local municipalities in the district are similar, the results will be useful for planning throughout the district and not just in Nongoma. A copy of the report will be issued to all managers in the district involved in planning, especially to those working in the Nongoma Local Municipality health sub-district.

A copy will also be issued to the epidemiology department of the provincial department of health. It is hoped that the report will serve as an aid to planning and a baseline for future research.

It is also planned that publications will arise out of this report. It is hoped that this wider distribution will provide a contribution to the limited literature on mortality trends in rural areas of South Africa.

6.2 Routine Data Collection

It is recommended that out of this study there should arise a routine collection of mortality data. This would provide routine accurate mortality data and allow mortality trends to be monitored annually. A minimum of data which should be captured would be age and sex, linked with diagnosis at death. It is recommended that one further piece of data be recorded. If the place of residence could also be recorded according to the local municipal ward, this would allow the mortality to be broken down even to the local municipal ward level if desired. This could allow epidemiological studies to be done even at a sub-municipal ward level. These four pieces of data could be captured on a carbonized sheet in a specially prepared mortuary register in order to eliminate any duplication of work. Also only those parts would be carbonized which are essential to the study preserving the anonymity of the deceased. These carbonized reports could be submitted to the sub-district information officer monthly for capturing and analysis.

This exercise involving routine collection of mortality data could even be extended to the whole of the Zululand District. As the data is already being collected in the hospital mortuaries, it could be integrated into the district health information system, where it would be possible for the district information to generate some meaningful mortality information.

In addition mortality information could be generated provincially and nationally with the development of sentinel sites as suggested earlier. The significance of the findings of this study, and the ease with which they should be able to be replicated in other settings, suggest that the effort should be made to pursue the development of mortality information on a more routine and widespread basis.

6.3 Further Studies

This study provides a baseline which could be extended or built upon. This baseline study could become more valuable if it was lengthened to a decade. It would be better if this baseline could be extended back towards 1990 before the effects of the AIDS epidemic began to affect the mortality pattern. Already by 1995 the first year of this study, it could be seen that the mortality pattern of young adult females had already begun to change. Secondly, if the actual causes of death as recorded on the death certificates could be accessed, then this would also strengthen this study by adding more accurate and valuable data as to the cause of death. Linking cause of death with age and sex in a future study would further strengthen this study. A third aspect for further mortality studies would be to attempt to discover the percentage of deaths which occur outside the health care system by accessing the number of deaths occurring in the Nongoma Local Municipality recorded at the Department of Home Affairs, if possible. The percentage of deaths occurring in the community could also possibly be assessed by evaluating the mortality data of a segment of the community health workers.

If this baseline study could be built upon by implementing a simple routine data collection system and correcting some of the deficiencies, there is potential for producing some valuable information from Zululand District and even provincially and nationally.

6.4 Summary

In this epidemiological study a longitudinal descriptive and analytical review of the mortuary register at Benedictine Hospital was done. Mortality was described at

Benedictine Hospital during the years 1995-2001 according to each sex and age group, and the causes of death as recorded in the mortuary register.

The purpose of this study was twofold. First as the new district health system was being established, it was desired to develop a baseline of mortality information to be utilized for management in the Nongoma Local Municipality. Second it was desired to raise AIDS awareness in the district by examining the effects of the AIDS epidemic on mortality.

In the analytic component of the study, first, it is assumed that most of the deaths occurred at Benedictine Hospital as it is the only health facility which handles severe illness in the Nongoma Local Municipality; therefore the number of deaths within the hospital and the population of Nongoma were used to calculate Age Specific (ASMRs) and Cause Specific Mortality Rates (CSMRs). Secondly an analysis of the age and sex distribution of deaths, ASMRs, the distribution of causes of death, and CSMRs was done. Two research questions were proposed. The first question was, has there been any change in the age distribution of death? It was demonstrated that while there was an 80% increase in the number of deaths, and although deaths increased in every age group except for the neonatal group, 70% of the increase was in the young adult ages particularly in the 20 through 39 years old age groups. By 2001 these groups were recording the largest number of deaths, 179 male deaths and 133 female deaths in the 30 through 39 years old group. Also the ASMRs of young adults had increased three to four times. The second question was, has there been any change in the distribution of causes of death? It was demonstrated that the infectious diseases which caused the largest numbers of deaths, pulmonary tuberculosis caused 353 deaths, pneumonia 250, gastroenteritis acute and chronic 203,

retro-viral disease 66, and meningitis 59, were six of the top seven causes of death in 2001. Chronic gastroenteritis, retro-viral disease, and meningitis had strengthened their position moving from the second ten into the top seven. Only trauma which was in the top five was not an infectious disease. Infectious diseases increased their share of the burden of disease from 36% in 1995 to 57% in 2001. While CSMRs for trauma and the type II non-communicable diseases were basically stable or falling, those of the infectious diseases increased three to four times. It is estimated that because the mortality pattern is similar to that of AIDS deaths in South Africa and Zimbabwe, that because it is young adult mortality that has increased and that it is infectious diseases which have increased that about 50% of mortality in Nongoma is due to AIDS. Recommendations are put forward as to how to disseminate this information and also how to institute a system to carry on monitoring mortality in Nongoma and even beyond to the district, province, and nation.

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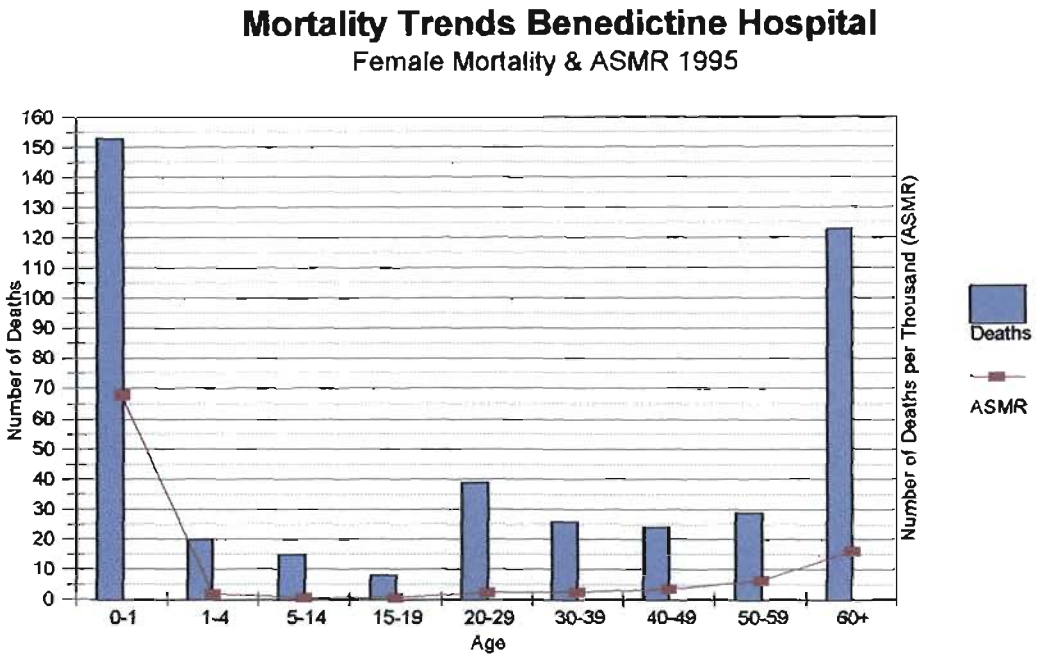
Appendix I

Population Nongoma Local Municipality {StatsSA mid-year estimates as derived from the HISP computer programme (HISP 2001)}												
	1995			1996			1997			1998		
Age Stratum	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-1	2,169	2,253	4,422	2,204	2,289	4,493	2,240	2,325	4,565	2,276	2,362	4,638
1-4	11,079	11,054	22,133	11,258	11,228	22,486	11,439	11,406	22,845	11,623	11,586	23,209
5-14	29,719	29,462	59,181	30,199	29,929	60,128	30,684	30,401	61,085	31,181	30,880	62,061
15-19	11,645	12,630	24,275	11,832	12,830	24,662	12,024	13,032	25,056	12,217	13,239	25,456
20-29	11,117	17,405	28,522	11,296	17,680	28,976	11,478	17,959	29,437	11,664	18,243	29,907
30-39	5,947	10,540	16,487	6,043	10,707	16,750	6,140	10,875	17,015	6,239	11,047	17,286
40-49	4,134	6,948	11,082	4,200	7,057	11,257	4,269	7,169	11,438	4,337	7,222	11,559
50-59	2,898	4,603	7,501	2,946	4,676	7,622	2,992	4,749	7,741	3,042	4,825	7,867
60+	3,922	7,664	11,586	3,985	7,785	11,770	4,050	7,906	11,956	4,116	8,031	12,147
Total	82,630	102,559	185,189	83,963	104,181	188,144	85,316	105,822	191,138	86,695	107,435	194,130

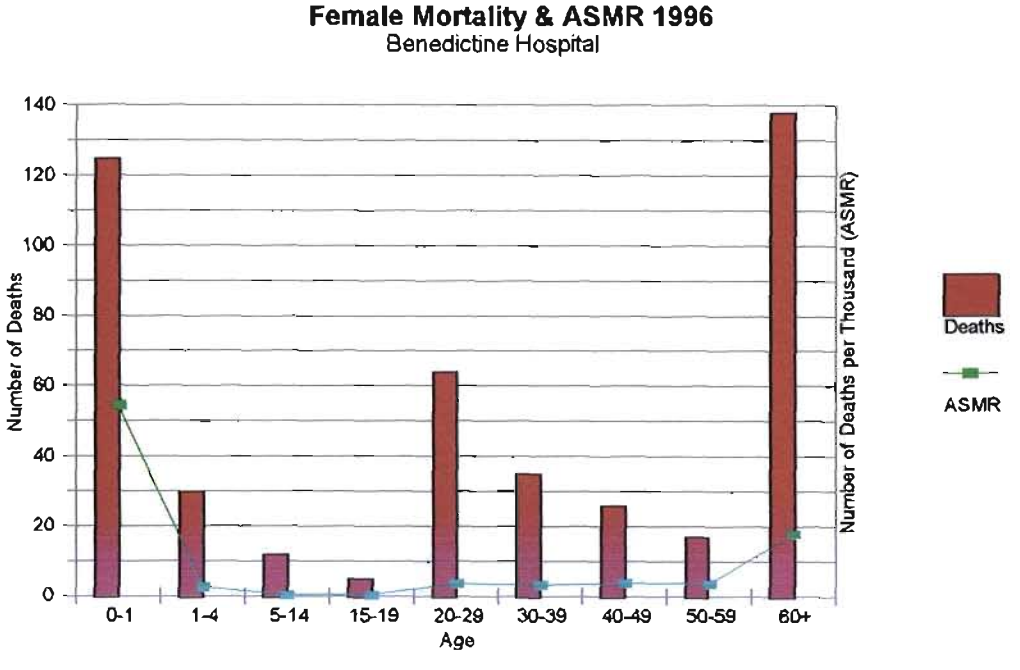
	1999			2000			2001		
Age Stratum	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-1	2,313	2,399	4,712	2,350	2,437	4,787	2,388	2,475	4,863
1-4	11,811	11,769	23,580	12,002	11,955	23,957	12,195	12,143	24,338
5-14	31,684	31,370	63,054	32,194	31,864	64,058	32,715	32,366	65,081
15-19	12,414	13,447	25,861	12,614	13,660	26,274	12,818	13,875	26,693
20-29	11,852	18,531	30,383	12,043	18,823	30,866	12,237	19,121	31,358
30-39	6,340	11,222	17,562	6,443	11,399	17,842	6,546	11,579	18,125
40-49	4,407	7,397	11,804	4,478	7,514	11,992	4,551	7,632	12,183
50-59	3,090	4,901	7,991	3,140	4,978	8,118	3,190	5,056	8,246
60+	4,183	8,158	12,341	4,250	8,288	12,538	4,318	8,418	12,736
Total	88,094	109,194	197,288	89,514	110,918	200,432	90,958	112,665	203,623

Age Specific Mortality Rates (Deaths per 1000) Nongoma 1995-2001																					
	1995	1996	1997	1998	1999	2000	2001	1995	1996	1997	1998	1999	2000	2001	1995	1996	1997	1998	1999	2000	2001
Age Group	TOTAL							Male							Female						
<1	65.81	59.20	63.31	62.96	55.18	46.17	44.83	63.62	63.97	65.63	70.30	61.39	48.51	45.64	67.9	54.61	61.08	55.88	49.19	43.91	44.04
1-4	2.08	2.40	2.93	3.62	2.04	2.96	4.03	2.35	2.13	3.58	4.04	2.03	3.67	4.10	1.81	2.67	2.28	3.19	2.04	2.26	3.95
5-14	0.39	0.48	0.31	0.45	0.56	0.67	0.81	0.27	0.56	0.20	0.51	0.63	0.68	0.64	0.51	0.40	0.43	0.39	0.48	0.66	0.99
15-19	0.41	0.45	0.32	0.31	0.43	0.30	0.67	0.17	0.51	0.33	0.16	0.24	0.24	0.62	0.63	0.39	0.31	0.45	0.59	0.37	0.72
20-29	2.49	3.49	2.99	4.55	5.96	7.45	7.27	2.88	3.28	2.96	5.06	5.65	9.05	8.25	2.24	3.62	3.01	4.22	6.15	6.43	6.64
30-39	4.49	5.97	6.64	9.20	9.45	11.99	17.21	8.07	10.76	10.42	15.87	15.93	16.76	27.34	2.47	3.27	4.51	5.43	5.79	9.30	11.49
40-49	5.23	6.57	8.48	11.07	9.57	13.26	17.65	8.22	11.43	15.69	18.68	16.34	17.42	26.37	3.45	3.68	4.18	6.51	5.54	10.78	12.45
50-59	9.07	7.35	12.40	9.15	10.51	18.11	15.28	13.46	13.24	20.72	12.82	16.83	26.11	22.88	6.30	3.64	7.16	6.84	6.53	13.06	10.48
60+	19.51	20.73	19.66	19.02	18.72	18.58	22.30	26.26	26.60	25.43	27.94	25.10	25.65	32.19	16.1	17.73	16.70	14.44	15.44	14.96	17.22
Total	4.68	4.97	5.29	5.86	5.72	6.62	7.62	5.20	5.75	6.19	7.13	6.65	7.47	8.80	4.26	4.34	4.57	4.84	4.97	5.92	6.67

Appendix III

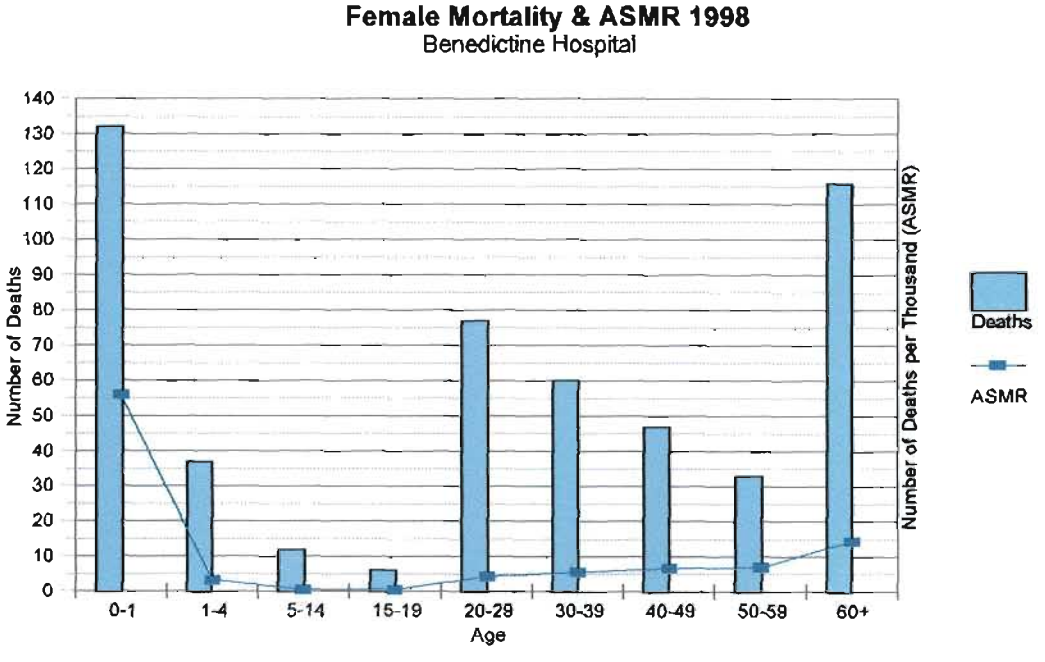


Appendix III-Figure 1

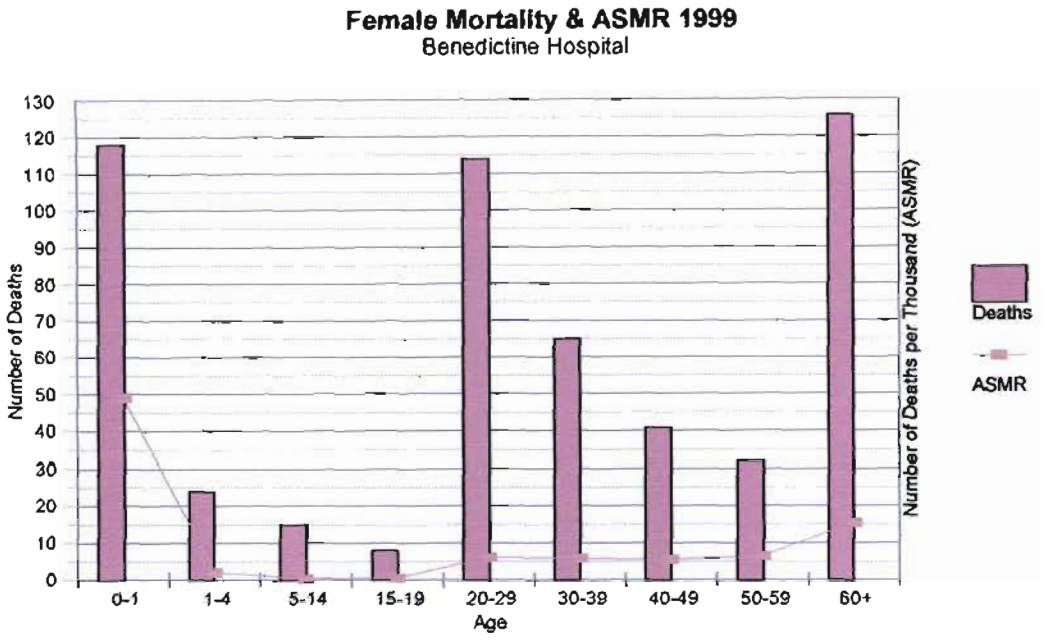


Appendix III-Figure 2

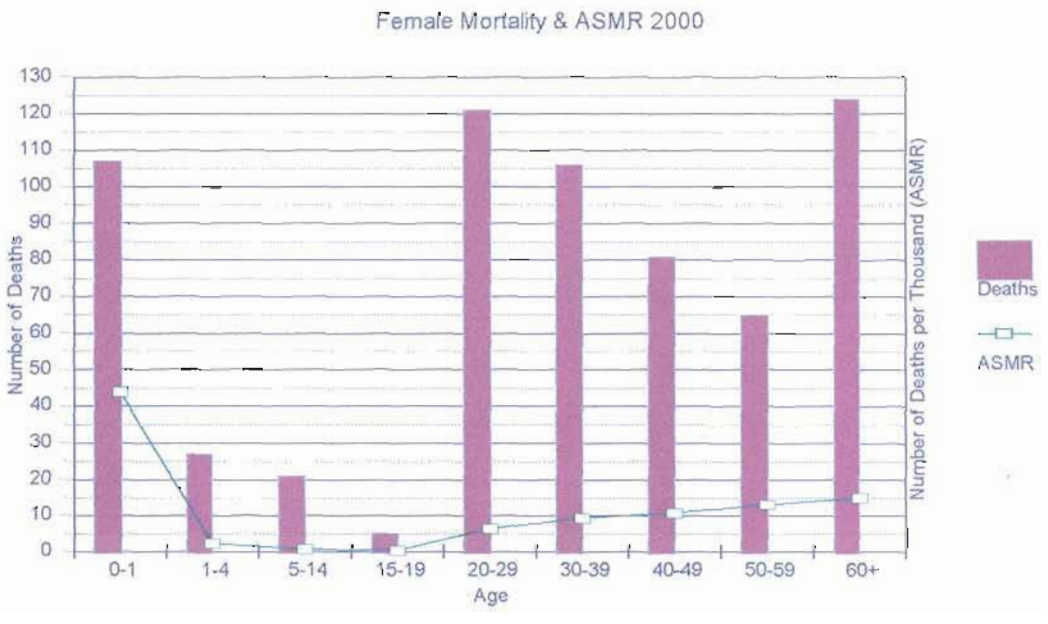
Appendix III-Figure 3



Appendix III-Figure 4



Appendix III-Figure 5



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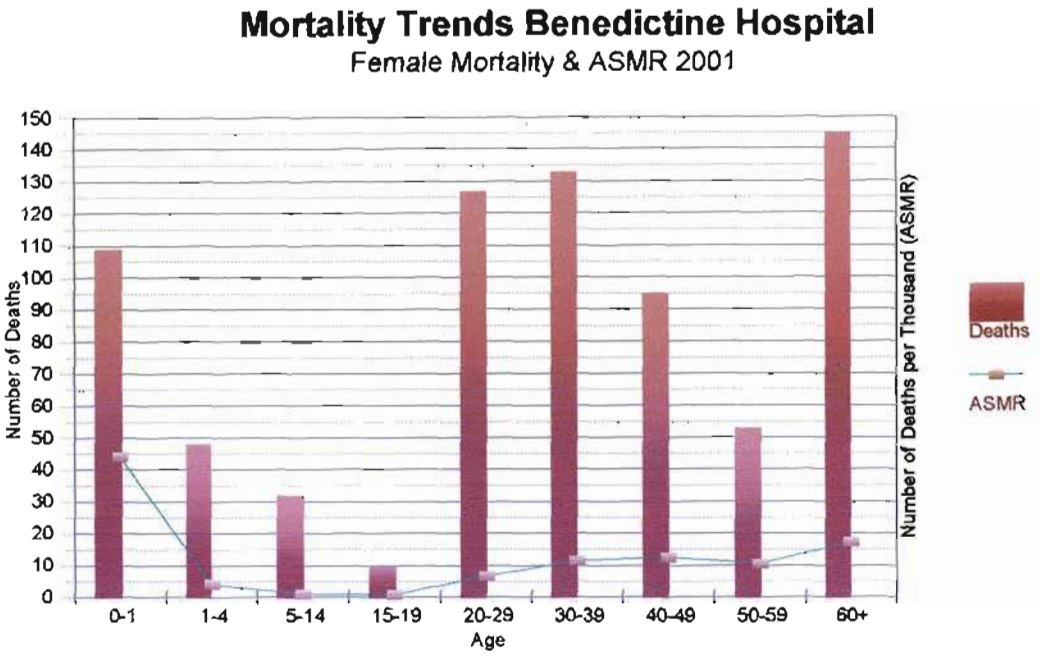

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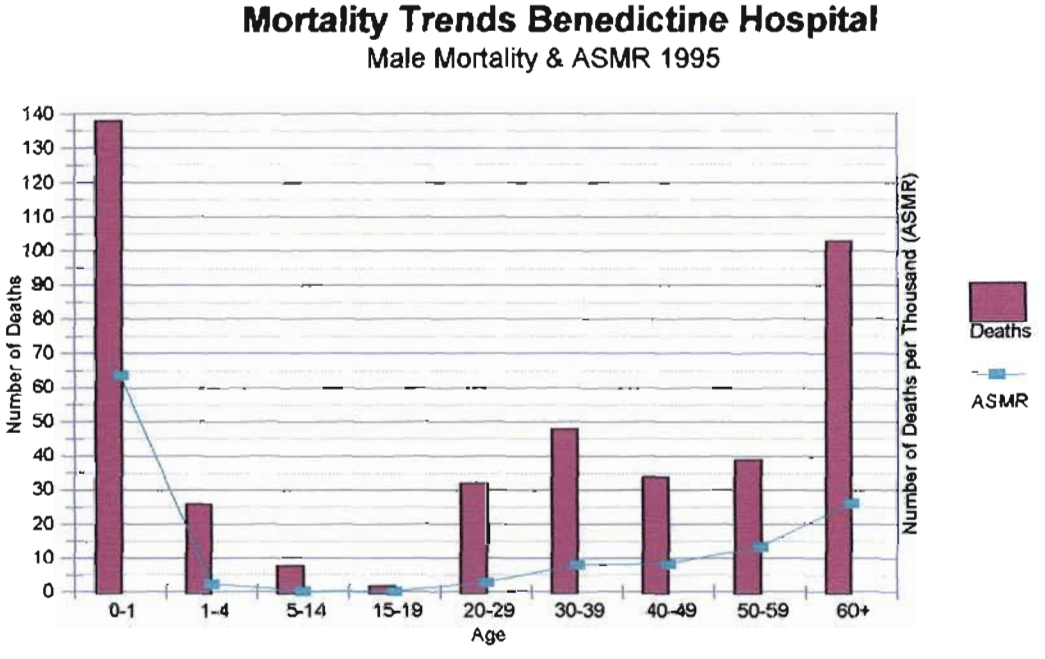

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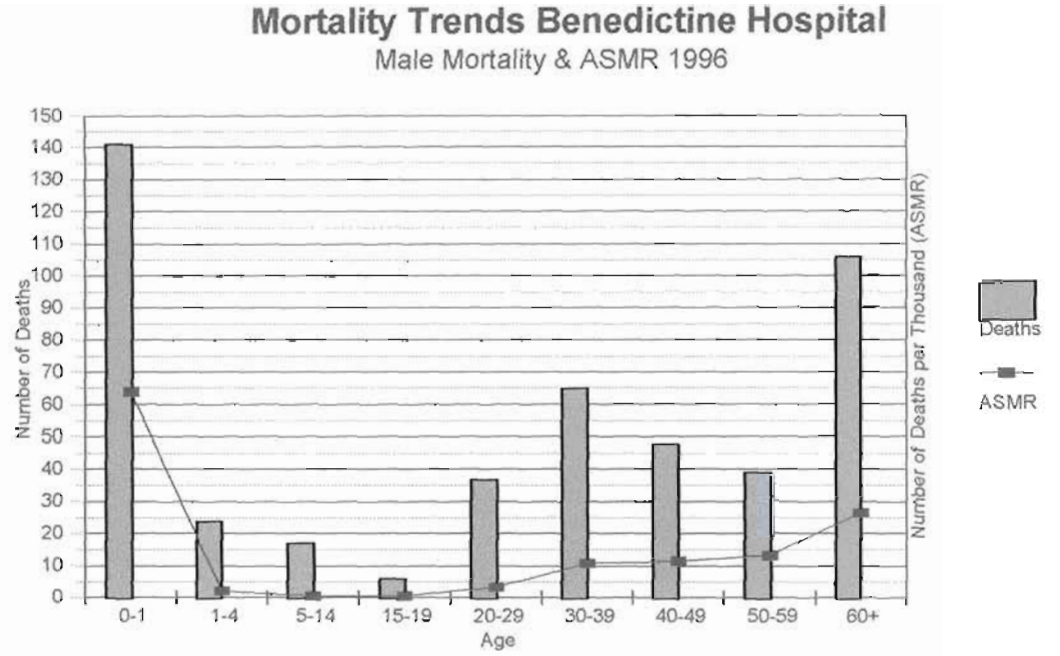
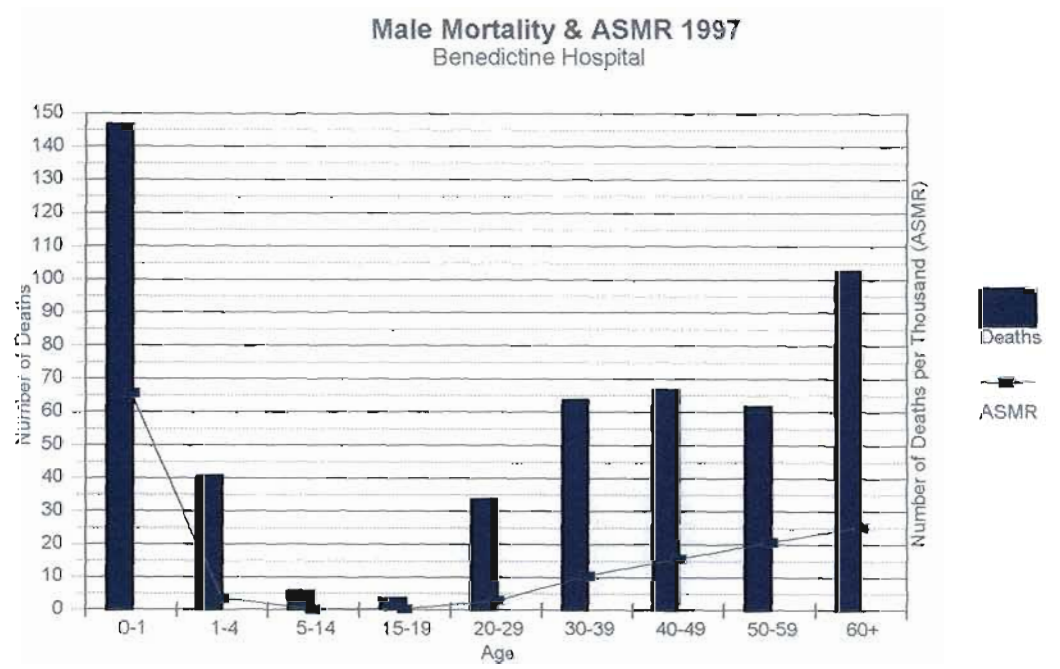
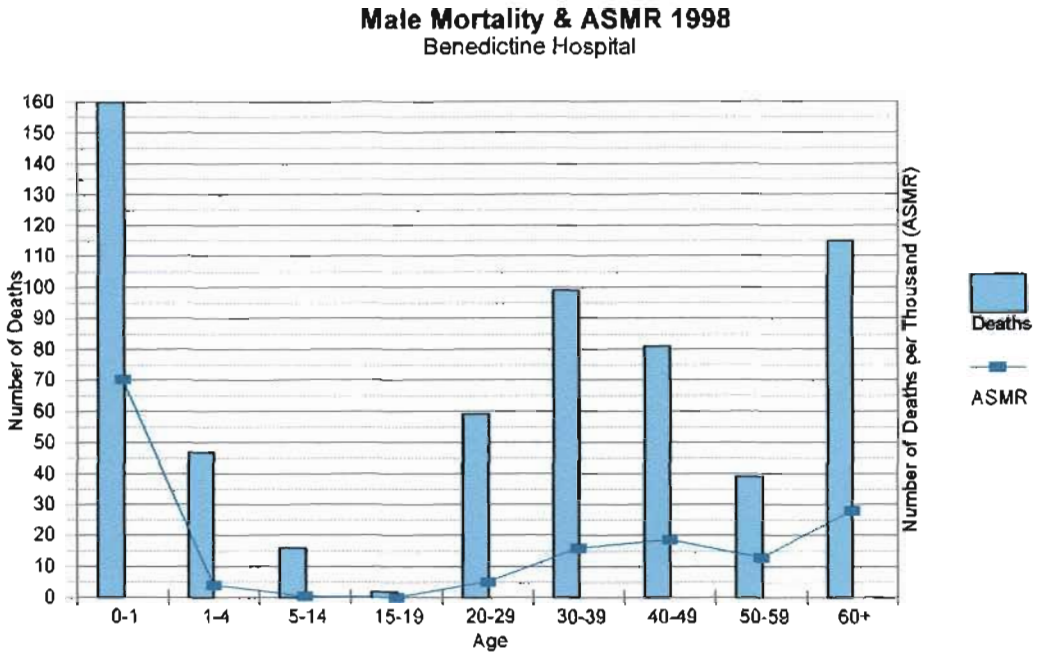


Appendix III-Figure 9



Appendix III-Figure 10



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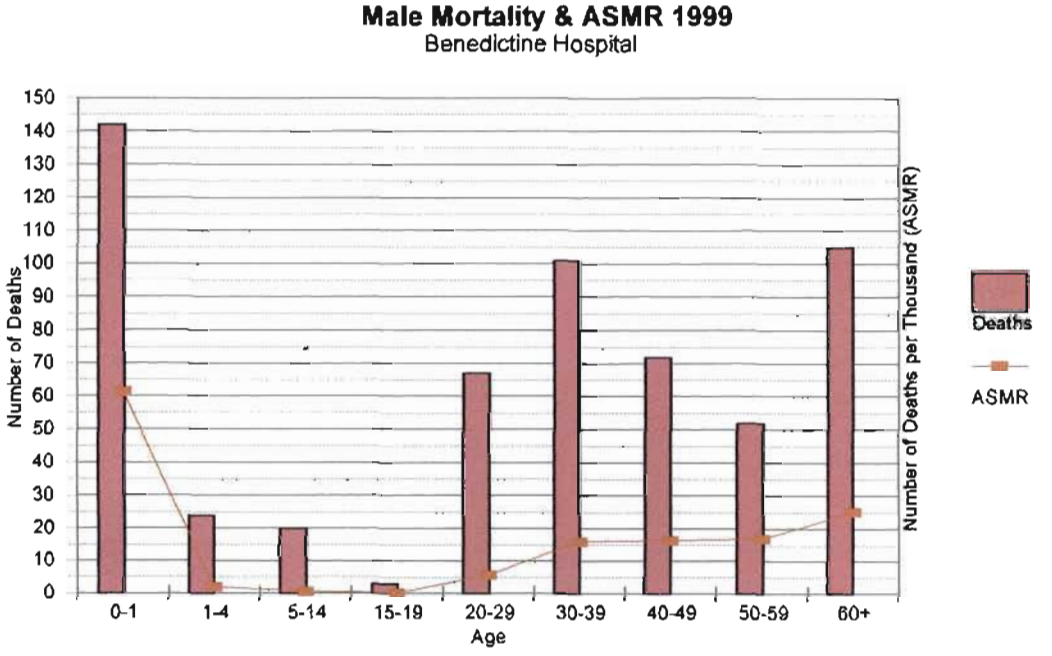

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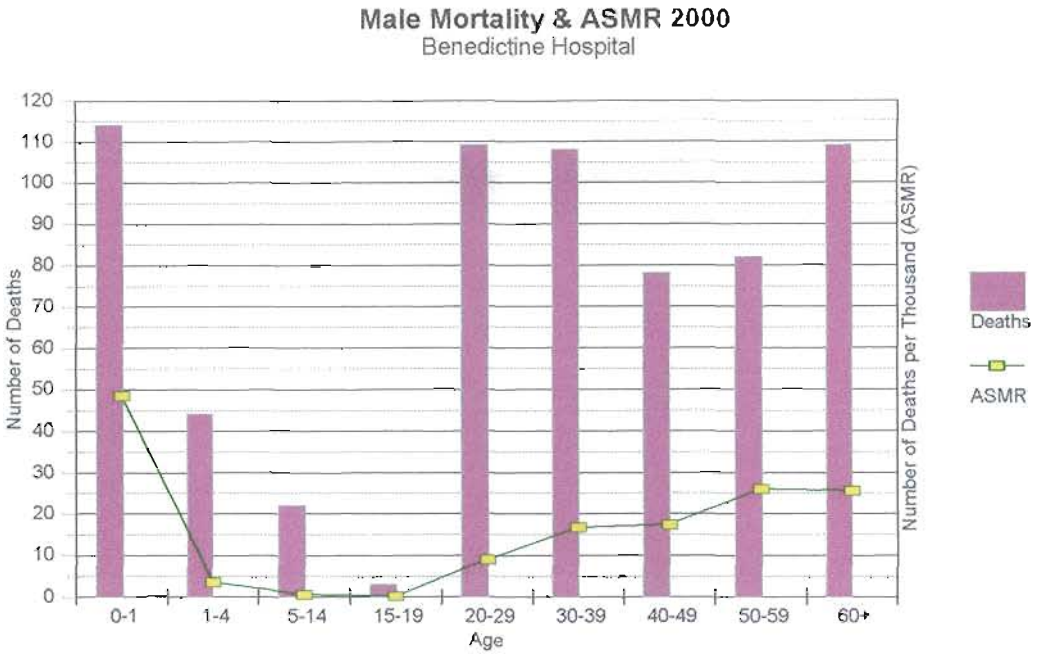
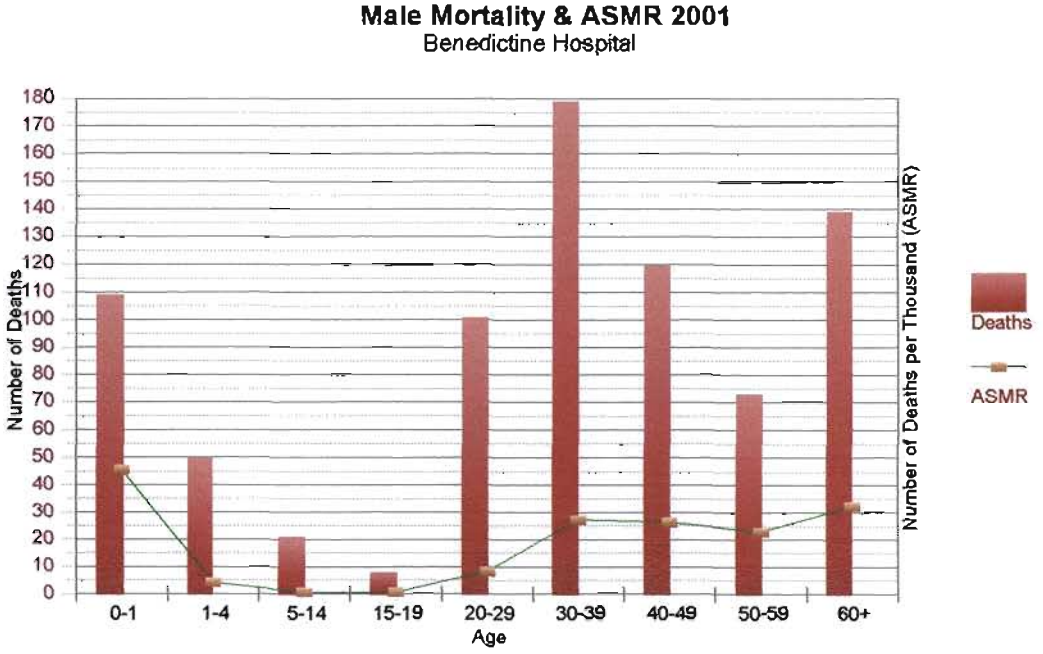


Appendix III-Figure 13



Appendix III-Figure 14

Appendix IV

Cause of Death	1995	1996	1997	1998	1999	2000	2001	TOTAL
Pneumonia	68	43	35	117	111	181	250	805
I Infectious (Respiratory)	68	43	35	117	111	181	250	805
Gastroenteritis	72	38	28	114	122	103	125	602
Chronic Diarrhea	16	4	2	35	22	51	78	208
I Infectious (GE)	88	42	30	149	144	154	203	810
PTb	71	67	49	118	195	206	353	1059
Tb pleural effusion	5	1	4	4	7	1	9	31
Tb Abdomen	0	0	2	0	0	1	2	5
Tb pericarditis	0	0	0	0	0	0	3	3
Tb Spine	1	0	0	0	1	0	0	2
I Infectious (Tb)	77	68	55	122	203	208	367	1100
Rv	26	21	14	13	25	48	66	213
Meningitis	12	20	13	32	34	47	59	217
Septicaemia	21	20	11	45	28	26	31	182
Malaria	1	3	1	1	11	12	5	34
Herpes	0	0	0	0	1	0	1	2
Measles	0	4	0	0	0	0	0	4
Chicken Pox	0	1	0	0	0	0	0	1
Typhoid	1	1	0	1	1	0	0	4
Rabies	1	0	0	2	1	0	0	4
Neonatal Tetanus	0	1	0	0	0	0	0	1
I Infectious (Other)	62	70	39	94	101	133	162	661
TYPE I Infectious	295	224	159	482	559	676	982	3377
PV Bleeding	0	0	0	0	1	1	1	3
Maternal	0	8	2	2	7	0	0	19
I Maternal	0	8	2	2	8	1	1	22
Prematurity	74	26	13	60	46	20	36	275
Low Apgar	41	17	10	22	33	20	17	160
I Perinatal	115	43	23	82	79	40	53	435
I Perinatal/Maternal	115	51	25	84	87	41	54	457
Anaemia	6	3	1	3	1	3	10	27
Malnutrition	48	37	10	79	53	60	52	339
I Malnutrition	54	40	11	82	54	63	62	366
TYPE I (Pre-transitional)	464	315	195	648	700	780	1098	4200

CVA	43	36	19	39	42	47	54	280
CCF	52	28	21	46	42	38	50	277
Cardiac	3	0	0	0	0	1	4	8
Pulmonary Embolus	0	0	0	0	0	2	0	2
Hypertension	10	5	1	7	13	5	7	48
II Cardiac	108	69	41	92	97	93	115	615
II Cancer	34	16	8	41	42	38	40	219
II Diabetes Mellitus	19	8	1	17	24	14	31	114
Psychosis	2	6	1	3	7	1	7	27
Confusion	0	0	0	5	0	5	8	18
II Mental	2	6	1	8	7	6	15	45
Epilepsy	7	6	2	16	22	19	20	92
Neurology	0	0	0	0	2	0	0	2
II Neurology	7	6	2	16	24	19	20	94
II COAD	10	6	6	8	6	5	4	45
Hepatic Failure	26	10	6	25	19	19	16	121
Ascites	4	1	1	5	8	10	9	38
II Hepatic	30	11	7	30	27	29	25	159
Gastritis	7	7	0	10	7	4	7	42
Intestinal Obstruction	2	3	5	6	13	6	0	35
II GI	9	10	5	16	20	10	7	77
II Digestive (Hepatic+GI)	39	21	12	46	47	39	32	236
Renal Failure	17	7	5	7	10	9	13	68
BPH	3	3	1	2	1	3	3	16
II GU	20	10	6	9	11	12	16	84
Herbal Enema	8	5	2	33	21	13	48	130
Congenital Abnormality	3	3	2	6	6	1	4	25
Bleeding	4	2	0	1	1	4	2	14
Lymphadenopathy	0	0	0	0	0	0	2	2
II Miscellaneous	15	10	4	40	28	18	56	171
II Other (non-communicable)	112	67	32	144	147	113	174	789
TYPE II (non-communicable)	254	152	81	277	286	244	329	1623

Trauma	29	21	12	34	23	7	16	142
Snakebite	0	1	0	1	1	0	1	4
Burns	3	6	1	8	6	5	4	33
Drug Overdose	0	0	1	0	1	2	0	4
III Benedictine (trauma)	32	28	14	43	31	14	21	183
District Surgeon Post Mortems [1]								
Motor Vehicle Accident					50	33	32	115
Gun Shot Wound					58	49	44	151
Blunt Trauma					14	8	16	38
Knife Wound					21	15	15	51
Trauma					4	9	5	18
SD / IC Haemorrhage					3	2	0	5
Trauma SUBTOTAL					100	83	80	263
Strangulation					13	12	11	36
Electrocultion / Lightning					10	1	1	12
Drowning					8	8	5	21
Aphyxia					2	2	3	7
Environmental Exposure					2	3	3	8
Burns					1	4	5	10
Other					6	2	0	8
Other SUBTOTAL					42	32	28	102
District Surgeon TOTAL					192	148	140	480
III Trauma (Unintentional)	3	7	1	9	83	52	50	205
III Trauma (Intentional)	29	21	13	34	114	97	91	399
III Trauma	32	28	14	43	197	149	141	604
IV Unknown	69	460	693	150	86	245	154	1857
TOTAL CAUSES	819	955	983	1118	1269	1418	1722	8284
Total Causes Benedict [2]	819	955	983	1118	1103	1283	1602	7863
Deaths Benedictine	867	935	1012	1138	1129	1326	1552	7959
Deaths DS					166	135	120	421
Deaths DS & Benedictin	867	935	1012	1138	1295	1461	1672	8380

[1] Trauma from the hospital mortuary register was only counted if the numbers exceeded those of post mortems done by the district surgeon. This was because trauma which ends in death in the hospital should be referred to the district surgeon as an unnatural cause of death. This was an attempt to avoid double counting; however it is realized that an under count might also occur.

[2] The total number of causes of death differ from the number of deaths as they were tabulated at different times and also retro-viral disease was counted double if there was another significant disease diagnosis given as the cause of death.

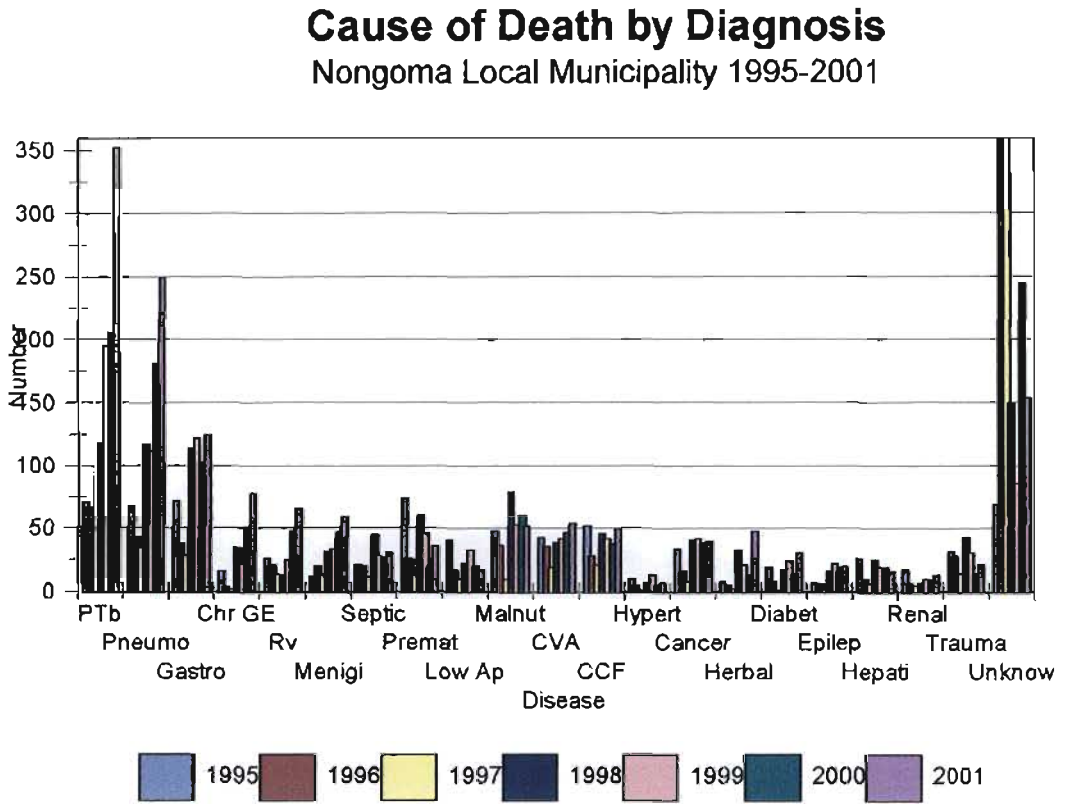
Appendix V

Appendix V-Table 1 – Leading Causes of Death Benedictine Hospital 1995-2001

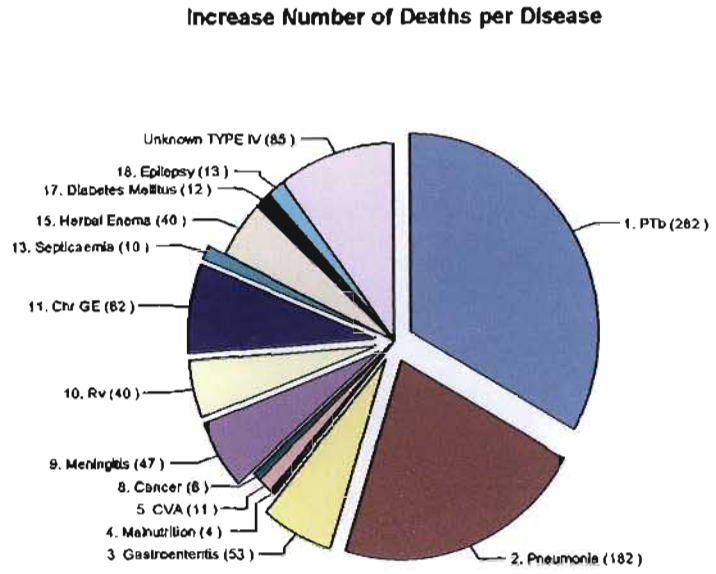
Cause of Death	1995	1996	1997	1998	1999	2000	2001	TOTAL
1. PTb	71	67	49	118	195	206	353	1059
2. Pneumonia	68	43	35	117	111	181	250	805
3. Trauma	32	28	14	43	197	149	141	604
4. Gastroenteritis	72	38	28	114	122	103	125	602
5. Malnutrition	48	37	10	79	53	60	52	339
6. CVA	43	36	19	39	42	47	54	280
7. CCF	52	28	21	46	42	38	50	277
8. Prematurity	74	26	13	60	46	20	36	275
9. Cancer	34	16	8	41	42	38	40	219
10. Meningitis	12	20	13	32	34	47	59	217
11. Rv	26	21	14	13	25	48	66	213
12. Chr GE	16	4	2	35	22	51	78	208
13. Septicaemia	21	20	11	45	28	26	31	182
14. Low Apgar	41	17	10	22	33	20	17	160
15. Herbal Enema	8	5	2	33	21	13	48	130
16. Hepatic Failure	26	10	6	25	19	19	16	121
17. Diabetes Mellitus	19	8	1	17	24	14	31	114
18. Epilepsy	7	6	2	16	22	19	20	92
19. Renal Failure	17	7	5	7	10	9	13	68
20. Hypertension	10	5	1	7	13	5	7	48
Unknown	69	460	693	150	86	245	154	1857
TOTAL	819	955	983	1118	1269	1418	1722	8284

Appendix V-Table 2 – Annual Ranking of the Twenty Leading Causes of Death

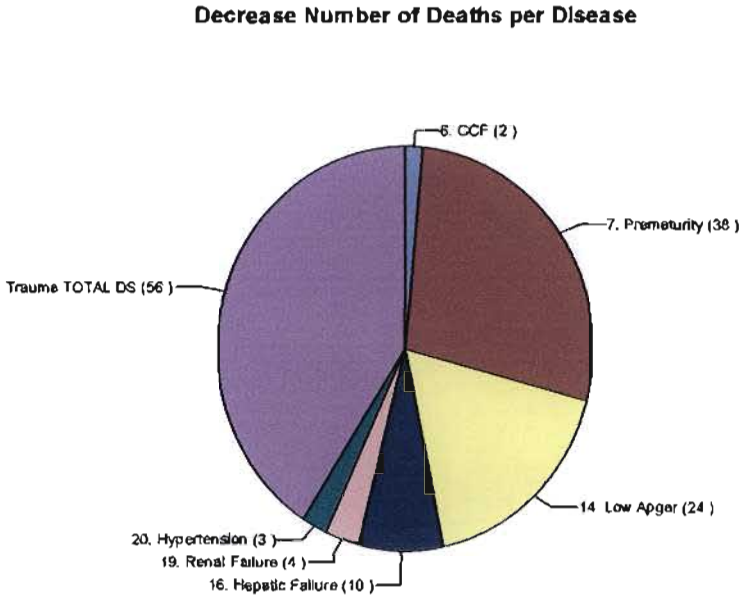
	1995	1996	1997	1998	1999	2000	2001
1	Prematurity 74	PTb 67	PTb 49	PTb 118	PTb 195	PTb 206	PTb 353
2	Gastroenteritis 72	Pneu 43	Pneu 35	Pneu 117	GE 122	Pneu 181	Pneu 250
3	Pulmonary Tuberculosis 71	GE 38	GE 28	GE 114	Pneu 111	GE 103	GE 125
4	Pneumonia 68	Maln 37	CCF 21	Maln 79	Maln 53	Maln 60	Chr GE 78
5	Congestive Cardiac Failure 52	CVA 36	CVA 19	Prem 60	Prem 46	Chr GE 51	RV 66
6	Malnutrition 48	CCF 28	RV 14	CCF 46	CCF 42	RV 48	Meningitis 59
7	Cerebral Vascular Accident 43	Prem 26	Meningitis 13	Sept 45	= CVA 42	Meningitis 47	CVA 54
8	Low Apgar 41	Trauma 21	= Prem 13	Cancer 41	= Cancer 42	= CVA 47	Maln 52
9	Cancer 34	= RV 21	Trauma 12	CVA 39	Meningitis 34	CCF 38	CCF 50
10	Trauma 29	Meningitis 20	Sept 11	Chr GE 35	Low Ap 33	= Cancer 38	Herb En 48
11	Hepatic Failure 26	= Sept 20	Low Ap 10	Trauma 34	Sept 28	Sept 26	Cancer 40
12	= Retro-viral 26	Low Ap 17	= Maln 10	Herb En 33	RV 25	Prem 20	Prem 36
13	Septicaemia 21	Cancer 16	Cancer 8	Meningitis 32	DM 24	= Low Ap 20	DM 31
14	Diabetes Mellitus 19	HF 10	COAD 6	HF 25	Trauma 23	Epilepsy 19	=Sept 31
15	Renal Failure 17	DM 8	= HF 6	Low Ap 22	Chr GE 22	= HF 19	Epilepsy 20
16	Chronic Gastroenteritis 16	= Maternal 8	Intestinal Obstruction 5	DM 17	= Epilepsy 22	DM 14	Low Ap 17
17	Meningitis 12	Renal Failure 7	= RF 5	Epilepsy 16	Herb En 21	Herb En 13	Trauma 16
18	Hypertension 10	= Gastritis 7	Tb effusion 4	RV 13	HF 19	Malaria 12	= HF 16
19	= Chronic Obstructive Airway Disease 10	Burns 6	Chr GE 2	Gastritis 10	HPT 13	Ascites 10	RF 13
20	Herbal Enema 8	= Psychosis 6	= Herb En 2	Burns 8	= Int Obstr 13	RF 9	Anaemia 10
21	Epilepsy 7	= Epilepsy 6	= Epilepsy 2	=COAD 8	Malaria 11	HPT 7	Tb effusion 9
22	= Gastritis 7	=COAD 6	= Maternal 2	RF 7	RF 10	= Gastritis 7	= Ascites 9
23	Anaemia 6	HPT 5	=Tb abd 2	=HPT 7	Ascites 8	= Trauma 7	Confusion 8
24	Tb effusion 5	= Herb En 5	=Congenital abnormality 2	Cong ab 6 = Int Obstr 6	Tb effusion 7 = Maternal 7 = Psychosis 7 = Gastritis 7	Int Obstr 6	HPT 7 = Psychosis 7 = Gastritis 7
	Unknown 69	Unkn 460	Unkn 693	Unkn 150	Unkn 86	Unkn 245	Unkn 154



Appendix V-Figure 1 – Top Twenty Causes of Death



Appendix V-Figure 2 Increase Number of Deaths per Disease



Appendix V-Figure 3 Decrease Number of Deaths per Disease

Appendix VI

South African Burden of Disease list (Bradshaw et al 2002b:18-21).

Type I INFECTIOUS, MATERNAL& PERINATAL, NUTRITION

ZA Code	Disease	ICD-9 code
A	**Infectious and parasitic**	**001-139, 209, 279, 320-322, 511, 614-616**
1	Tuberculosis	010-018, 137, 511
2	STD excluding HIV	090-099, 614-616
3	HIV/AIDS	209, 279
4	Diarrhoeal diseases	001, 002, 004, 006-009
5	Childhood (Vaccine preventable) cluster	032, 033, 037, 045, 050, 055, 056, 138
6	Bacterial meningitis	036, 320-322
7	Hepatitis	070
8	Malaria	084
9	Schistosomiasis and other tropical diseases	085, 086, 120, 125
10	Leprosy	030
11	Intestinal parasites	126-129
12	Septicaemia	038
13	Other infectious and parasitic	003, 005, 020-027, 031, 034, 035, 039-041, 046, 047.048, 049, 051-052, 053, 054, 057, 060-066, 071-079, 080-083, 087, 088, 100-104, 110-118, 121-124,130-136, 139
B	**Respiratory infections**	**460-466, 480-487, 381-383**
14	Lower respiratory infections	466, 480-487
15	Upper respiratory infections	460-465
16	Otitis media	381-383
C	**Maternal conditions**	**630-676**
17	Maternal haemorrhage	640, 641, 666
18	Maternal sepsis	670
19	Hypertension in pregnancy	642
20	Obstructed labour	660
21	Abortion	630-639
22	Other maternal	643-659, 661-665, 667-669, 617-676
D	**Perinatal conditions**	**760-779**
23	Low birth weight	764-765, 769
24	Birth asphyxia and trauma	767-768
25	Other respiratory conditions	770
26	Neonatal infections	771
27	Foetal alcohol syndrome	760.7
28	Other perinatal	760.0-760.6, 760.8-760.9, 761-763, 766, 772-778
E	**Nutritional deficiencies**	**243, 260-269, 280-281, 285**
29	Protein-energy malnutrition	260-263
30	Deficiency anaemias	280-281, 285
31	Other nutritional deficiencies including pellagra and vitamin A deficiency	243, 264-269

Type II	NON COMMUNICABLE DISEASE	
ZA Code	**Disease**	**ICD-9 code**
F	**Malignant neoplasms**	**140-208**
32	Mouth and oropharynx	140-149
33	Oesophagus	150
34	Stomach	151
35	Colo-rectal	153, 154
36	Liver	155
37	Pancreas	157
38	Larynx	161
39	Trachea/bronchi/lung	162, 166
40	Bone and connective tissue	170-171
41	Melanoma	172
42	Other skin cancer	173
43	Breast	174, 175
44	Cervix	180
45	Corpus uteri	179, 181-182
46	Ovary	183
47	Prostate	185
48	Bladder	188
49	Kidney	189
50	Brain	191
51	Lymphoma	200-202
52	Leukaemia	204-208
53	Other malignant neoplasm	152.156, 158-160, 163-165, 184, 186-187, 190, 192-194, 203
G 54	**Benign neoplasms**	**210-239**
H 55	**Diabetes Mellitus**	**250**
I	**Endocrine and metabolic disorder**	**240-242,244-246, 251-259, 270-278, 282-284, 286-289**
56	Albinism	270.2
57	Other endocrine and metabolic	270.0-270.1, 270.3-270.9, 240-242, 244-246, 251-259, 271-278, 282-284, 286-289
J	**Mental disorders**	**291-319, 327**
58	Alcohol dependence	291, 303
59	Drug use	304, 305
60	Schizophrenia	295
61	Affective disorders (depression, bipolar)	296
62	Anorexia	327
63	Anxiety disorders (obsessive compulsive/panic)	300
64	Hyperkinetic syndrome of childhood	314
65	Adjustment reaction (PTSS)	309
66	Mental disability	317-319
67	Other mental disorders	292-294, 297-299, 301-302, 306-308, 310, 313, 315-316

Type II	NON COMMUNICABLE DISEASE (continued)	
ZA Code	**Disease**	**ICD-9 code**
K	**Nervous system disorders**	**290, 323-326, 330-337, 340-359**
68	Alzheimer and other dementias	290, 330, 331
69	Parkinsons disease	332
70	Multiple sclerosis	340
71	Epilepsy	345
72	Encephalitis and brain abscess	323, 324
73	Other nervous system disorders	325-326, 333-337, 341-344, 346-349, 350-359
L	**Sense Organs**	**360-380, 384-389**
74	Glaucoma	365
75	Cataracts	366
76	Other visual disorders	360-364, 367-379
77	Hearing loss and other disorders	380, 384-389
M	**Cardiovascular**	**390-402, 404-415, 417-455, 457-459, 514**
78	Rheumatic heart disease	390-398
79	Ischaemic heart disease	410-414
80	Stroke	430-438
81	Inflammatory heart disease	420-422, 425
82	Hypertensive heart disease	401-402, 404, 405
83	Non-rheumatic valvular disease	424
84	Pulmonary embolism	415
85	Aortic aneurism	441
86	Peripheral vascular disorders	442-448, 451-455
87	Other cardiovascular	417, 423, 426, 457, 458, 459, 514
N	**Respiratory infections**	**470-478,490-496, 500-509, 510-513, 515-519, 416**
88	COPD	490-492, 495-496, 416
89	Asthma	493
90	Aspiration pneumonia/lung abscess	507, 513
91	Other respiratory	470-478, 494, 500-506, 508,509, 510, 512, 515-519
O	**Digestive**	**456, 530-579, 609**
92	Peptic ulcer	531-533
93	Cirrhosis of liver	571-572, 609, 456
94	Appendicitis	540-543
95	Intestinal obstruction, noninfective gastroenteritis and colitis, peritonitis	551, 552, 560, 558, 567
96	Gall bladder disease	574-576
97	Pancreatitis	577
98	Other digestive	530, 534-537, 550,553-557, 562-566, 568-570, 573, 579
P	**Genital-Urinary**	**403, 580-608, 610-611, 617-629**
99	Nephritis/nephrosis	580-589, 403
100	Benign prostatic hypertrophy	600
101	Stress incontinence	625.6
102	Other genito-urinary	590-599, 601-608, 610-611, 617-624, 625.0-625.5, 625.7-625.9, 626-629
Q 103	**Skin disease**	**680-698, 700-709**

Type II	NON COMMUNICABLE DISEASE (continued)	
ZA Code	**Disease**	**ICD-9 code**
R	**Musculo-skeletal**	**710-739**
104	Rheumatoid arthritis	714
105	Osteoarthritis	715
106	Other musculo-skeletal	710-713, 716-739
S	**Congenital abnormalities**	**740-759**
107	Neural tube defects	740-742
108	Cleft lip/palate	749
109	Congenital heart disease	745-747
110	Congenital disorders of GIT	750-751
111	Down syndrome and other chromosomal anomalies	758
112	Other congenital abnormalities	743-744,748, 752-757
T	**Oral conditions**	**520-529**
113	Dental carries	521
114	Periodontal disease	523
115	Other oral health	520, 522, 524-529
U 116	**Cot death**	**699, 798 <12 months**

Type III	INJURIES	
ZA Code	**Disease**	**ICD-9 code**
V	**Unintentional**	**E800-807, E810-838, E840-858, E860-880, E980-949**
117	Road traffic accidents	E810-819, 826-829
118	Other transport accidents	E800-807, 820-825, 830-838, 840-848
119	Mining accidents	E849
120	Poisoning	E050-858, E860-869
121	Surgical/medical misadventure	E870-879, E875
122	Falls	E880-888
123	Fires	E890-899
124	Natural and environmental factors	E900-909
125	Drowning	E910
126	Suffocation and foreign bodies	E911-915
127	Other unintentional injuries specified	E839, E916-927, E930-949
W	**Intentional Injuries**	**E950-979, E990-999**
128	Suicide and self-inflicted	E950-959, E979
129	Homicide and violence	E960-E969
130	Legal intervention and war	E889, E970-978, E990-999

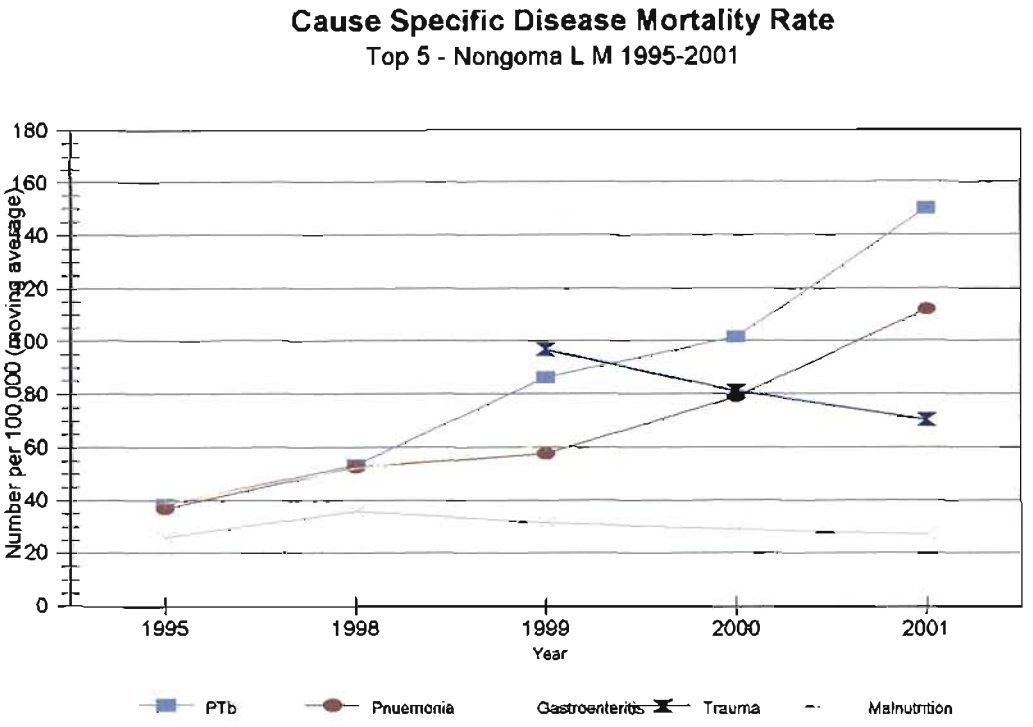
Appendix VII
Cause Specific Mortality Rate per 100,000

Cause of Death	1995	1996	1997	1998	1999	2000	2001
Population	185189	188,144	191,138	194,130	197,288	200,432	203,623
Pneumonia	36.72	22.85	18.31	60.27	56.26	90.30	122.78
I Infectious (Respiratory)	36.72	22.85	18.31	60.27	56.26	90.30	122.78
Gastroenteritis	38.88	20.20	14.65	58.72	61.84	51.39	61.39
Chronic Diarrhea	8.64	2.13	1.05	18.03	11.15	25.45	38.31
I Infectious (GE)	47.52	22.32	15.70	76.75	72.99	76.83	99.69
PTb	38.34	35.61	25.64	60.78	98.84	102.78	173.36
Tb pleural effusion	2.70	0.53	2.09	2.06	3.55	0.5	4.42
Tb Abdomen	0.00	0.00	1.05	0.00	0.00	0.50	0.98
Tb pericarditis	0.00	0.00	0.00	0.00	0.00	0.00	1.47
Tb Spine	0.54	0.00	0.00	0.00	0.51	0.00	0.00
I Infectious (Tb)	41.58	36.14	28.78	62.84	102.90	103.78	180.24
Retro-viral	14.04	11.16	7.32	6.70	12.67	23.95	32.41
Meningitis	6.48	10.63	6.80	16.48	17.23	23.45	28.98
Septicaemia	11.34	10.63	5.76	23.18	14.19	12.97	15.22
Malaria	0.54	1.59	0.52	0.52	5.58	5.99	2.46
Herpes	0.00	0.00	0.00	0.00	0.51	0.00	0.49
Measles	0.00	2.13	0.00	0.00	0.00	0.00	0.00
Chicken Pox	0.00	0.53	0.00	0.00	0.00	0.00	0
Typhoid	0.54	0.53	0.00	0.52	0.51	0.00	0
Rabies	0.54	0.00	0.00	1.03	0.51	0.00	0.00
Neonatal Tetanus	0	0.53	0.00	0.00	0.00	0.00	0
I Infectious (Other)	33.48	37.21	20.40	48.42	51.19	66.36	79.56
TYPE I Infectious	159.3	119.06	83.19	248.29	283.34	337.27	482.26
PV Bleeding	0	0.00	0.00	0	0.51	0.50	0.49
Maternal	0.00	4.25	1.05	1.03	3.55	0.00	0
I Maternal	0.00	4.25	1.05	1.03	4.05	0.50	0.49
Prematurity	39.96	13.82	6.80	30.91	23.32	9.98	17.68
Low Apgar	22.14	9.04	5.23	11.33	16.73	9.98	8.35
I Perinatal	62.10	22.85	12.03	42.24	40.04	19.96	26.03
I Perinatal/Maternal	62.10	27.11	13.08	43.27	44.10	20.46	26.52
Anaemia	3.24	1.59	0.52	1.55	0.51	1.50	4.91
Malnutrition	25.92	19.67	5.23	40.69	26.86	29.94	25.54
I Malnutrition	29.16	21.26	5.76	42.24	27.37	31.43	30.45
TYPE I (Pre-transitional)	250.55	167.42	102.02	333.80	354.81	389.16	539.23

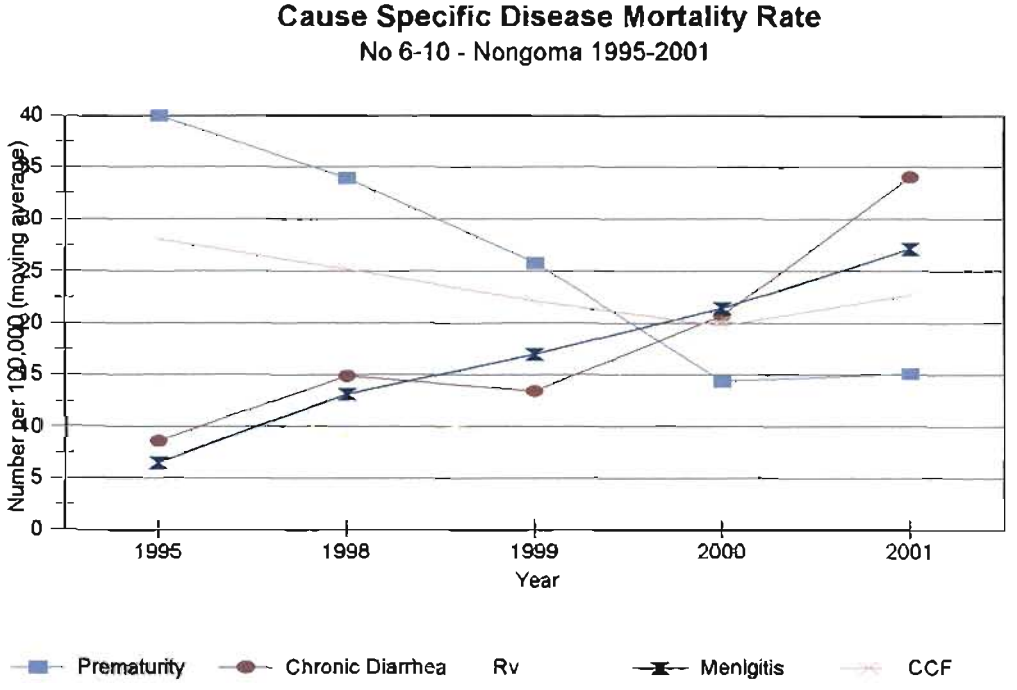
CVA	23.22	19.13	9.94	20.09	21.29	23.45	26.52
CCF	28.08	14.88	10.99	23.70	21.29	18.96	24.56
Cardiac	1.62	0.00	0.00	0.00	0.00	0.50	1.96
Pulmonary Embolus	0	0.00	0.00	0.00	0.00	1.00	0
Hypertension	5.40	2.66	0.52	3.61	6.59	2.49	3.44
II Cardiac	58.32	36.67	21.45	47.39	49.17	46.4	56.48
II Cancer	18.36	8.5	4.19	21.12	21.29	18.96	19.64
II Diabetes Mellitus	10.26	4.25	0.52	8.76	12.16	6.98	15.22
Psychosis	1.08	3.19	0.52	1.55	3.55	0.5	3.44
Confusion	0.00	0	0	2.58	0.00	2.49	3.93
II Mental	1.08	3.19	0.52	4.12	3.55	2.99	7.37
Epilepsy	3.78	3.19	1.05	8.24	11.15	9.48	9.82
Neurology	0.00	0.00	0.00	0.00	1.01	0.00	0
II Neurology	3.78	3.19	1.05	8.24	12.16	9.48	9.82
II COAD	5.4	3.19	3.14	4.12	3.04	2.49	1.96
Hepatic Failure	14.04	5.32	3.14	12.88	9.63	9.48	7.86
Ascites	2.16	0.53	0.52	2.58	4.05	4.99	4.42
II Hepatic	16.2	5.85	3.66	15.45	13.69	14.47	12.28
Gastritis	3.78	3.72	0.00	5.15	3.55	2.00	3.44
Intestinal Obstruction	1.08	1.59	2.62	3.09	6.59	2.99	0
II GI	4.86	5.32	2.62	8.24	10.14	4.99	3.44
II Digestive (Hep + GI)	21.06	11.16	6.28	23.70	23.82	19.46	15.72
Renal Failure	9.18	3.72	2.62	3.61	5.07	4.49	6.38
BPH	1.62	1.59	0.52	1.03	0.51	1.5	1.47
II GU	10.8	5.32	3.14	4.64	5.58	5.99	7.86
Herbal Enema	4.32	2.66	1.05	17.00	10.64	6.49	23.57
Congenital Abnormality	1.62	1.59	1.05	3.09	3.04	0.50	1.96
Bleeding	2.16	1.06	0.00	0.52	0.51	2.00	0.98
Lymphadenopathy	0	0.00	0.00	0.00	0.00	0.00	0.98
II Miscellaneous	8.1	5.32	2.09	20.6	14.19	8.98	27.5
II Other (non-communicable)	60.48	35.61	16.74	74.18	74.51	56.38	85.45
TYPE II (non-communicable)	137.16	80.79	42.38	142.69	144.97	121.74	161.57

Trauma	15.66	11.16	6.28	17.51	11.66	3.49	7.86
Snakebite	0.00	0.53	0.00	0.52	0.51	0.00	0.49
Burns	1.62	3.19	0.52	4.12	3.04	2.49	1.96
Drug Overdose	0.00	0.00	0.52	0.00	0.51	1	0.00
III Benedictine (trauma)	17.28	14.88	7.32	22.15	15.71	6.98	10.31
District Surgeon Post Mortems							
Motor Vehicle Accident	0	0	0	0	25.34	16.46	15.72
Gun Shot Wound	0.00	0.00	0.00	0.00	29.40	24.45	21.61
Blunt Trauma	0.00	0.00	0.00	0.00	7.10	3.99	7.86
Knife Wound	0.00	0.00	0.00	0.00	10.64	7.48	7.37
Trauma	0.00	0.00	0.00	0.00	2.03	4.49	2.46
SD / IC Haemorrhage	0.00	0.00	0.00	0.00	1.52	1.00	0
Trauma SUBTOTAL	0	0	0.00	0.00	50.69	41.41	39.29
Strangulation	0.00	0.00	0	0	6.59	5.99	5.4
Electrocution / Lightning	0.00	0.00	0.00	0.00	5.07	0.50	0.49
Drowning	0.00	0.00	0.00	0.00	4.05	3.99	2.46
Asphyxia	0.00	0.00	0.00	0.00	1.01	1.00	1.47
Environmental Exposure	0.00	0.00	0.00	0.00	1.01	1.50	1.47
Burns	0.00	0.00	0.00	0.00	0.51	2.00	2.46
Other	0.00	0.00	0.00	0.00	3.04	1.00	0
Other SUBTOTAL	0	0	0	0	21.29	15.97	13.75
District Surgeon TOTAL	0	0	0	0	97.32	73.84	68.75
III Trauma (Unintentional)	1.62	3.72	0.52	4.64	42.07	25.94	24.56
III Trauma (Intentional)	15.66	11.16	6.8	17.51	57.78	48.4	44.69
III Trauma	17.28	14.88	7.32	22.15	99.85	74.34	69.25
IV Unknown	37.26	244.49	362.57	77.27	43.59	122.24	75.63
TOTAL per Cause of Death	442.25	507.59	514.29	575.9	643.22	707.47	845.68
Total per Cause of Death – Benedictine	442.25	507.59	514.29	575.90	559.08	640.12	786.75
Total per Deaths – Benedictine	468.17	496.96	529.46	586.21	572.26	661.57	762.19
Total per Deaths – DS	0.00	0.00	0.00	0.00	84.14	67.35	58.93
Total per Deaths – DS & Benedictine	468.17	496.96	529.46	586.21	656.40	728.93	821.13

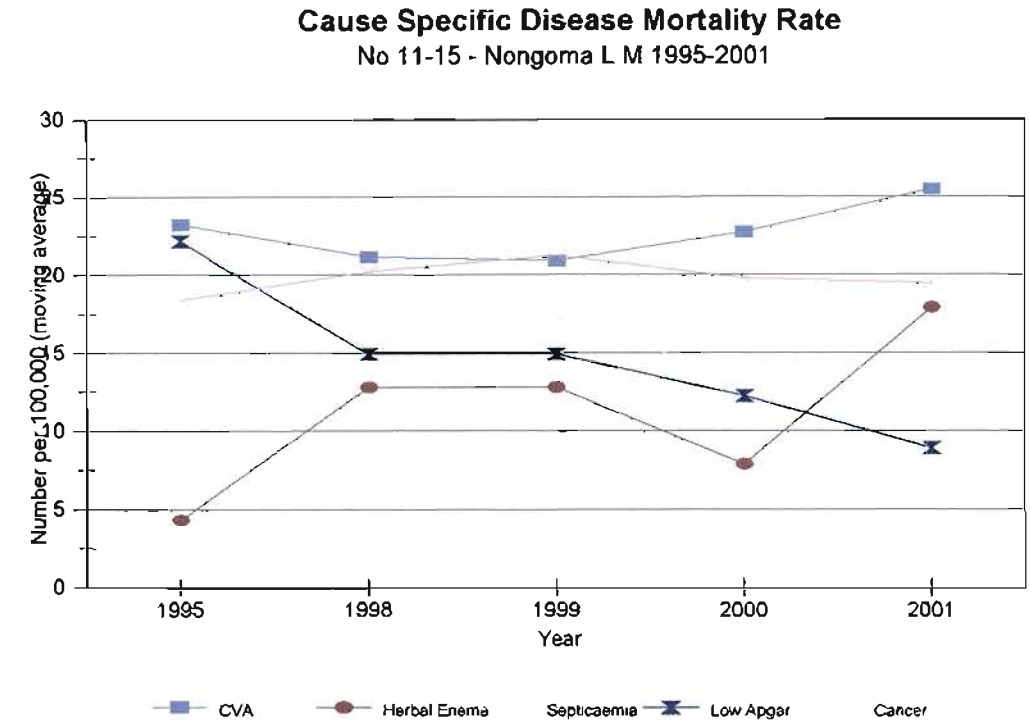
Appendix VIII



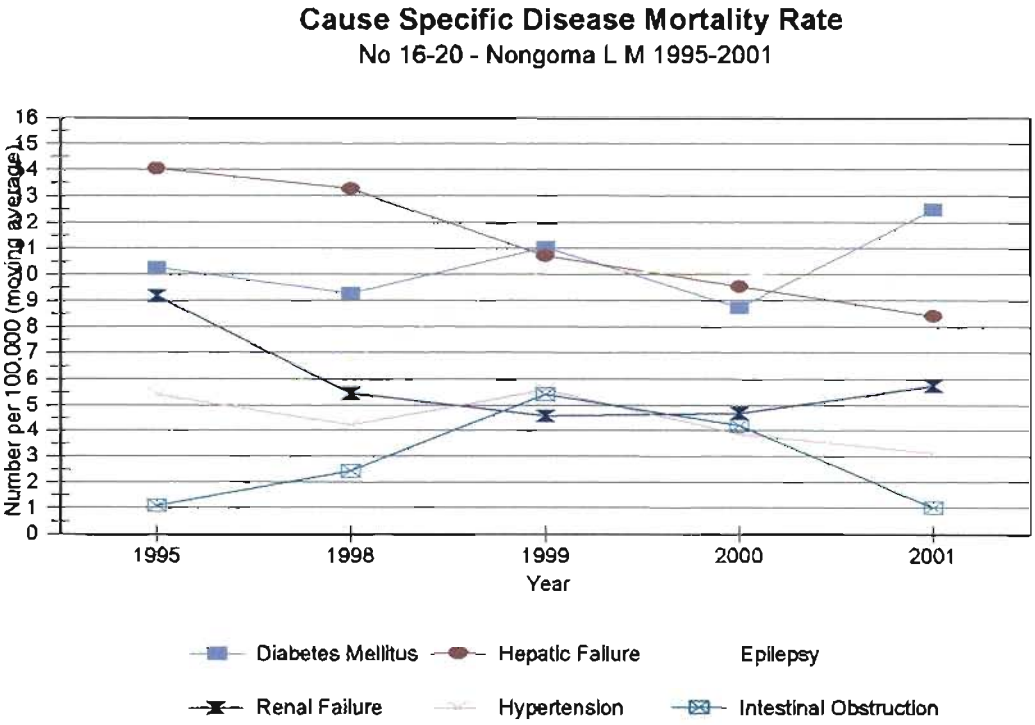
Appendix VIII – Figure 1



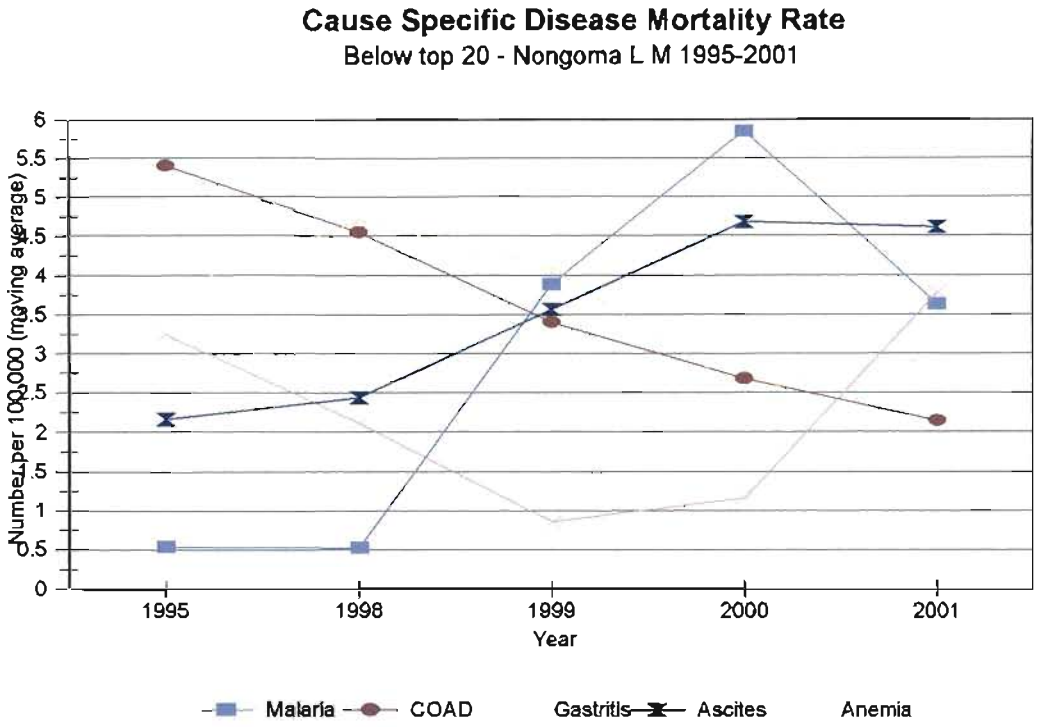
Appendix VIII – Figure 2



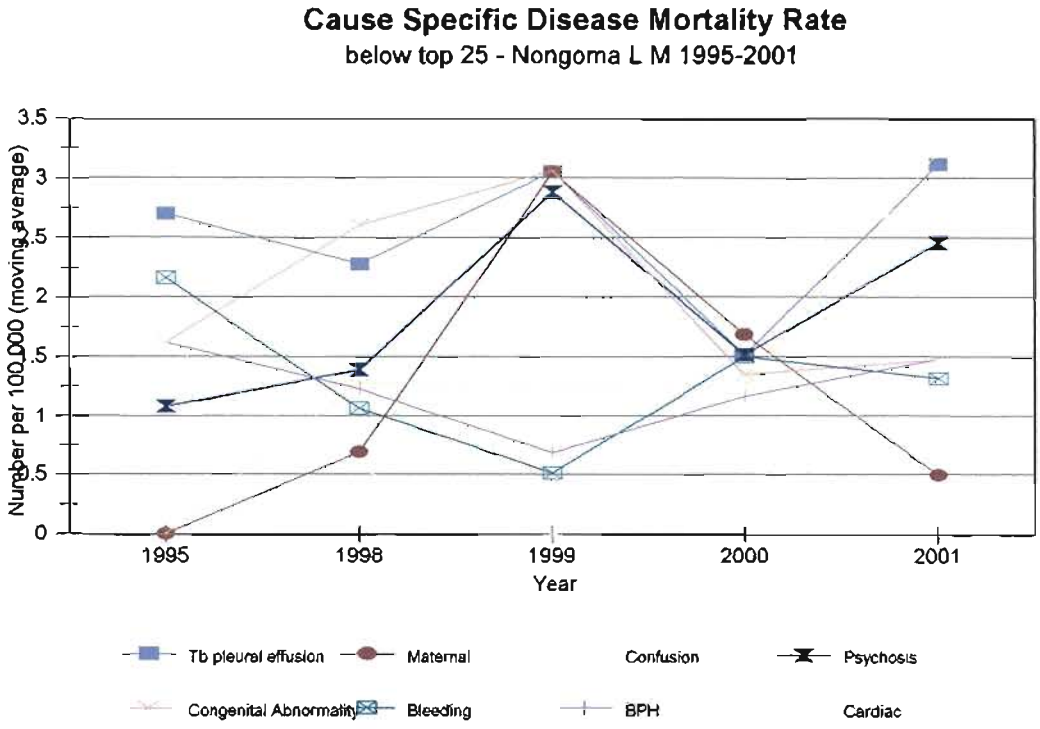
Appendix VIII – Figure 3



Appendix VIII – Figure 4

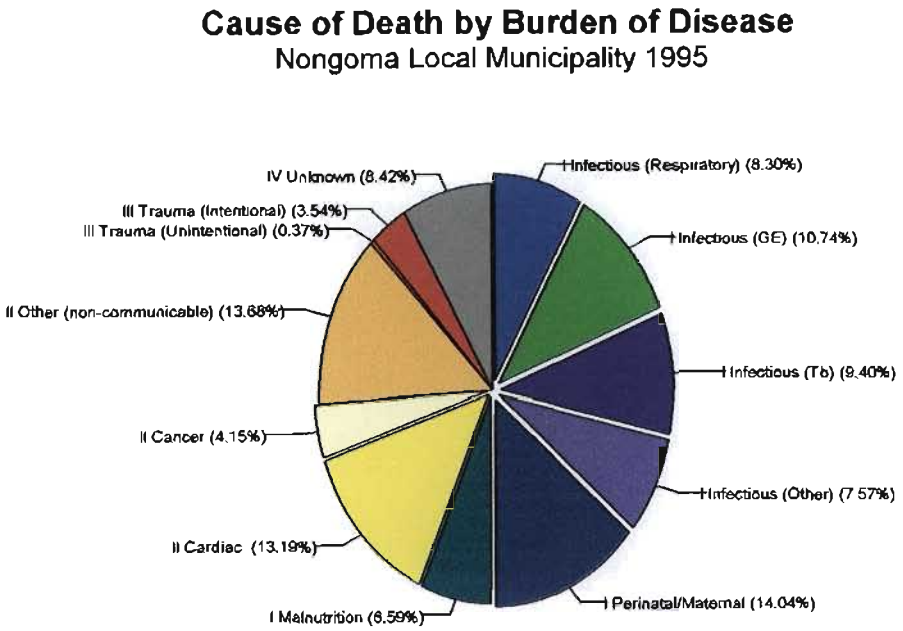


Appendix VIII – Figure 5

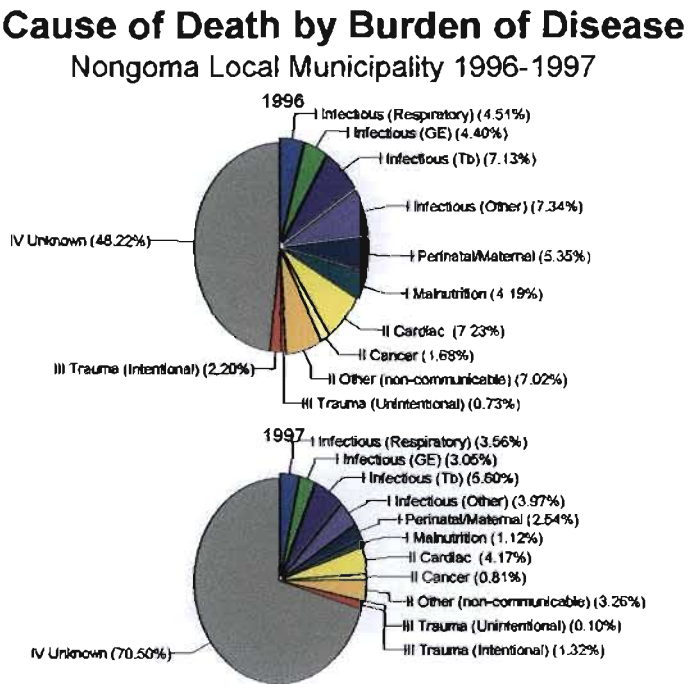


Appendix VIII – Figure 6

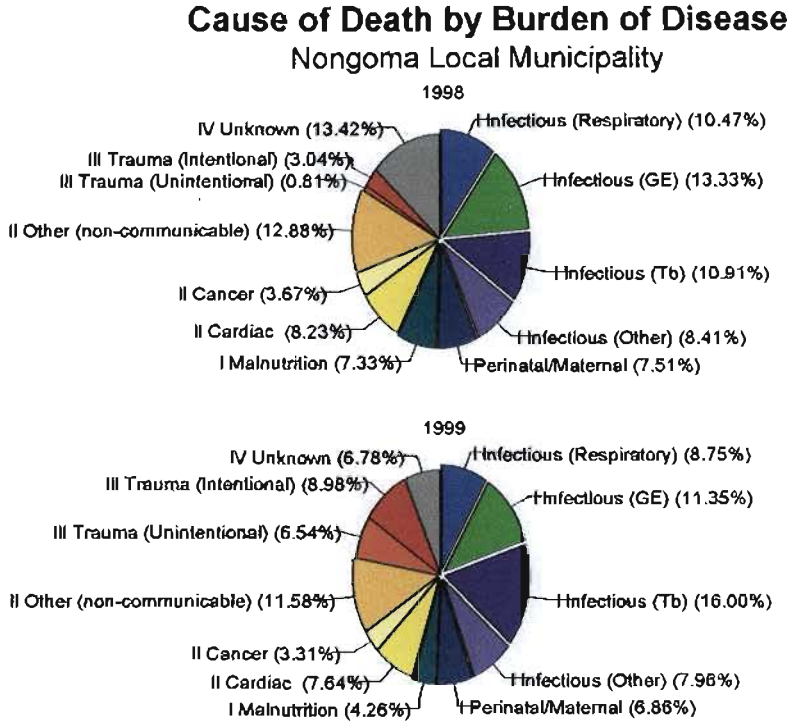
Appendix IX



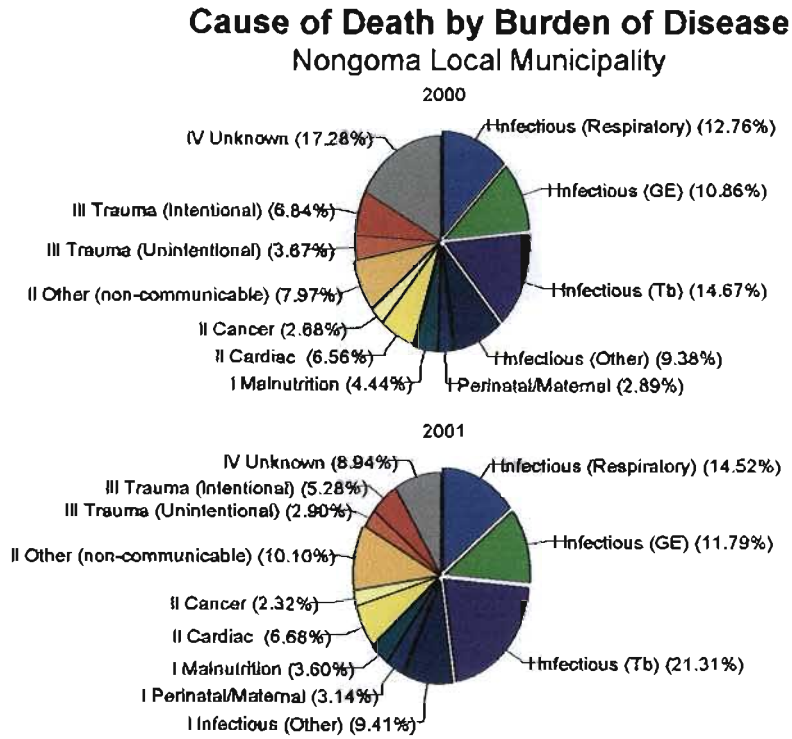
Appendix IX-Figure 1 Cause of Death by Burden of Disease 1995



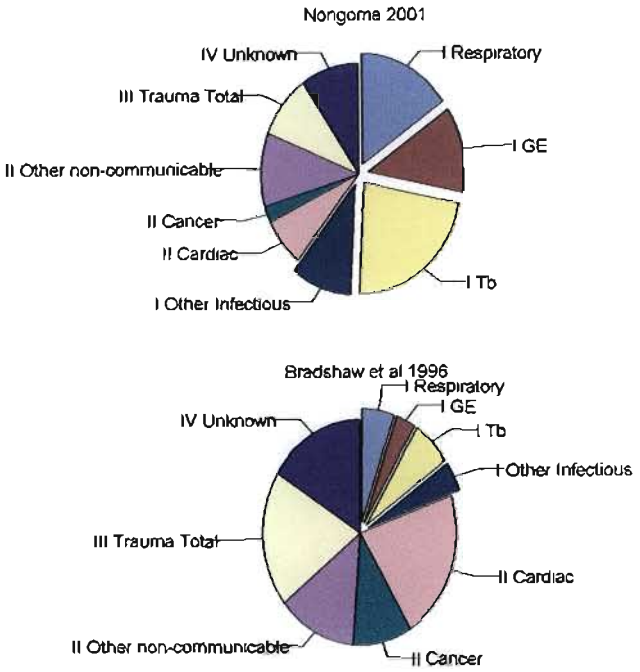
Appendix IX-Figures 2 & 3 – Cause of Death by Burden of Disease 1996 & 1997



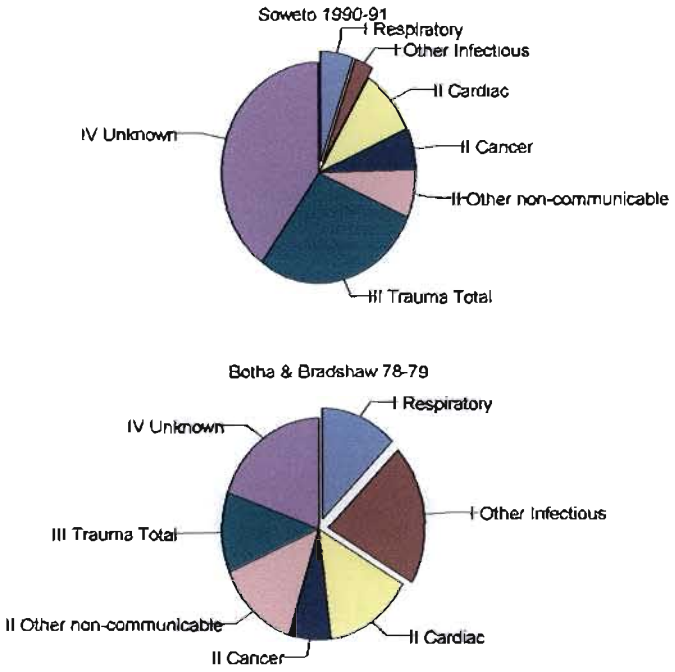
Appendix IX-Figures 4 & 5 – Cause of Death by Burden of Disease 1998 &1999



Appendix IX-Figures 6 & 7 – Cause of Death by Burden of Disease 2000 & 2001



Appendix IX-Figures 8 & 9 Comparison Burden of Disease from Different Studies



Appendix IX-Figures 10 & 11 Comparison of Burden of Disease from Different Studies

Appendix X

Method to Address Criticisms and Deficiencies

I. Editorial
The editorial changes requested have been implemented.
A list of abbreviations has been placed at the beginning of the thesis in the preface.

II. Literature
The South African Demographic and Health Survey – 98 and other sources have been consulted and incorporated into the discussion in the literature review. They have also been utilized throughout the rest of the document in the discussion and interpretation of the results of the study.

III. Methodology
Grimes and Schulz (2002a &b) have been consulted and the section on the type of study has been rewritten.
The issue of the study proposing research questions rather than hypotheses has been corrected.
The methodology chapter has been rewritten. The methodology of the utilization of the additional sources has been explained. Explanations on the methodology of the different methods of measurement has been expanded. An expanded section on definitions has been included. The section on data management has been expanded and explained in more detail.

IV. Restructuring of the chapters on methodology and results
The chapters on methodology, results and discussion were substantially rewritten. An attempt was made to incorporate the comments. Sections were not combined; however attempts were made to explain the rationale. Graphs and tables were rationalized, with extra tables and graphs being placed in the appendices. In the discussion chapter attempts were made to more extensively discuss and interpret the results.