ENSIGN COLLEGE OF PUBLIC HEALTH, KPONG EASTERN REGION, GHANA

CAUSES OF DEATH AT THE UNIVERSITY OF GHANA HOSPITAL IN ACCRA - A 37 YEAR REVIEW (1979-2015)

by

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MASTER OF PUBLIC HEALTH

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DECLARATION AND CERTIFICATION

I, Edward Kofi Sutherland, declare that this submission is my own work towards the MPH and that to the best of my knowledge, it contains no material previously published by another person nor material which has been accepted for the award of any other degree of the University, except where due acknowledgement has been made in the text.

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Student's name Signature Date

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Student's ID

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Supervisor's name Signature Date

Certified by:

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Head of Department's name Signature Date

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Finally, whatever I have been able to achieve has been by the grace of God (1 Corinthians 15:10) and for that I am grateful to the source and sustenance of my being.

ABSTRACT

The aim of the study was to conduct an analysis of the causes of death at the University of Ghana Hospital, Legon (UGHL) from 1979 to 2015. The objectives were to conduct cross-sectional and temporal analysis of the causes of death and also evaluate the quality of the data. Secondary data from medical cause of death certificates was extracted and analysed using SPSS. Diseases were grouped into three main categories and analysed by age, gender and time in years. Of 3263 deaths recorded, 45.2% were adults 60 years and above and 37.7% were adults aged 19-59 years. Male deaths (58.06%) were higher than female deaths (41.94%). Findings revealed a common pattern of yearly deaths decreasing till 1991-1995 after which they increased. It revealed deaths in adults older than 19 years are increasing whilst those in younger age groups are declining. Almost 60% of all deaths were caused by non-communicable diseases. HIV/AIDS deaths rose sharply from 1996.Within the last decade, deaths by Malaria, Tuberculosis and Diarrheal diseases in individuals' $\geq$ 18 years has declined. In addition, deaths from malaria and diarrheal diseases in individuals < 18 years of age declined. Deaths by Tuberculosis in individuals < 18 years of age have been zero since 1985. Measles ceased to be a cause of death after 1990.Tetanus was not a cause of death after 1985 until it re-emerged in 2011-2015. A shift from communicable to non-communicable diseases was observed within this period, depicting a dual burden of disease. Amongst the top causes of non-communicable deaths were cardiovascular disease and cancer. The UGHL cause of death database was assessed to be 95.95 - 97.3% complete. Non- documentation of time interval between disease onset and death, recording "mode of dying" as the immediate cause of death, the use of non-conventional abbreviations, ill-defined causes of death and improperly written cause based sequence were some of the data quality issues identified. In conclusion, generally the descriptive findings at the UGHL are quite similar to those of similar research studies conducted in sub-Saharan Africa and the world. It supports well established findings and projections made on the Global burden of Disease and the epidemiological transition. However, the UGHL study setting had exceptional findings relating to the overall disease and age distribution of death. This suggests that targeted public health interventions need to be put in place to deal with this issue. Findings emphasized the need to upgrade physician knowledge on death certification practices to ensure good quality cause of death data. The study has yielded results that may be applicable to the national populace as it is the longest retrospective study of its kind in Ghana.

ABBREVIATIONS

Dx - Disease

GBD – Global Burden of Disease

HIV/AIDS – Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome

ICD-10 – International Classification of Diseases, 10th Revision

NCD – Non-communicable diseases

TB – Tuberculosis

UGHL – University of Ghana Hospital, Legon

UN – United Nations

UNICEF- United Nations Children's Emergency Fund

WHO –World Health Organization

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CHAPTER ONE

INTRODUCTION

1.0 Background

Mortality is known to be the oldest health care indicator (Corrigan et al, 1999). Death within populations is inevitable and it “affects all age groups” (Malangu et al, 2014).

“In almost all developing countries where death registration is functional, even for only a fraction of the population, it would be reasonable to expect that the correct diagnoses of causes of death would be highest for those deaths that occur in hospitals compared with those that occur elsewhere” (Pattaraarchachai et al. 2010).

“The optimal source of information on causes of death in populations is vital registration data based on medical certificates of cause of death, issued by attending physicians. The World Health Organization (WHO) has prescribed a standard form for the medical certificate of cause of death, which allows for the listing of multiple diseases or conditions that occur in a chronological and pathophysiological sequence terminating in death, as well as the mention of associated diseases or conditions that are not directly linked to the causal sequence” (WHO, 1993). “In each case, the listed causes are usually based on the attending physician's firsthand knowledge of the illness and circumstances leading to death, or on information derived from available medical records that support any observations during the terminal phase. In some instances, deaths in hospitals are also subjected to pathological autopsies to determine the cause, but these are becoming increasingly rare, reserved largely for medico-legal cases” (Hill and Anderson, 1996).

The importance of knowing the causes of death cannot be over-emphasized as it plays a very important role in the development of health systems world-wide.

“The review of causes of morbidity and mortality in health care facilities is an important exercise with far reaching implications. This form of clinical audit gives a picture of the prevailing disease pattern in the particular community and at the same time looks out for any change in the disease pattern over time” (Fadare and Afolabi , 2010).

Despite the fact that Hospital information may not precisely speak to national wellbeing statistics, they give helpful markers of the wellbeing status of the community and especially of childhood (Univ. College Hosp., Ibadan, 1985).

1.1. Statement of the Problem

Data on causes of death is scanty in several developing nations (Sibai, 2004). However, there is a growing increase in demand for health care and Ghana is no exception to this. With the increase in demand for health care services, upgrading of the health care system is a pressing need. Priorities for transformation should be based on evidence because they are not easy to define (Iordanis et al, 2008). Causes of death data, the oldest healthcare indicator provides such evidence (Corrigan et al, 1999).

A PubMed search to date revealed quite substantial research has been done on causes of death by use of verbal autopsy in Ghana. Those done by use of hospital mortality records are few. This also applied to Africa. Hence, the aim of the study.

The analysis of hospital mortality (in Ghana) can help to assess the standards of health care delivery (Iordanis et al, 2008). Data on the recurrence of particular diseases and their significant addition to morbidity and mortality in the populace helps in the reinforcement of effective healthcare systems. The measurement of mortality, as well as cause of death determination, helps in the upgrade of healthcare planning, asset distribution and delivery of health services (Baiden et al, 2007; Murray et al, 2011).

The epidemiological transition is a world-wide public health concern. In developing countries, there is a gradual decline of deaths from infectious diseases, while the

proportion of deaths from non-communicable diseases is increasing (Baiden et al, 2007; Murray et al, 2011).

According to the WHO country statistical profile for Ghana (WHO and UN partners, 2015), cardiovascular diseases and diabetes, cancers and other NCDs have seen a considerable increase in cause mortality between years 2000-2012. The top five leading causes of death were lower respiratory infections, stroke, malaria, ischemic heart disease and HIV/AIDs in descending order.

1.2. Rationale of the Study

Although the hospital mortality records (1979 to 2015) reviewed is not representative of the nation; there was a need for analysis of causes of death within this time period to ascertain the current burden of the causes of death in the hospital for comparative analysis with the world- wide epidemiological transition as well as comparison with death patterns in other areas of Ghana and Africa. This study is the longest retrospective analysis of its kind in Ghana. It is also the first of its kind at the University of Ghana Hospital, Legon.

1.3. Aim of the Study

The aim of the study is to review and summarize all causes of death across all age-groups at the University of Ghana Hospital, Legon for the time period 1979 to 2015 as a basis for public health interventions.

Primary Objective:

1. To describe the causes of death at the University of Ghana Hospital, Legon over the 37 year period from 1979 to 2015

Secondary Objectives:

1. To describe demographic factors influencing the causes of death.
2. To describe temporal trends in the causes of deaths.
3. To evaluate the quality of causes of death records at the Legon Hospital.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

“Population-based mortality data are scarce in sub-Saharan Africa and most developing countries. Hospital-based mortality analysis becomes important and can help assess burden of diseases, quality of health care delivery, and provide approximate measure of mortality” (Arodiwe et al. Nov-Dec 2014).

The literature reviewed was guided by the problem statement, the rationale, the aim and objectives of the study. It was based on cause of death, data quality in the healthcare sector, the need for evaluation and assessment of causes of death data; the epidemiological health transition and comparative analysis of findings of similar research studies.

2.1. International definition of 'cause of death'

“In 1967, the Twentieth World Health Assembly defined the ‘causes of death’ to be entered on the medical certificate of cause of death as ‘all those diseases, morbid conditions or injuries which either resulted in or contributed to death and the circumstances of the accident or violence which produced any such injuries’. The purpose of the definition is to ensure that all the relevant information is recorded and that the certifier does not select some conditions for entry and reject others. The definition does not include symptoms and modes of dying, such as heart failure or respiratory failure” (WHO, 2011).

2.1.1 Underlying cause of death

“It was agreed by the Sixth Decennial International Revision Conference 1948 that the cause of death for primary tabulation should be designated the underlying cause of death. From the standpoint of prevention of death, it is necessary to break the chain of

events or to effect a cure at some point. The most effective public health objective is to prevent the precipitating cause from operating. For this purpose, the underlying cause has been defined as '(a) the disease or injury which initiated the train of morbid events leading directly to death, or (b) the circumstances of the accident or violence which produced the fatal injury'" (WHO, 2011).

2.1.2 The Medical Cause of Death Certificate

The WHO standards of completion of the medical cause of death certificate are that adopted by Ghana and many other countries. The WHO format for medical cause of death certificate has remained the same over the study time period 1979 -2015. Below is the format.

INTERNATIONAL FORM OF MEDICAL CERTIFICATE OF CAUSE OF DEATH

	CAUSE OF DEATH	Approximate interval between onset and death
I		
Disease or condition directly leading to death *	(*a*) . . . . . due to (or as a consequence of)	. . . . .
Antecedent causes Morbid conditions, if any, giving rise to the above cause, stating the underlying condition last	(*b*) . . . . . due to (or as a consequence of)	. . . . .
	(*c*)	. . . . .
II		
Other significant conditions contributing to the death, but not related to the disease or condition causing it	. . . . .	. . . . .
	. . . . .	. . . . .

*. This does not mean the mode of dying, e.g., heart failure, asthenia, etc. It means the disease, injury, or complication which caused death.

Figure 2-1: Medical Cause of Death Certificate

"The death certificate has two parts: Part I and Part II. Part I has four lines to record the sequence of events leading to death. The disease or condition directly leading to death (the immediate cause) is always recorded on line I (a). This may be the only condition recorded if there are no other conditions in the sequence. Other conditions leading to I

(a) are entered in sequence on lines (b), (c) and (d), with the underlying cause on the lowest line used.

Part II is used to record other significant conditions contributing to the death but not relating to the disease or condition causing it. The right hand column is used to report the duration of the conditions recorded in Parts I and II. Conditions should be listed with the oldest conditions lowest, so that the timing of the sequence confirms the cause-based sequence.

The term ‘sequence’ refers to two or more conditions entered on successive lines of Part I, each condition being an acceptable cause of the one entered on the line above it” (WHO, 2011).

2.2 Data Quality in the Healthcare Sector

The definition of data quality and the realization of the need for information that is free of defects and that possess the right qualities for any task at hand remains a difficult issue. For the healthcare sector, this is particularly so because the need for effective decision making is high (Kerr et al, 2007).

It has been approximated that up to 5% of data found in organizations are of low quality (Redman, 2001). Many definitions for data quality exist but data are generally considered high quality if, “they are fit for their intended uses in operations, decision making and planning" (Redman, 2008).

High quality data has many characteristics and attributes. Depending on the research situation and setting, the appropriate set of attributes and acceptable levels of these attributes may differ. It is also important to note that many of these attributes are interdependent (Quality health data, 2016).Wang *et. al.* (1994) analyzed the different attributes of good quality data and grouped them into fifteen different categories.

"The characteristics of accessibility, volume of data, believability, completeness, concise and consistent representation, ease of manipulation, free of error, interpretation, objectivity, relevance, reputation, security, timeliness, understandability, and value-added are associated with data and its overall quality" (Abate et. al.,1998).

The lack of data quality in the healthcare sector has far-reaching effects (Kerr et al, 2007). During normal business activities, healthcare data is created at the source by providers such as physician groups, hospitals, skilled nursing facilities and pharmacies. This data is then converted into secondary data which is shared with entities like third party vendors, health information organizations, public health agencies, government agencies and the consumer. Each entity may have different reasons for collecting and using the data. Focus could range from the clinical, administrative, or financial bearings of the data (Dooling and RHIA, n.d.).

Dooling and RHIA (n.d.) reported that, "the reliability and integrity of healthcare data begins with the accuracy and the completeness of the data captured in the patient's health record. This process includes elements like information governance where information is recognized as an asset; patient matching where error and duplicate rates are monitored and remediated; identification and authentication of all authors contributing to an entry; a process for amendments and record corrections; and adequate audit trail functionality". They further reported that, "for these processes to achieve and maintain a high level of compliance there must be existence of established policies, procedures, and staff education".

In relation to the above, the main focus of healthcare data quality for this research study was based on the accuracy and the completeness of the data captured in the patient's medical cause of death certificate.

2.3 The Need for Evaluation of causes of Death

Cause of death data by age group and sex is critical information both to identify key public health issues contributing to premature mortality and to design interventions that are appropriately targeted (Carter *et al.,* 2012).

Information on disease prevalence, patterns of morbidity and mortality in communities is of vital importance to health planners. Unfortunately, such information is often lacking in developing countries as a result of the cost and logistics involved in obtaining it. As such, hospital-based disease frequency and pattern of death often offer second best alternative. Such hospital based data, when monitored over a period of time may assist in assessing changes in disease and death pattern, thus helping health planners to re- order their priority(Adeolu *et al,*2010).

The causes of mortality in hospitals are mostly human related problems (Ben-Tovim et al, 2009) and disease conditions like infectious and non-infectious diseases (Bradshaw et al, 2010). The majority of the causes are known to be preventable/avoidable (Boman et al 1999) by devising preventable strategies such as guidelines and being compliant with it (Malomo et al 2004; Boman et al 1999; Bachou et al 2006).

Up-to-date evidence on levels and trends for age-sex-specific all-cause and cause-specific mortality is essential for the formation of global, regional, and national health policies (GBD, 2013).

2.4 Epidemiological Health Transition

Recent population studies have shown that the most developing regions of the world are undergoing gradual epidemiological transition resulting in high burden of both communicable and non-communicable diseases (Omran, 1983).

Global projections of mortality and burden of disease up to 2030 have indicated a significant shift from infectious/communicable to non-communicable diseases worldwide and this transition is expected to affect developing countries (Mathers, 2006).

Worldwide, cancer deaths are more than the percentage of deaths caused by HIV/AIDS, tuberculosis, and malaria put together. It is the second leading cause of death in developed countries and is among the three leading causes of death for adults in developing countries (Ferlay et al.2004.). The three leading causes of burden of disease in 2030 are projected to include HIV/AIDS, unipolar depressive disorders, and ischemic heart disease (GBD, 2013).

2.5 Comparative Analysis from Similar Studies

Etyang and Scott, (2013), in a recent systematic review showed that infectious and parasitic disease and disorders of the circulatory and digestive system were the leading causes of death in sub-Saharan Africa.

Death resulting from cardiovascular disease is known to be a problem worldwide (WHO, 2011). Bradshaw et al reported that hypertension, strokes and ischemic heart disease were causing many adult deaths in South Africa. (Etyang and Scott, 2013)

The above trends have also been reported in other African countries. They underline the existence of the triple burden of infectious disease, NCDs and injury as major causes of morbidity and mortality, as African populations experience the demographic transition (Kanjala *et al,*2010;Mayosi *et al,*2009;Preacel *et al,*2012; Sanya *et al,*2011; Etyang and Scott,2013).

A study by Arodiwe, *et al.*, (Nov-Dec 2014), also revealed that a higher number of males died than females (62.9% and 37.1%, respectively). This is not unusual in most studies from Africa, which show that men are more likely to be admitted into the hospital than women are. African men may not be as health conscious as women, with the result that most women report for treatment early without waiting for their health to degenerate to the extent of requiring hospitalization, while men only attend to their health when complications have set in. Majority of the deaths (65.6%) occurred within the 20-59 years age group. This is the most active and economically vibrant age group. This observation is common in most studies emanating from Africa, especially sub-Saharan Africa where the life span is short. (Ogun et al, 1999; Adeolu et al, 2010; Chijioke and Kolo, 2009; Iliyasu et al, 2010; Sani et al, 2007). Infections were the overall most common cause of death. This has continued to be the pattern in most low-income countries (Adeolu et al, 2010; Chijioke and Kolo, 2009; Huerga et al, 2009; Guha-Sapir et al, 2005).

CHAPTER THREE

METHODOLOGY

3.0 Description of Study site and the Rationale for selection

The University of Ghana Hospital, popularly known as Legon Hospital, is situated at an easily accessible area behind the Legon Police Station from the main Accra-Aburi road. It is part of the hierarchy for the delivery of health care services in the Greater Accra Region which has a population of approximately 5 million and was established in 1957 primarily to serve the health needs of the student population, staff and staff dependents of the University.

Currently, it assumes the functions of a district hospital offering health services to populations in its immediate environs, as well as other communities both within and outside Accra. It provides emergency health, pediatric, surgical, gynecological and obstetric health services. It has a total bed capacity of 130.

The study site was purposefully selected on account of the convenience of easy access to data, the diverse background of patients under its service coverage, and its functional role in the hierarchy of health services in Ghana. Sample Death certificate records of people who died at the facility from the year 1979 to the year 2015.

All patients, male and female of all age groups dying at the University of Ghana hospital between the years 1979 and 2015. All still births registered at the facility from the year 1979 to the year 2015.

Inclusion criteria	Exclusion criteria
All patients, male and female of all age groups dying at the University of Ghana hospital between the years 1979 and 2015	All still births[1] registered at the facility from the year 1979 to the year 2015.

3.1 Data Collection Method/ Management and Analysis.

Study Design: Retrospective Study

Data in excel format was collected from the hospital records unit. The demographic data of patients such as age, gender, patient type (- private, student, staff, staff dependent-),residence and hospital record on last date seen, date of death and the diagnosis before death; direct, secondary and tertiary cause of death; co-morbid conditions were extracted.

A team of three physicians and three research assistants were set up to clean the data and to review the data. A short training session on the data cleaning and review was done to ensure outputs were standardized. Data was verified and corresponding medical records were retrieved for reference when clarification was needed.

The WHO ICD-10 training tool online, an interactive self - training course, was accessed by the physicians to enable them understand and use ICD-10. The causes of death data

[1] The WHO defines a still birth as a baby born with no signs of life at or after 28 weeks' gestation

was then classified guided by the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10) codes.

As William Farr stated in 1856 (9): Classification is a method of generalization. Several classifications may therefore , be used with advantage; the physician, pathologist or the jurist each from his own point of view, may legitimately classify the diseases and the causes of death in a way that he thinks best to facilitate his inquiries and to yield general results (WHO, 2011).

All causes of death were then further condensed into three broad groups of causes of death as per the Global Burden of Disease cause list with some diseases of epidemiologic importance outlined:

Group I: Communicable diseases (TB, Non-TB Respiratory Infections, HIV, diarrhea, malaria, childhood cluster diseases), Maternal/perinatal causes and nutritional conditions.

Group II: Non-communicable diseases (Cancer, Diabetes, Cardiovascular disease)

Group III: External causes of mortality. (Injuries)

Ill- defined diseases, injuries and accidents were also identified.

The classification of diseases was done using the underlying cause of death. Identification of the underlying cause of death was guided mainly by the direct cause of death, the secondary and tertiary causes of death as written in the death records.

For the purposes of comparative analysis, the death patterns were analyzed by gender, age categories and year categories. The mortalities were divided into age categories less

than 18 years and greater than or equal to 18 years. This distinguished children and adolescents from adults.

In other comparison cases age categories Under-fives, 5-17 years and greater than or equal to 18 years were used for purposes of description. Detailed age categories under-fives, 6-12 years, 13-18 years, 19-59 years, and 60 years and above were used in further detailed analysis.

The year categories used were 1979-1985,1986-1990,1991-1995,1996-2000, 2001-2005,2006- 2010,2011-2015; five year intervals excluding 1979-1985 which is of a six year interval.

Data quality Assessment - This was done by analysis of all data from the years 1980, 1985, 1990, 1995, 2000, 2005, 2010, 2015. These years were systematically selected using a five year interval approach.

The completeness of the medical records of death for the 37 year period was assessed by the data variables: years, months, age and gender.

The medical causes of death certificates were also analyzed for completeness by entries made at section for the time duration interval of onset of diseases/conditions that led to death.

The quality of data as provided on the death certificates was also assessed in terms of accuracy using the standard recommendations made by the WHO that :

- All entries should be typed or written legibly in black ink, without the use of abbreviations, alterations or erasures.

- As much detail as possible should be recorded so that it can be used to assign complete and specific codes from the ICD.
- In the case of accidents, injuries or poisonings, the external cause should be reported as the underlying cause.
- The mode of dying, such as cardiac arrest or respiratory failure, should not be reported as the immediate cause of death.
- If the cause of death is unknown, even after investigation, it is correct to record it as 'unknown'

(ICD-10 Classifications and Terminology, 2016)

Sequences of cause of death were also analyzed.

All data summaries and descriptive analysis were done using the statistical software SPSS.

Constraints:

a) The data size to be analyzed was large.
b) There was limited budget for the project work.
c) There was limited time given for the dissertation due to other related pressures.
d) Inputs on the death certificate form were varied; findings are discussed in chapter four.

Ethical Considerations:

No direct identifiers (e.g. names) were used. The data obtained was kept strictly confidential and made available to only persons connected with the study. Administrative approval for the conduct of the study was obtained from the Authorities of the University of Ghana Hospital and Ethical approval from the Noguchi Memorial Institute for Medical Research (NMIMR), University of Ghana.

CHAPTER FOUR

RESULTS

4.0 General Descriptive Statistics and Data Summaries

With reference to Table 4-1 below, 45.20% of the majority of deaths recorded over the 37 year period was adults above 60 years, followed by adults between the age years 19 and 59 recording 37.72%, then 13.48% for the children under -five years old. Children between the ages 6 and12 years constituted 1.82% and adolescents between the ages 13 and 18 years constituted 1.78%.

Table 4-1: Distribution of total deaths over the 37 year period (1979-2015)

Age Categories	Female (%)	Male (%)	All
Under Fives	12.44%	14.23%	**13.48%**
Children 6 - 12 years	2.27%	1.49%	**1.82%**
Adolescents 13 - 18 years	1.68%	1.86%	**1.78%**
Adults 19 - 59 years	34.09%	40.36%	**37.72%**
Adults older than 60 years	49.52%	42.06%	**45.20%**
TOTAL	**1367**	**1883**	**3250**

From figure 4-1, it can be seen that male deaths recorded were higher than female deaths in under-fives and in adults between the ages of 19 to 59 years whereas female deaths were higher in adults over 60 years of age. In children between the ages of 6 to 12 years female deaths are also higher than males. Male deaths were also observed to be higher in adolescents between the ages of 13 and 18 years.

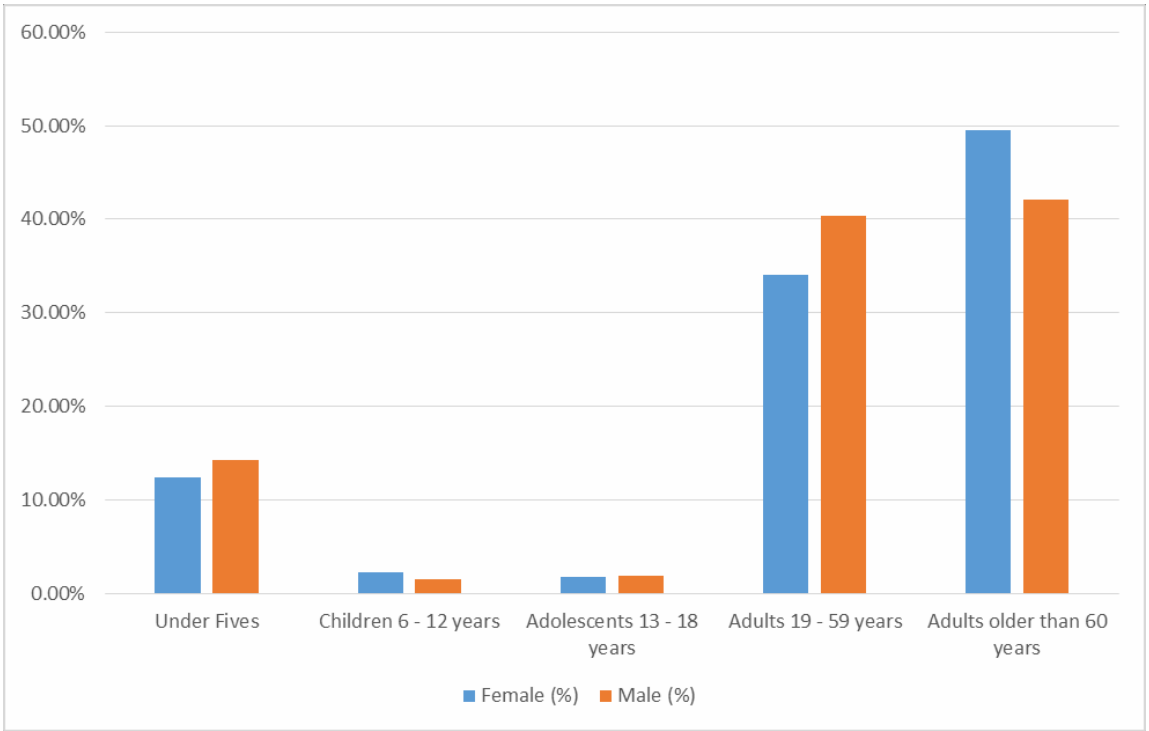

Figure 4-1. Graph Distribution of total deaths over the 37 year period (1979-2015)

Figure 4-2 illustrates the trends in counts of death by gender and years. Male deaths recorded over the years have been higher as compared to female deaths. It is also observed that from the year 2003-2009, there was a sharp rise in death for both sexes with male deaths still recording higher deaths in (2007-2009) and female in (2007-2009). From the years 2011-2013 female deaths increased with a little decline in male deaths. After which the trend changed to male deaths being more than female deaths.

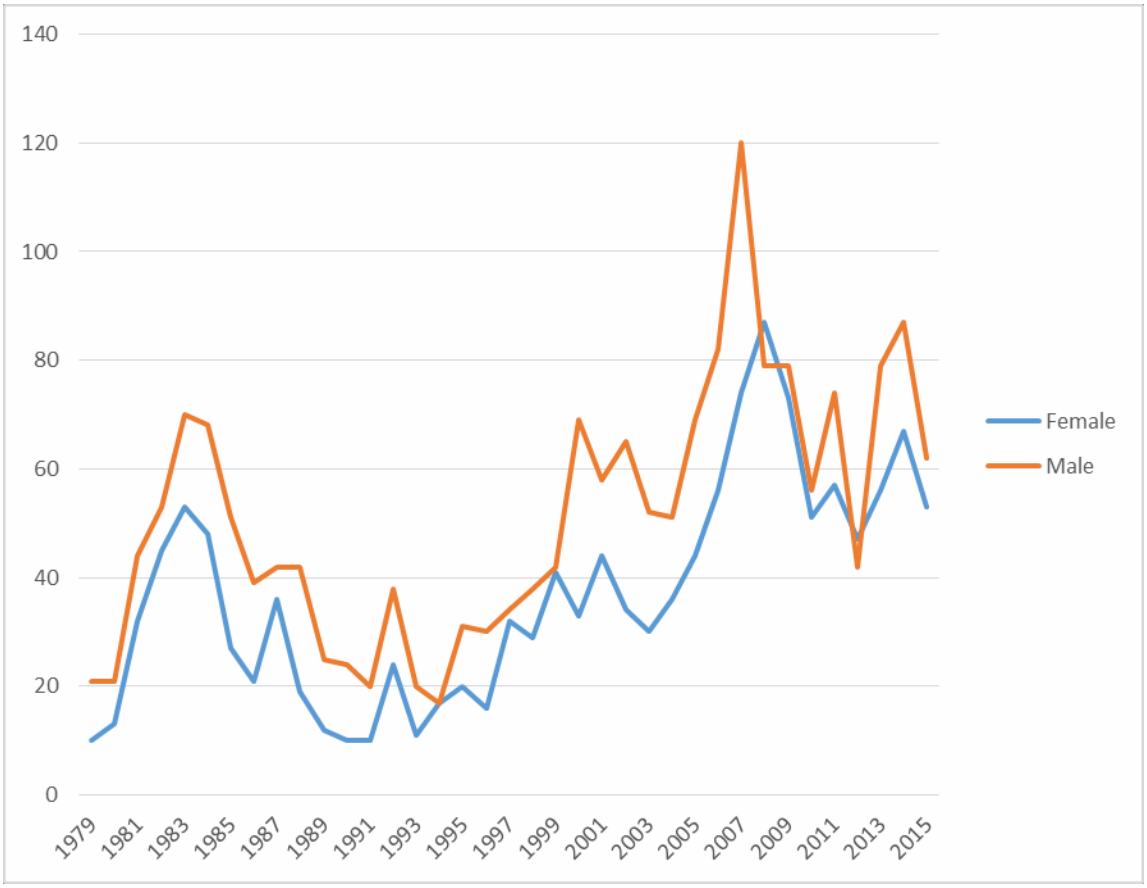

Figure 4-2. Comparison of Trends in counts of death by gender

In summary, as illustrated in figure 3, more male deaths (58.06%) were recorded than female deaths (41.94%) over the 37 year period.

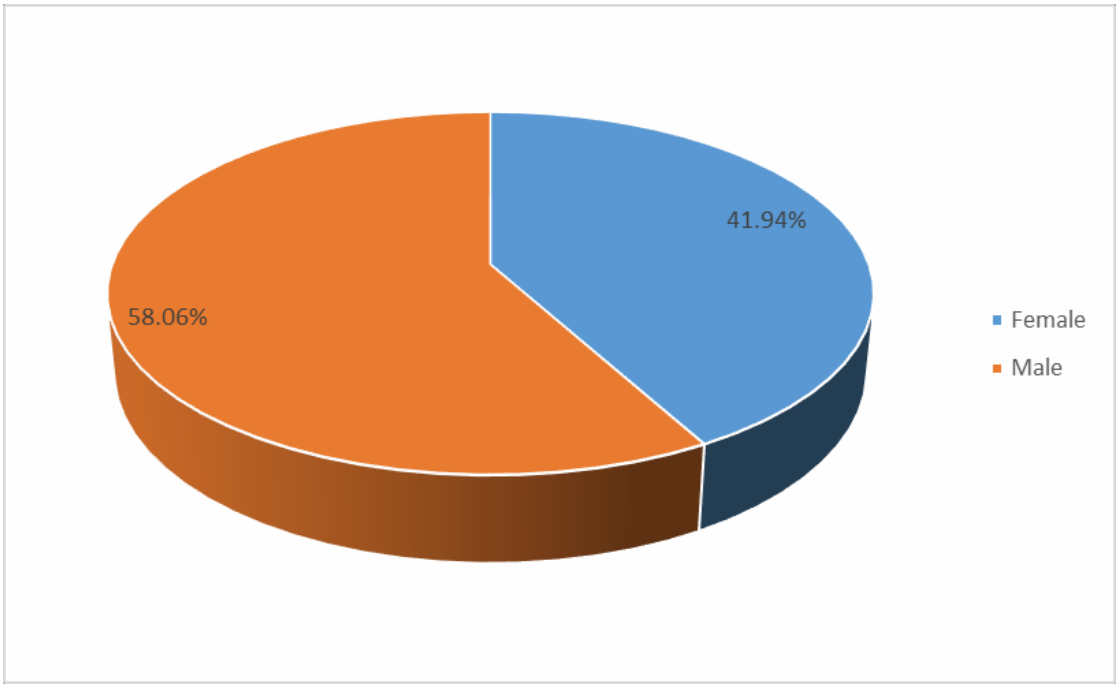

Figure 4-3: Distribution of Deaths by Gender 1979-2015

As illustrated in figure 4-4 and shown in table 4-2, It can be observed that there was a decrease in deaths recorded from 1979 to1990 for children under five, adults from 19-59 years and adults older than 60 years. Deaths recorded for children under five gradually decreased over the years to its lowest at 18.21 deaths/1000 in 2011-2015. Death of adults between 19-59 years of age was low in 1991- 1995 at 129.33 deaths/1000.

It gently rose in the subsequent years to its peak at 581.06 deaths/1000 in 2006-2010. Deaths in adults older than 60 years followed the same pattern recording a low of 156.65 deaths/1000 in 1986-1990. Deaths recorded for age categories (under five, 18-59 years and above 60 years) gently sloped downwards from their peaks from the year 2006 to the year 2015. Interestingly, children 6-12 years and adolescents 13-18 years recorded the lowest deaths with no significant change in their slope patterns for the whole time

period. Their highest recorded deaths were in 1979- 1985 at 40.07 deaths /1000 and 36.43 deaths/1000 respectively.

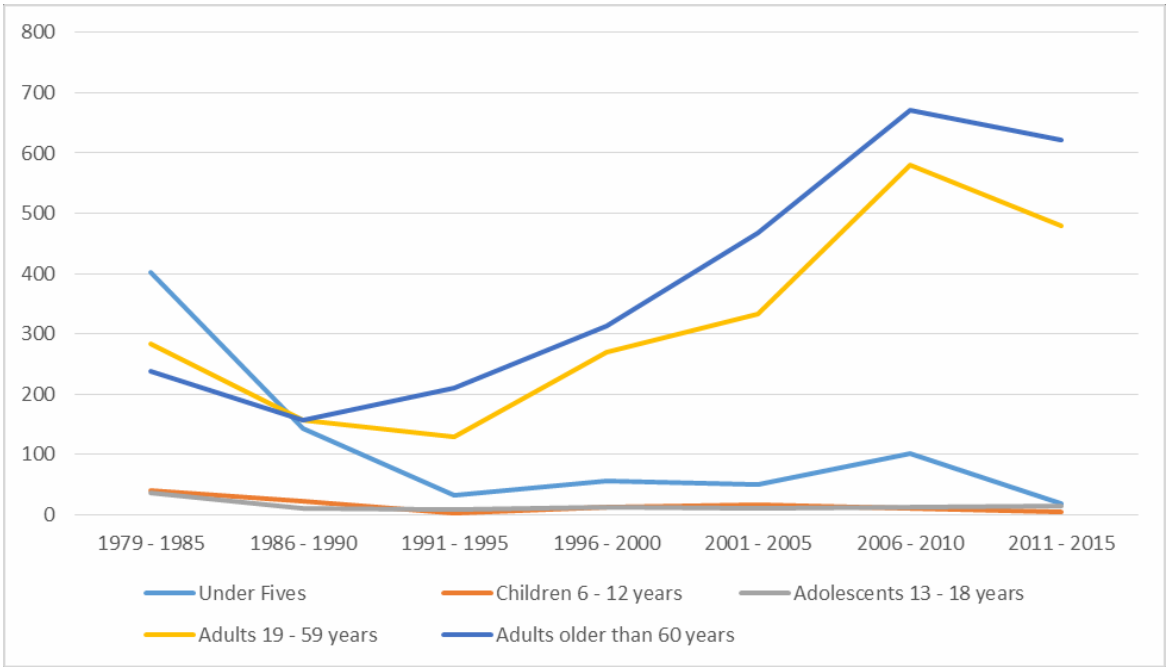

Figure 4-4: Age Distribution of Deaths across Years per 1000 Deaths

Table 4-2: Distribution of deaths per 1000 across the year categories and age categories

Age Categories	1979-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015
Under fives	402.55	142.08	30.97	54.64	49.18	102.00	18.21
Children 6-12 years	40.07	21.86	1.82	12.75	16.39	10.93	3.64
Adolescents 13-18 years	36.43	10.93	7.29	12.75	10.93	12.75	14.57
Adults 19-59 years	284.15	156.65	129.33	269.58	333.33	581.06	479.05
Adults older than 60 years	236.79	156.65	209.47	313.30	468.12	670.31	621.13

Table 4-3 and figure 4-5 shows that the number of total deaths per 1000 recorded was at its peak in 2006-2010. The lowest was recorded in 1991-1995. The proportion of deaths recorded decreased from 1979-1985 through to 1991-1995. It however increased from 1996 to 2010 with a decrease from 2011-2015.

Table 4-3. Distribution of deaths recorded/1000 by Year Category

Year of Death	Deaths per 1000
1979 – 1985	170
1986 – 1990	83
1991 – 1995	64
1996 – 2000	112
2001 – 2005	148
2006 – 2010	232
2011 – 2015	192
TOTAL	**1000**

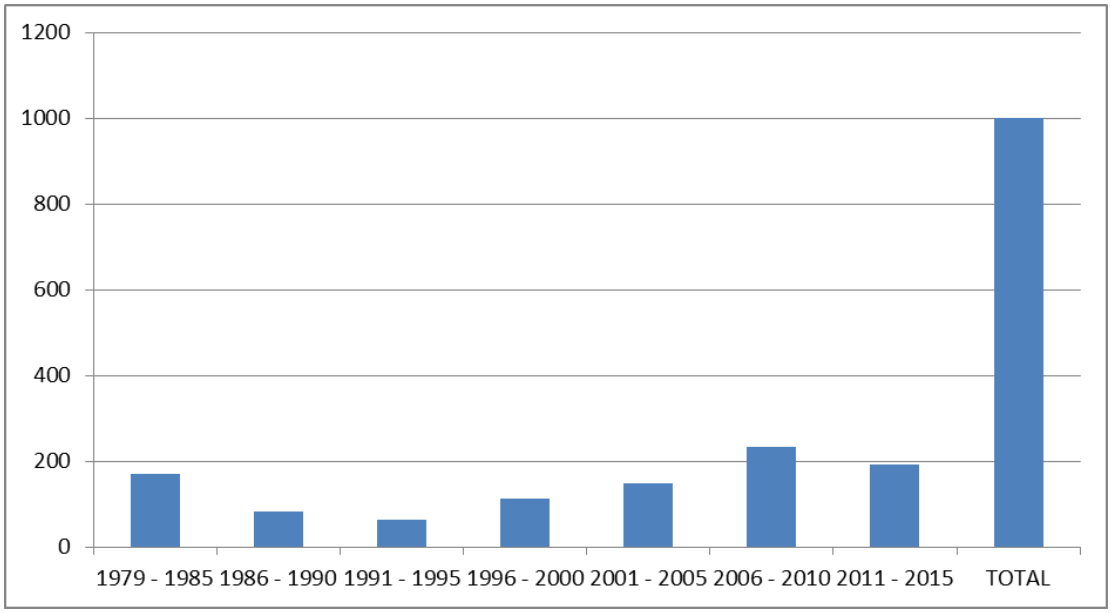

Figure 4-5: Distribution of deaths recorded/1000 by Year Category

Figure 4-6 below illustrates that male deaths have always been higher than female deaths across the year categories. The gender proportions simultaneously responded to general drops and increases in mortality patterns.

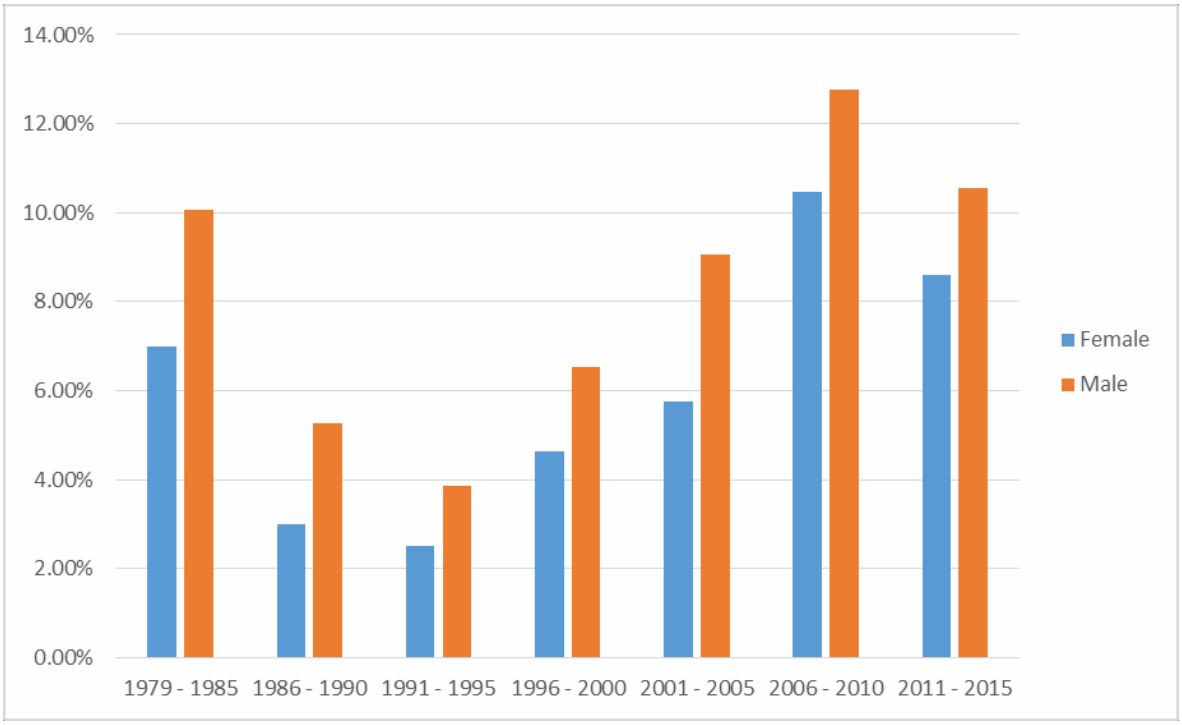

Figure 4-6. Proportions of Deaths by Gender across Years

As seen in Table 4-4, 59.99% of all deaths recorded were caused by non-communicable diseases. Communicable, maternal, perinatal and nutritional conditions were the second major cause of death at 35.56%. Injuries caused the least recorded deaths at 0.55% of all deaths. 3.89% of the causes of death within this time period were not clearly defined; ill-defined injuries/accidents and diseases.

Table 4-4: Percentage Distribution of Deaths by Disease Category and Gender

Disease Categories	Female	Male	ALL
Communicable, maternal, perinatal & nutritional conditions	14.47	21.09	**35.56**
Non-communicable diseases	25.17	34.83	**59.99**
Ill-defined injuries/accidents & diseases	2.12	1.78	**3.89**
Injuries	0.18	0.37	**0.55**
TOTAL	**1368**	**1894**	**3262**

4.1 Descriptive Statistics for Communicable Diseases (Tb, Non-Tb Respiratory Infections, HIV, Diarrhea, Malaria, Measles), Maternal and Perinatal Causes and Nutritional Conditions

Table 4-5: Distribution of communicable diseases (TB, Non-TB respiratory infections, HIV, Diarrhoeal, Malaria, Childhood cluster diseases), maternal and perinatal causes and nutritional conditions by Age and year category

DISEASE	Age	1979 - 1985	1986 - 1990	1991 - 1995	1996 - 2000	2001 - 2005	2006 - 2010	2011 - 2015
Malaria	< 18	127	248	119	110	83	79	5
	≥18	6	0	48	20	62	56	11
Tuberculosis	< 18	6	0	0	0	0	0	0
	≥ 18	35	9	95	20	55	79	38
Diarrheal diseases	< 18	83	115	24	30	28	8	0
	≥ 18	73	106	190	90	117	48	27
HIV	< 18	0	0	0	20	0	12	27
	≥ 18	0	0	0	120	193	313	582
Non-TB Respiratory Infections	< 18	67	35	71	50	28	24	0
	≥ 18	64	44	167	240	193	107	121
Other Infectious diseases, perinatal and nutritional conditions	< 18	245	177	95	80	76	63	49
	≥ 18	89	150	190	190	145	183	121
Maternal related conditions	< 18	0	0	0	10	0	0	0
	≥ 18	16	44	0	20	21	28	11
Childhood cluster dx (Measles)	≤ 5	172	71	0	0	0	0	0
Childhood cluster dx (Tetanus)	≤ 5	16	0	0	0	0	0	5

TOTAL	1000	1000	1000	1000	1000	1000	1000

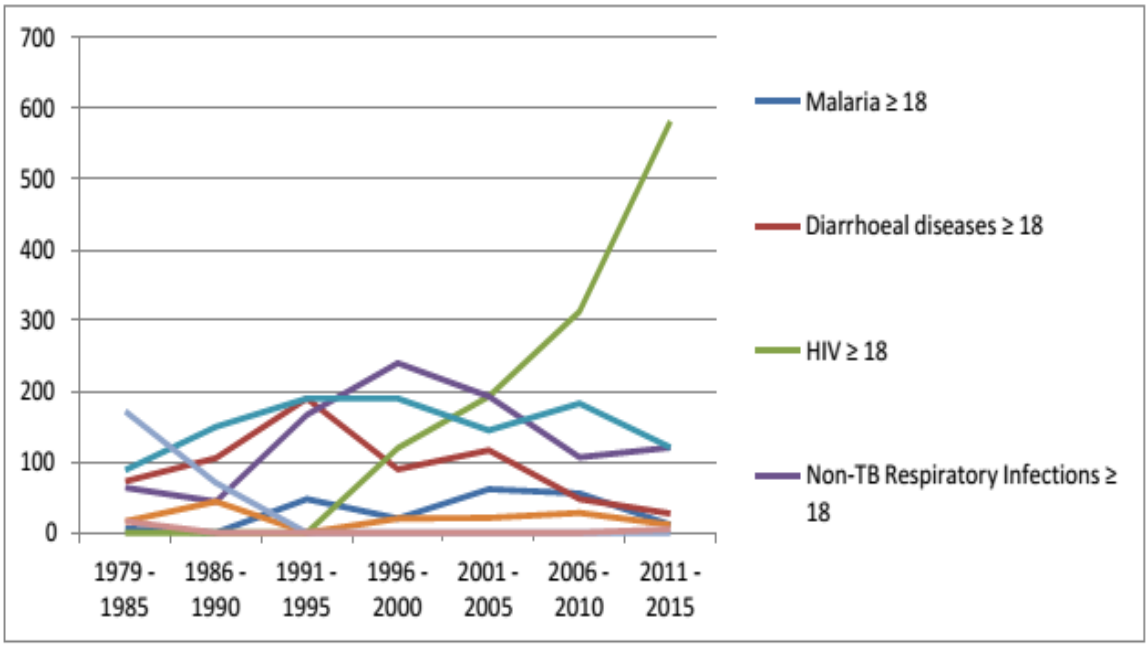

Figure 4-7. Graph Distribution of communicable diseases (TB, Non-TB respiratory infections, HIV, Diarrhoeal, Malaria, Childhood cluster diseases), maternal and perinatal causes and nutritional conditions by Age and year category.

As seen in figure 4-7 and Table 4-5 above, there is a steep rise in the number of people who died from HIV from 1996-2000 through to the year 2011-2015. Deaths from diarrheal diseases peaked in 1991-1995 at 190 deaths/1000.It also peaked in 2001-2005 at 117 deaths /1000 subsequently deaths recorded by cause of diarrheal diseases declined to 27/1000 in the year 2011-2015.

4.2 Descriptive Statistics for Non Communicable Diseases (Cardiovascular Diseases, Diabetes Mellitus, Cancers)

Figure 4-8 and Table 4-6 suggest that cardiovascular diseases have been the leading cause of death amongst non-communicable diseases in adults' ≥ 18 years within the 37 year span. It rose to its peak from a low of 507 deaths/1000 in 1979-1985 to a high of 683 deaths/1000 from 1996 to 2000. The deaths recorded since have slowly decreased and currently at 548 deaths/1000 in 2011 -2015. The cumulative of other non-communicable diseases together are the second leading cause of death since 1979. However, cancer the third leading cause of death as a singular disease was higher (203 deaths/1000) than the cumulative of other non-communicable diseases (175 deaths/1000) in the years between 2011 and 2015. The constituents of the other non-communicable causes of death recorded were congenital anomalies, digestive diseases, endocrine diseases, genitourinary diseases, musculoskeletal diseases, neuropsychiatric conditions, oral conditions, respiratory diseases, sense organ diseases and skin diseases.

Diabetes mellitus the least cause of death in this category was low in the years 1979-1985 and 1986-1990 at 22 deaths/ 1000 and 8 deaths/ 1000 respectively. However, the disease as a cause of death gently rose over the years to its peak at 87 deaths/ 1000 in the years 2001-2005. It has gently decreased since then but still high at 65 deaths/ 1000 in the years between 2011 and 2015.

Table 4-6: Distribution of non-communicable Diseases (Cardiovascular diseases, Diabetes Mellitus, Cancers) by age and year category

DISEASE	AGE	1979 - 1985	1986 - 1990	1991 - 1995	1996 - 2000	2001 - 2005	2006 - 2010	2011 - 2015
Cardiovascular diseases	≤ 18	18	8	7	0	3	6	2
	≥ 18	507	542	600	683	587	599	548
Diabetes mellitus	≤ 18	0	0	0	0	0	0	0
	≥ 18	22	8	62	49	87	84	65
Cancers	≤ 18	4	15	0	0	0	0	0
	≥ 18	139	115	138	95	112	99	203
Others	≤ 18	112	92	21	21	25	28	7
	≥ 18	197	221	172	152	186	183	175
TOTAL		1000	1000	1000	1000	1000	1000	1000

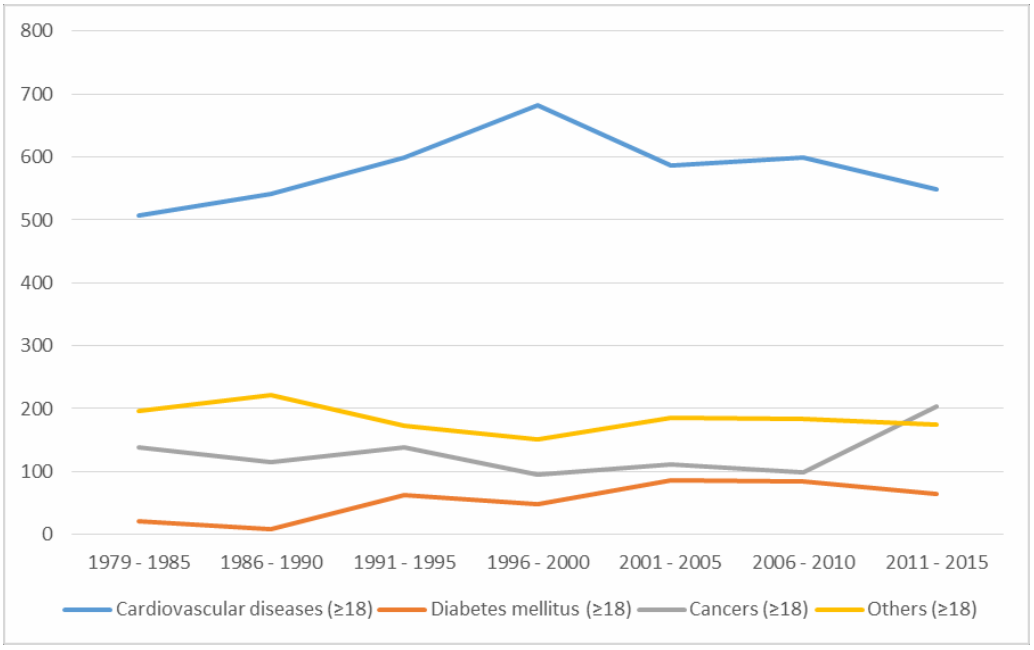

Figure 4-8: Graph distribution of non-communicable Diseases (Cardiovascular diseases, Diabetes Mellitus, Cancers) by age and year category

4.2.1 Cardiovascular diseases

Cardiovascular diseases as the highest leading cause of death in adults' ≥ 18 years for non-communicable diseases has cerebrovascular disease as its leading cause of death as shown in table 4-7 and illustrated in figure 4-9. Cerebrovascular disease has always caused the majority of deaths since 1979 at 573 deaths/ 1000 decreasing to a low in the years 1986 to 1990. It has since risen steeply to 682 deaths/ 1000 and still at a high at 648 deaths/ 1000 in the years between 2011 and 2015.

Inflammatory heart disease and other cardiovascular diseases have gently dropped from a high of 458 deaths/ 1000 in 1986-2000 and across the years to a low of 165 deaths/ 1000 between the years 2011 and 2015.

Hypertensive heart disease as a cause of death has risen since the years 1996-2000 and still at a high of 123 deaths/ 1000 in the years between 2011 and 2015.

Ischemic heart disease has generally been the least cause of death over the years. However it recorded higher deaths than hypertensive heart disease between the years 1986 and 1990. It dropped to 11 deaths/ 1000 in the years 1991-1995. It has gently risen since 1991-1995 as a cause of death without a decrease to 64 deaths/1000 in the years 2011-2015.

Table 4-7: Distribution of Cardiovascular disease by year category

CARDIOVASCULAR DX	1979 - 1985	1986 - 1990	1991 - 1995	1996 - 2000	2001 - 2005	2006 - 2010	2011 - 2015
Cerebrovascular disease	573	431	682	687	653	633	648
Hypertensive heart disease	60	42	57	48	163	157	123

Inflammatory heart disease & Other	316	458	250	241	153	164	165
Cardiovascular Dx							
Ischemic heart disease	51	69	11	24	32	46	64
TOTAL	1000	1000	1000	1000	1000	1000	1000

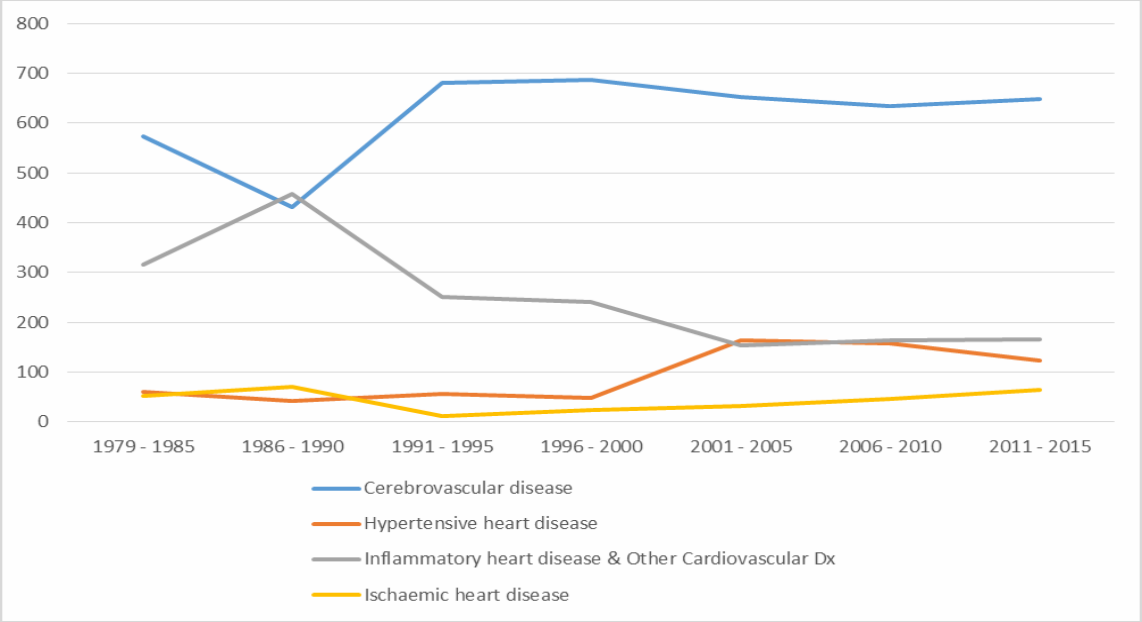

Figure 4-9. Graph Distribution of Cardiovascular disease by year category

4.3 Descriptive Statistics for Accidents and Injuries

As shown in table 4-8, deaths caused by accidents and injuries were more in individuals aged < 18 years of age. There were deaths recorded for each year category for those less than 18 years of age. There were no deaths recorded for those 18 years and above for the years 1979-1985, 2001-2005 and 2011-2015.

Table 4-8: Distribution of accidents and injuries by age and year category

	Age	1979 - 1985	1986 - 1990	1991 - 1995	1996 - 2000	2001 - 2005	2006 2010	2011 2015
Accidents & Injuries	< 18	1000	500	500	333	1000	333	1000
Accidents & Injuries	≥ 18	0	500	500	667	0	667	0
TOTAL		1000	1000	1000	1000	1000	1000	1000

4.4 The Epidemiological Transition

As shown in Table 4-9 and in figure 4-10, Communicable diseases, maternal, perinatal and nutritional conditions have declined from a high of 587 deaths/1000 in year 1979-1985 to a low of 222 deaths/1000 in 1991-1995. The deaths recorded since have gently risen to 297 deaths/1000 in 2011-2015. In contrast, deaths caused by non-communicable diseases have risen from 411 deaths/1000 in 1979-1985, reaching its peak at 767 deaths/1000 in 1991-1995. It has since remained twice higher and more in comparison to deaths caused by communicable diseases, maternal and perinatal conditions.

Deaths caused by external causes (injuries) in comparison to the above disease groups have been at a steady low.

Table 4-9. Distribution of Communicable diseases, non-communicable diseases and injuries

Disease Category	1979 - 1985	1986 - 1990	1991 - 1995	1996 - 2000	2001 - 2005	2006 - 2010	2011 -
Communicable, maternal, perinatal &	587	456	222	293	311	353	297
Injuries	2	24	11	9	4	4	2
Non-communicable diseases	411	520	767	698	685	643	701
Grand Total	1000	1000	1000	1000	1000	1000	1000

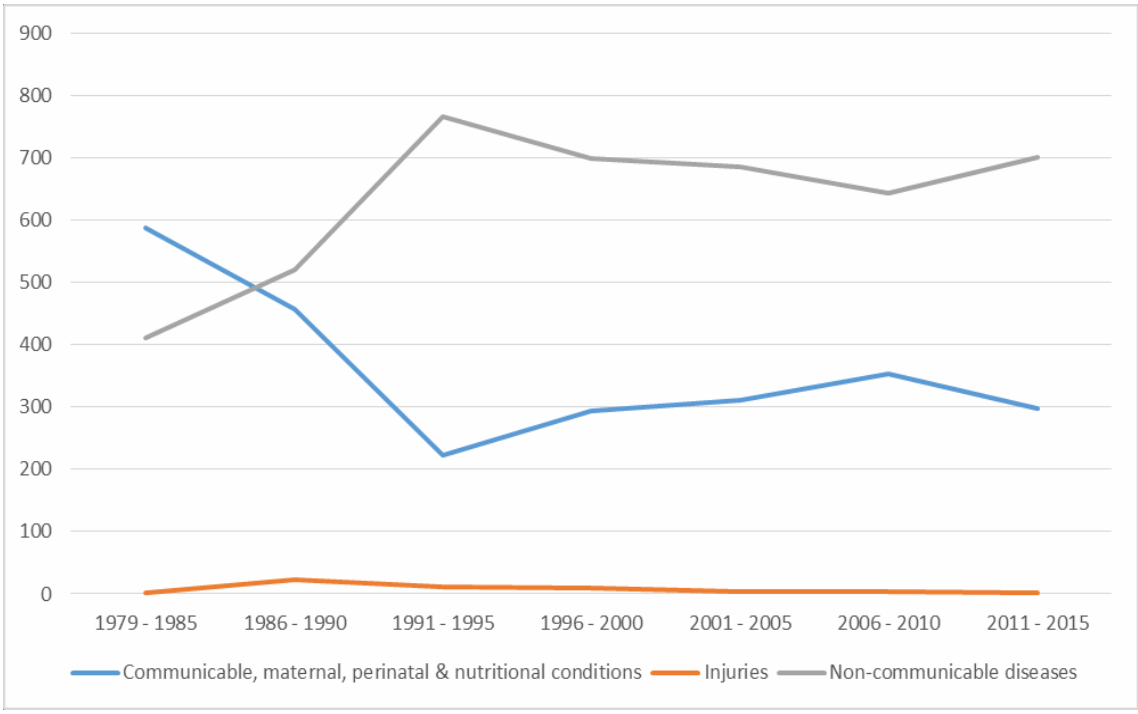

Figure.4-10 Graph of the epidemiological transition

4.5 Leading causes of death across the age groups

It was observed from Table 4-10 below that in Under-fives Measles and kwashiorkor were the top two leading cause of death in 1979-1985. Malaria ranked third. However 10 years, between 1996-2000, Malaria is the leading cause of death with Anemia and infective gastroenteritis ranking second and third place. No Measles or kwashiorkor was recorded. A decade afterwards, between 2011-2015 Malaria ranked second as the leading cause of death together with sickle cell disease, Meningitis, Tetanus and other diseases. Prematurity was the leading cause of death.

In the age group 6-18 years, the leading cause of death in 1979-1985 was Typhoid fever, Tetanus and sickle cell disease all in first rankings. Infective gastroenteritis and malaria

ranked second as a cause of death in this age group. In 1996-2000, Kwashiorkor took leading place as a cause of death, Typhoid fever, Tetanus, Malaria, Pneumonia, HIV and other diseases followed in second place. A decade afterwards in 2011-2015, the leading causes of death were Malaria, HIV and Asthma. Meningitis, Amoebic liver abscess, Sepsis and other diseases followed in second ranking.

For adults 19 years and above, cerebrovascular accidents have always remained a leading cause of death since 1979. For 1979-1980, Congestive cardiac failure, Infective gastroenteritis and Typhoid fever ranked in second, third and fourth place respectively. A decade afterwards, between 1996-2000, Congestive cardiac failure was still observed to be the second leading cause of death in adults above 19 years of age. Pneumonia ranked third. In the year 2011-2015, HIV rose to second rank as a cause of death with Prostate cancer in third place.

Table 4-10. Leading causes of death amongst age groups

Under 5 years			6 - 18 years			Above 19 years		
Year	**Dx**	**Count**	**YEAR**	**Dx**	**Count**	**Year**	**Dx**	**Count**
1979 - 1985	Measles	71	**1979 - 1985**	Typhoid fever	7	**1979 - 1985**	Cerebrovascular Accident	113
	Kwashiorkor	55		Tetanus	7		Congestive Cardiac failure	51
	Malaria	65		Sickle Cell Disease	7		Unspecified Infective gastroenteritis	20
	Unspecified Infective gastroenteritis	35		Unspecified Infective gastroenteritis	5		Typhoid fever	16
				Malaria	5		Pneumonia	16
1996 - 2000	Malaria	22	**1996 - 2000**	Kwashiorkor	6	**1996 - 2000**	Cerebrovascular Accident	308
	Anaemia	11		Typhoid fever	3		Congestive Cardiac failure	77
	Unspecified Infective gastroenteritis	6		Tetanus	3		Pneumonia	53
	Pneumonia	6		Malaria	3			
				Pneumonia	3			
2011 - 2015	Prematurity	4		HIV	3	**2011 - 2015**	Cerebrovascular Accident	232
	Malaria	2		Grandmal status epilepticus	3		HIV	112
	Sickle Cell Disease	2		Acute Renal failure	3		Prostate Cancer	38
	Meningitis	2		Congenital malformation of heart	3			
	Tetanus	2		Drowning	3			
	Birth Asphyxia	2						
	Protein Energy Malnutrition	2						
	HIV	2		Malaria	3			
	Congenital malformation of heart	2		HIV	3			
				Asthma	3			
			2011 - 2015	Meningitis	2			
				Amoebic liver abscess	2			
				Sepsis	2			
				Congestive Cardiac failure	2			
				Pneumonia	2			

4.6 QUALITY OF DATA

4.6.1 Completeness of data

4.6.1.1 Death records by month

Table 4-11a Death records by months and years

Year of Death	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1979	-	-	-	-	-	-	-	1	10	8	5	7
1980	7	7	2	-	-	-	-	-	1	7	2	8
1981	2	7	7	7	5	5	9	10	7	4	5	7
1982	9	6	12	6	8	16	2	12	7	9	2	9
1983	9	7	3	6	9	13	15	10	10	12	17	12
1984	13	12	12	10	8	9	8	8	12	5	8	11
1985	4	9	8	7	6	4	11	4	4	4	9	8
1986	7	6	3	2	2	4	5	7	5	8	5	6
1987	6	9	2	8	6	7	3	6	7	10	7	7
1988	15	6	5	5	5	6	5	1	5	3	2	3
1989	3	2	1	3	4	4	3	6	6	1	1	3
1990	4	2	4	2	6	1	5	3	-	2	2	3
1991	3	2	5	3	2	2	-	2	6	1	2	2
1992	5	3	4	4	7	12	7	5	1	7	-	7
1993	2	2	2	3	4	4	2	2	2	5	3	-
1994	3	3	3	-	1	3	5	1	2	8	3	2
1995	5	3	9	5	3	9	1	5	2	3	4	2
1996	4	3	3	5	6	4	2	1	3	5	7	3
1997	7	3	7	3	6	8	4	4	2	10	7	5
1998	13	1	9	10	6	5	3	7	4	4	3	2
1999	2	8	9	5	-	9	11	13	7	4	3	12
2000	7	11	9	4	5	12	13	6	13	4	9	9
2001	4	12	5	7	7	8	7	17	4	18	6	7
2002	5	8	7	7	8	12	7	5	6	15	14	5
2003	5	10	5	4	6	6	9	9	8	11	5	4
2004	9	5	6	6	7	9	6	10	5	5	11	8
2005	6	5	12	9	7	12	14	10	14	9	8	7
2006	6	6	8	11	13	16	15	17	8	14	12	12
2007	16	12	21	21	12	20	17	20	10	22	18	5
2008	10	16	7	18	15	16	15	12	15	12	14	16
2009	8	12	14	12	20	11	15	17	10	10	9	14
2010	7	8	13	10	4	12	8	15	2	10	10	8

2011	10	7	9	9	11	10	17	17	11	6	13	11
2012	11	12	4	5	3	8	4	11	12	3	8	8
2013	6	12	16	9	13	11	10	13	10	14	13	8
2014	17	13	11	14	8	12	16	13	13	17	15	5
2015	5	13	11	10	15	6	9	12	11	7	7	10

Table 4-11b Summarization of death records by month and years.

Year	Months	Year	Months	Year	Months
1979	5/12	1991	11/12	2003	1
1980	7/12	1992	11/12	2004	1
1981	1	1993	11/12	2005	1
1982	1	1994	11/12	2006	1
1983	1	1995	1	2007	1
1984	1	1996	1	2008	1
1985	1	1997	1	2009	1
1986	1	1998	1	2010	1
1987	1	1999	11/12	2011	1
1988	1	2000	1	2012	1
1989	1	2001	1	2013	1
1990	11/12	2002	1	2014	1
				2015	1
Total	10 11/12		11 7/12		13

From Tables 4-11a and 4-11b, the months January, February, March, April, May, June and July of the year 1979; April, May, June, July and August of the year 1980; September of the year 1990, July of the year 1991, November of the year 1992, December of the year 1993, April of the year 1994 and May of the year 1999 were unavailable for analysis. They could not be found. Assuming that the unavailable data for analysis are all missing data, then the total data reviewed in years is 35½ of 37 years

$$Percentage\ completeness\ = \frac{number\ of\ years}{37\ years} \times 100 = 95.95\%$$

Assuming that the unavailable data for those years with one missing month data indicate no deaths recorded, and then the total data reviewed is 36 of 37 years, which is

97.23%. From the above data, the range of completeness for the 37 year period is between 95.95% to 97.23%.

4.6.1.2 Age

There were 12 missing age entries for recorded deaths for the 37 year period. This constituted 0.35% of the data.

4.6.1.3 Gender

There was 1 missing entry for gender. This constituted 0.03% of the data.

4.6.1.4 Documentation of time interval between disease onset and death

As shown in Table 4-12 and figure 4-11 below, non- documentation of time interval between disease onset and death was high across the sample years. It was only in 1980 that documentation of time interval between disease onset and death surpassed non – documentation.

Table 4-12. Documentation of time interval between disease onset and death

Year	Number of deaths	% Time interval written	% Time interval not written
1980	34	68	32
1985	78	22	78
1990	34	15	85
1995	51	31	69
2000	102	16	84
2005	113	7	93

2010	107	15	85
2015	116	40	60

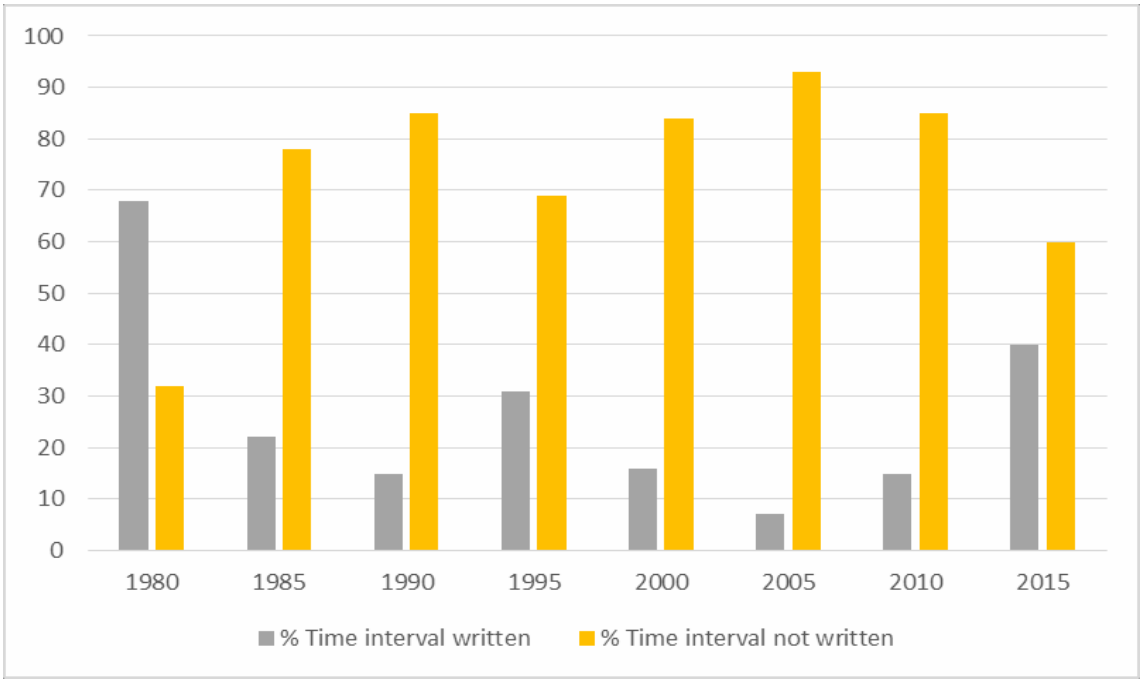

Figure 4-11.Graph representation of documentation of time interval between disease onset and disease

4.6.2 ACCURACY

At the University of Ghana Hospital medical certificate of causes of death have always been filled by attending physicians as is required by WHO. All the documents assessed evidenced this. Record books found were in fairly good condition and all writings were in ink.

4.6.2.1 The use of abbreviations

As shown in Table 4-13b and figure 4-12, the use of abbreviations as in the writing of cause of death was present in all the years. The use of abbreviations was least in 1980. It was noted that the non-use of abbreviations in the records was however high in all the years. Table 13a.shows the meanings of abbreviations encountered.

Abbreviations commonly encountered were C.V.A, M.I, U.T.I, Upper G.I. bleeding, L.V.F, C.K.D, B.V.F, C.C.F, I.R.S, D.K.A, H.P.T, D.M, G.6.P.D, H.I.V/A.I.D.S, T.B., D.x, R.T.A, S.A.H, C.A, R.T, B.P.H, U.R.T.I, P.C.M.

Table.4-13a. Meanings to Common Abbreviations Used

Abbreviation	Full meaning
C.V.A	Cerebrovascular accident
M.I.	Myocardial Infarction
UTI	Urinary Tract Infection
Upper G. I. bleeding	Upper Gastrointestinal bleeding
L.V.F	Left Ventricular Failure
C.K.D.	Chronic Kidney Disease
B.V.F.	Biventricular Heart Failure
C.C.F.	Congestive Cardiac Failure
I.R.S.	Immune Reconstitution Syndrome or Insulin Resistance Syndrome
D.K.A.	Diabetic Ketoacidosis
H.P.T.	Hypertension
D.M.	Diabetes Mellitus
G.6.P.D	Glucose 6 Phosphate Defect
H.I.V/A.I.D.S	Human Immunodeficiency Virus/ Acquired Immunodeficiency Syndrome
T.B.	Tuberculosis
D.x.	Disease
R.T.A.	Road Traffic Accident
S.A.H.	Subarachnoid Hemorrhage
CA	Cancer
R.T	Right
B.P.H	Benign Prostatic Hypertrophy
U.R.T.I	Upper Respiratory Tract Infection
P.C.M	Protein Calorie Malnutrition

Table 4-13b. Percentage Use of Abbreviations

Year	Number of deaths Recorded	%Use of Abbreviations	%Non-use of abbreviations
1980	34	3	97
1985	78	28	72
1990	34	21	79
1995	51	37	63
2000	102	35	65
2005	113	23	77
2010	107	18	82
2015	116	6	94

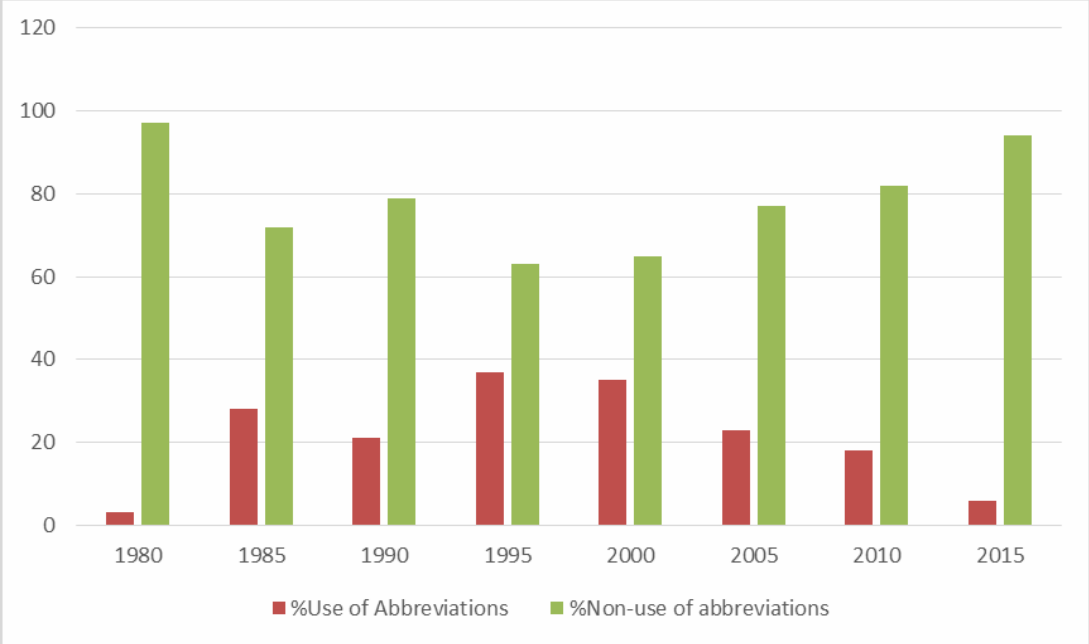

Figure 4-12 Percentage Use of Abbreviations

4.6.2.2 Documentation of "Mode of dying" as immediate cause of death

From, table 4-14 and figure 4-13, all the years assessed had records of "Mode of dying" documentation as immediate cause of death. It is however worth noting that a larger proportion of the records did not show so.

Some medical cause of death certificates had the mode of dying entered as the immediate cause of death. Modes of dying entered were : Respiratory failure, Circulatory collapse, Hepatic failure, Severe dehydration, Hyperthermia, Shock, Cachexia, Cardiac failure, Hepatic coma, Cardio-renal failure, Cardiorespiratory failure, Cardiovascular collapse, Hyperpyrexia, Hyperthermia, Vascular collapse, Cardiac arrest, Respiratory collapse, Cardiopulmonary collapse, Cardiopulmonary failure and Multiple organ failure.

Table 4-14. "Mode of Dying" as Intermediate Cause of Death Across the years

Year	Number of deaths	% Mode of dying written	% Properly written
1980	34	18	82
1985	78	12	88
1990	34	29	71
1995	51	12	88
2000	102	12	88
2005	113	31	69
2010	107	25	75
2015	116	19	81

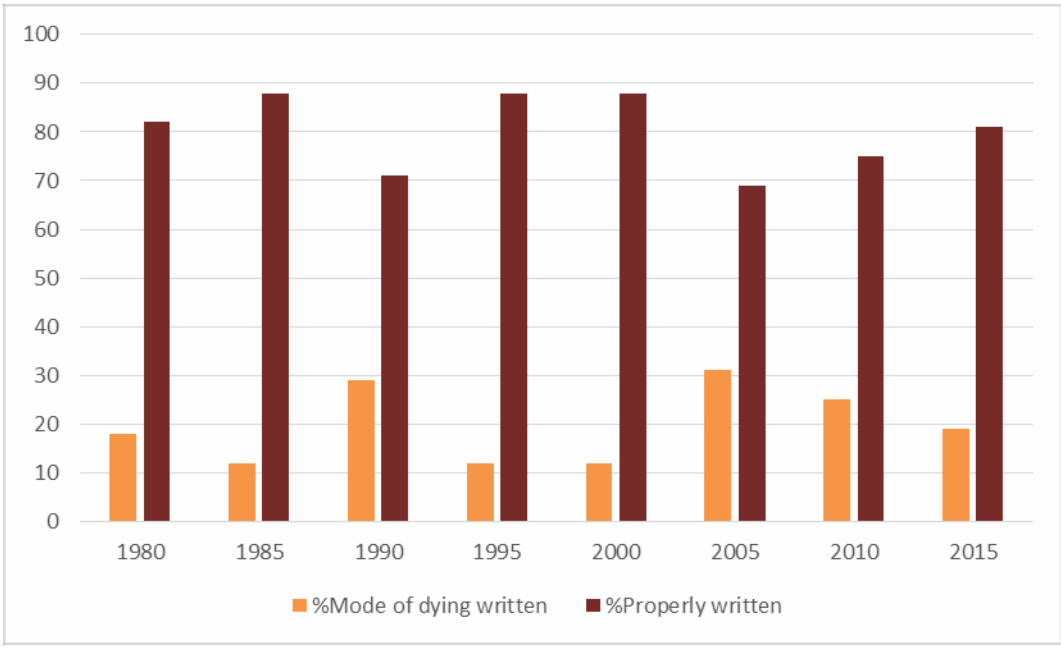

Figure 4-13. "Mode of Dying" as Immediate cause of death across the years

4.6.2.3 Assessment of Cause Based Sequence

In Table 4-15 and figure 4-14, improperly written cause based sequence of death was highest in 1990 and has decreased since to the year 2015. 1985 and 1980 were amongst the least recorded. Improperly written cause based sequence on medical cause of death certificate was noted to be present in all the years.

Table 4-15. Assessment of Cause Based Sequence across the Years

Year	Number of deaths	%Improper cause based	%Properly written
1980	34	6	94
1985	78	1	99
1990	34	26	74
1995	51	16	84
2000	102	17	83
2005	113	10	90
2010	107	12	88

2015	116	5	95

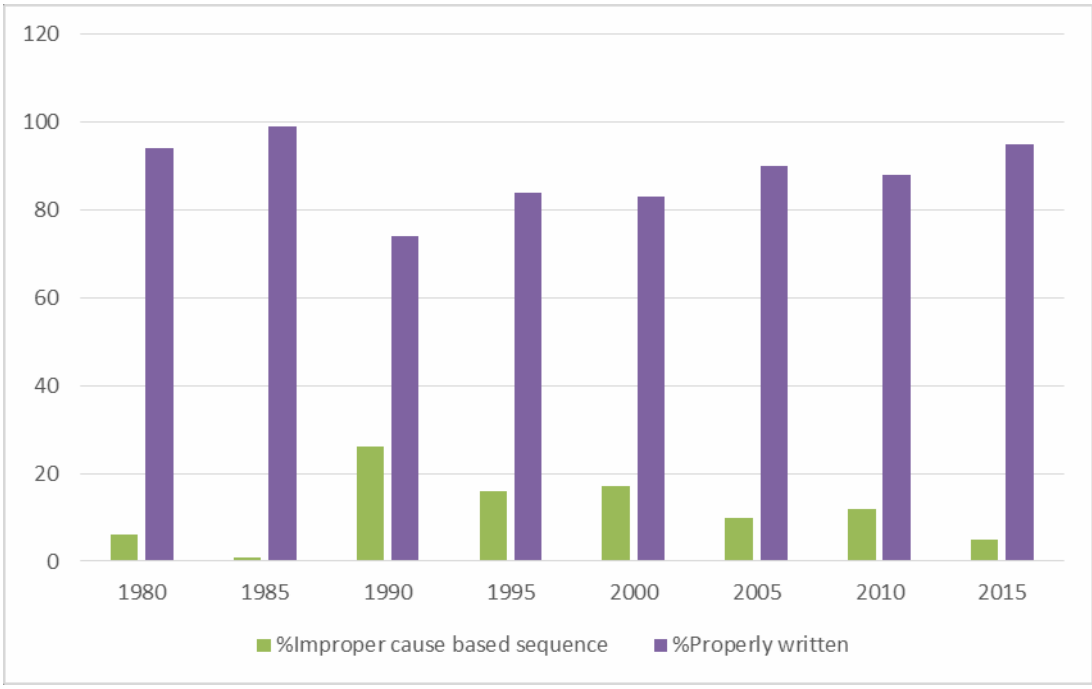

Figure 4-14 Assessment of Cause Based Sequence across the Years

4.6.2.4 Ill-defined Diseases/Injuries/Accidents

As shown in Table 4-16 and figure 4-15, Ill-defined diseases/accidents/conditions constituted 3.89% of all deaths recorded over the 37 year period. The highest recorded was 35 in the years 2006-2010 and the second highest was 19 between 1991 and 1995. The least recorded was 13 in the years 1979-1985, 2001-2005 and 2011-2015.

Table 4-16: Ill-defined diseases/Injuries/accidents

Years	1979-1985	1986-1990	1991-1995	1996-2000	2001-2005	2006-2010	2011-2015	Total
Ill-defined diseases/Injuries/accidents	13	18	19	16	13	35	13	127

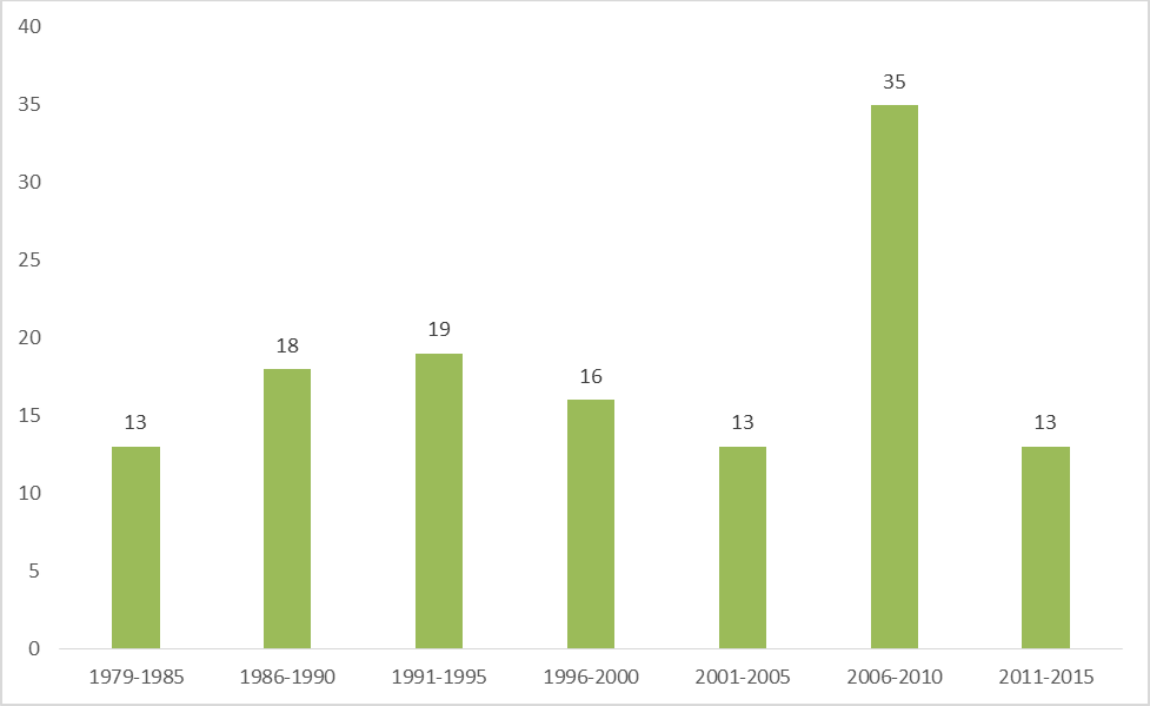

Figure 4-15.Ill-defined diseases/Injuries/Accidents deaths in counts across the years

CHAPTER FIVE

DISCUSSION

5.0 INTRODUCTION

The study sought to review and summarize all causes of death across all age-groups at the Legon Hospital for the period 1979 to 2015 and to use the findings as a basis for public health interventions. The primary objective was to describe the causes of death at the University of Ghana Hospital, Legon over the 37 year period. The secondary objectives were to describe demographic factors influencing the causes of death, to describe temporal trends in the causes of death and to evaluate the quality of the data. To accomplish the above objectives, the medical causes of death data of all patients whose deaths were certified by physicians at the Legon Hospital between 1979 and 2015 were accessed and the relevant data extracted.

Data cleaning and classification of the causes of death was done as detailed in chapter III, and chapter IV provided an overview of the main research findings. Classifications enabled the summarized descriptive characteristics of all deaths that have occurred in the hospital by age and gender of the deceased patients, the underlying cause of death and their temporal trends. Fetal deaths were excluded in the study.

5.1 KEY FINDINGS

5.1.1 General descriptive statistics

From the study results, 45.2% of the deaths recorded over the 37 year period were adults above 60 years, followed by adults between ages 19 and 59 years recording 37.72%.

This differed from the results of a study by Arodiwe et al. (2014) in which the majority of the deaths (65.6%) occurred within the 20-59 years age group. This is the most active and economically vibrant age group. The majority of the active and vibrant age group dying is a common observation in most studies emanating from Africa, especially Sub-Saharan Africa where the life span is short (Ogun et al, 1999; Adeolu et al , 2010; Chijioke and Kolo, 2009; Iliyasu et al, 2010; Sani et al,2007). The reason for this variation in findings may be attributed to the differences in disease burden of study sites. This is further discussed in section 5.2.3 which focuses on the distribution of deaths by disease category.

Male deaths (58.06%) were higher than female deaths (41.94%) in this study. The study results by Arodiwe et al. (2014) were similar in that a higher number of males died than females (62.9% and 37.1%, respectively). It is not unusual in most studies from Africa, to show that men are more likely to be admitted into the hospital than women are. The explanation proposed by Arodiwe et al (2014) was that African men may not be as health conscious as women, with the result that most women report for treatment early without waiting for their health to degenerate to the extent of requiring hospitalization, while men only attend to their health when complications have set in. To further support this proposed explanation by Arodiwe et al., (2014), there is a need for further research

on health-seeking behavior with respect to gender at the University of Ghana Hospital. Such research has not yet been conducted.

5.1.2 Temporal Distribution of Deaths by Age and Gender

The results revealed a common pattern of yearly deaths decreasing till 1991-1995 after which the recorded deaths began to increase again. This observation was unaffected by gender. Multiple factors may have contributed to the increase in mortality trends from 1995 onwards. The increasing mortalities may have been directly associated with increasing demand for health care delivery and utilization over the affected years. The progressive introduction of specialist medical, pediatric, surgical and gynecological services may have led to increased referrals to UGHL. The increase of health service coverage to the growing populations in the immediate communities of UGHL, increasing staff strength together with staff dependents, increasing student numbers may also have contributed. Also the introduction and acceptance of NHIS scheme may have increased healthcare accessibility. This observed pattern could also have been due to missing or unavailable records of which the quality of data section in chapter 4 does not conclude. The quality of data section 4.7.1 on completeness of data is not suggestive of missing data within 1991-1995. Although July 1991, November 1992, December 1993 and April 1994 did not have any record of death provided, it could just as well be that there were no deaths recorded in the above times. Rigorous investigations are warranted to explore the reasons behind this temporal pattern.

From the results of this study, it is evident that whilst deaths recorded in adults 19 years and older are increasing, the deaths recorded for the population below 19 years are on the decline. Factors found in repeated Demographic and Health Survey(DHS) programs explaining these decreasing mortality trend among infants and children in Ghana and other sub-Saharan countries fall into five categories: 'fertility behavior', 'nutritional status', 'breastfeeding and infant feeding'; 'the use of health services by mothers and for children'; 'environmental health conditions'; and 'socioeconomic status'. Both simple analyses and multivariate analyses of changes in these factors between surveys indicate that all factors affected the mortality trends (Rutstein, 2000).

Garenne and Gakusi (2006) suggested that," the variation between countries' health transitions in sub-Saharan Africa are the results of the interference of several factors, the most important of which seem to be political stability, state management, and emerging diseases. In Ghana, under- five mortality increased between 1979 and 1983 during the political crisis that was later resolved with the return of Jerry Rawlings".

Another observation made was that deaths for under- fives and adults older than 19 years peaked at the same time period 2006-2010 after which they all declined. They followed a similar trend. This observed pattern may have been influenced by economic, political or social factors in Ghana within the period. Institutional changes at UGHL could also have influenced the pattern. Hence, this result findings on age trends at the University of Ghana Hospital setting, in further research studies need to be investigated to ascertain the reasons for these temporal changes.

5.1.3 Distribution of recorded Deaths by Disease Category

The most common causes of death were non-communicable diseases. Almost 60% of all deaths recorded were caused by non-communicable diseases. This is in contrast to findings in other research studies where infections(communicable diseases) were the most common cause of death and also showing infectious diseases to be the pattern in most low-income countries (Adeolu et al, 2010; Chijioke and Kolo ,2009 ; Huerga et al,2009; Guha- Sapir et al,2005).

The study by Adeolu et al (2010) was based on retrospective analysis of 6250 death records over a 10 year period (1995-2010). This time period falls within the time span of this 37 year retrospective study. Non-communicable diseases have always been higher than communicable diseases within this time frame of 1995 -2010. Their study was conducted at the University of Nigeria Teaching Hospital, Enugu, and South East Nigeria. Both studies have commonality in that they are Sub- Saharan African research studies. The study by Chijioke and Kolo (2009) was also a retrospective study in University of Ilorin Teaching Hospital in Nigeria showing that infectious diseases were higher within its period of study 1996-2010. In its analysis of 4220 death records, infections caused 1501 deaths (35.6%) with HIV and TB constituting a major proportion.

Non-communicable diseases are usually chronic in nature and affected populations tend to live longer. The finding of non-communicable diseases being the major cause of mortality in this research setting may therefore be the significant contributor to the increased mortality in adults older than 60 years.

Communicable diseases are mostly acute in nature. Known chronic communicable diseases such as HIV without health interventions may lead to rapid deterioration of population health status and thus mortality. The youth who are the vibrant and sexually active group are most affected and thus lead to mortality increase in the youthful population. And Nigeria has a higher HIV prevalence between the 15-49 years age group than Ghana (WHO 2015).The above may be a reason for the difference in age group mortality (as described in 5.2.1 General descriptive statistics) between the University of Ghana Hospital research finding and those carried out in Nigeria. However, this warrants further investigative research.

5.1.4 Communicable Diseases, Maternal and Perinatal Causes and Nutritional Conditions

The three leading causes of burden of disease in 2030 are projected to include HIV/AIDS, unipolar depressive disorders, and ischemic heart disease (GBD 2013).

This study on causes of death at the University of Ghana Hospital, Legon is consistent with HIV/AIDS as a leading cause of burden of disease with projection to 2030. It showed a sharp rise in HIV as a cause of death from 1996 to 2015.The hospital has been a nationally recognized treatment center for HIV/AIDS since the year 2008 and has therefore been a referral center for both public and private health facilities. This may be contributory to the suggestive high disease burden of HIV/AIDS in this study. This study done at the UGHL does not provide information on the HIV disease burden in the hospital and its environs; hence further research study is needed to ascertain this disease burden.

Malaria, Tuberculosis and Diarrheal diseases as communicable diseases that cause death were observed to have decreased within the last decade 2006-2015 for individuals more than 18 years. Malaria and Diarrheal diseases are also observed to have decreased as causes of death in individuals < 18 years of age within the last decade. Tuberculosis as a cause of death in individuals < 18 years of age has been nil for 31 years now with the last recorded deaths between the years 1979-1985.

This sustained record may be attributed to the fact that the National Tuberculosis Control Program was launched in 1994 and UHGL has been a diagnostic and treatment center for TB since 2004. Under this program there has been active case finding and nationwide access to effective treatment under supervised care. This has ensured a nationwide increase in successful treatment, reduced default, and reduced mortality (Ansa 2011).

5.1.5 Childhood-Cluster Diseases

Measles, a childhood cluster disease, was observed as a cause of death mostly in 1979 - 1990 after which there were no reports as a cause of death. According to Bosu et al (2003), this is because "Ghana developed a strategic plan to reduce measles deaths to near zero. Nationally, measles vaccination coverage increased from 24% in 1980 to 84% in 2000. This achievement is attributed to health sector reforms that included a higher district share of the total recurrent health budget from 20% in 1996 to 42% in 1999. The budget reallocation resulted in improved access to immunization services, supply procurement, transport management, staff motivation, and information flow. Routine

vaccination coverage of >80% has resulted in lower measles incidence, a longer inter-epidemic interval, and a shift in cases to older children."

Tetanus also a childhood cluster disease caused deaths in 1979-1985; no deaths were recorded afterwards until 2011-2015 when it was recorded as a cause of death. Other childhood cluster diseases like Pertussis, Poliomyelitis, Diphtheria were not found in the records as causes of death in under-fives during the given study period.

These may be attributed to improved efforts through the Expanded Program on Immunization launched in 1976 by WHO and UNICEF. However, the re-emergence of Tetanus in 2011-2015 within this study is suggestive of investigative research.

5.1.6 Non-communicable diseases

Cardiovascular diseases were the leading cause of death amongst the non-communicable diseases in adults within the 37- year span. The WHO in 2011 reported that death resulting from cardiovascular disease is known to be a problem worldwide. Bradshaw et al, 2010 also reported that hypertension, strokes and ischemic heart disease were causing many adult deaths in South Africa. Hence, the above finding corroborates a world-wide phenomenon. The findings of the study at the UGHL revealed cancer to be the third leading cause of death in adults. This is consistent with the findings by Ferlay et al. (2004) that cancer is among the three leading causes of death for adults in developing countries. Diabetes mellitus as a cause of death was low but has gently risen over the years from 1979 to 2015.

5.1.7 Accidents and Injuries

Deaths caused by accidents and injuries were observed to be more in individuals aged < 18 years of age. Deaths were recorded yearly from 1979 to 2015 in this age group. These accidents included road traffic accidents, fall from heights and drowning.

5.1.8 The epidemiological transition

Global projections of mortality and burden of disease up to 2030 have indicated a significant shift from infectious/communicable to non-communicable diseases worldwide and this transition is expected to affect developing countries (Mathers 2006).

The findings of the study at the University of Ghana Hospital support this indication in that there was a significant shift from communicable to non-communicable diseases in 1979- 1985. These trends have also been reported in other African countries. They underline the existence of the triple burden of infectious disease, NCDs and injury as major causes of morbidity and mortality, as African populations experience the demographic transition (Kanjala et al 2010; Mayosi et al 2009; Preacel et al, 2012; Sanya et al 2011; Etyang and Scott, 2013). The epidemiologic transition curve in this study however, depicted more of dual burden of disease between communicable and non-communicable diseases. Injury as a cause of disease was minimal in comparison to the two, and has remained at a relatively stable prevalence over the period of study.

5.2 QUALITY OF DATA

5.2.1 Completeness of Data

It has been approximated that up to 5% of data found in organizations are of poor quality (Redman, 2001).The purpose of the data analysis done was to ascertain the quality of data provided for the study. There are many definitions of data quality but data are generally considered high quality if, "they are fit for their intended uses in operations, decision making and planning." (Redman, 2008).

The percentage completeness of the data provided ranged between 97.23% to 95.95% in terms of months and years. It was observed that the records assessed were not indicative of whether there were no deaths recorded for undocumented time slots or whether documented data was missing.

Other observations made were 12 missing age entries for recorded deaths and one missing gender entry of a recorded death. These omissions may be attributed to the attending physicians who filled these death certificate records.

The result findings on documentation of time interval between disease onset and death revealed proportionally high undocumented data since 1985 onwards. 1980 showed good documentation. This suggests a generalized decrease in good documentation practices of attending physicians over the years.

5.2.2 Accuracy

It was observed that medical cause of death certificates had all been filled by attending physicians as is required by WHO. All record books for reference were in fairly good condition with all writings in ink as per the standard recommendation of filling death certificates by the WHO. Abbreviations are not to be used in medical cause of death certificates but abbreviations were found in the data provided over the years. It is however worth noting that all these abbreviations are well known abbreviations in medicine but there is no standardization at the hospital level. Some abbreviations may have dual meanings and may be misinterpreted. For the purposes of medical cause of death certification by WHO recommended standards there should be no use of abbreviations. The use of abbreviations in the years reviewed is indicative of the need for upgrading physicians' knowledge on death certification practices.

All medical cause of death certificates sampled had "mode of dying" entered as the immediate cause of death in some instances. The mode of dying as immediate cause of death is against the standard recommendations by WHO for the filling of medical cause of death certificates. Again this is reflective of the need for upgrading physicians' knowledge on death certification practices.

Again, improperly written cause based sequence was noted to be present in all the years assessed. This can be attributed to the attending physician. Regular reviews and checks need to be put in place to ensure the input of good quality data on medical cause of death certificates.

Finally, ill-defined causes of death data was present in all the years assessed. These data did not give detailed information on the underlying cause of death needed for planning and public health interventions. This again, may be attributed to attending physicians and thus the need for upgrading their knowledge regarding causes of death certification.

To conclude this discussion, there is a need to maintain reliability and integrity of healthcare data. Dooling and RHIA reported that,

"the reliability and integrity of healthcare data begins with the accuracy and the completeness of the data captured in the patient's health record. This process includes elements like information governance where information is recognized as an asset; patient matching where error and duplicate rates are monitored and remediated; identification and authentication of all authors contributing to an entry; a process for amendments and record corrections; and adequate audit trail functionality". They further reported that, "for these processes to achieve and maintain a high level of compliance there must be existence of established policies, procedures, and staff education".

5.3 Implications of the study

The implications of the findings of this study on Ghana, Africa and the world are varied.

Health Policy:

The study corroborates the fact that efforts towards curbing under five mortality in Ghana have improved. There is however, a need for much greater effort through the Expanded Program on Immunization as well as political and social measures. The recognition of non-communicable diseases as the major burden of disease at the University of Ghana setting creates the awareness that this could be a trend in other parts of Ghana. Further research is thus needed to support this finding. Health policy should

therefore shift towards curbing this trend. More funding should be allocated towards the early detection, diagnosis and prevention of non-communicable diseases.

Clinical Practice:

For clinical practice, this would mean implementation of health strategies to improve patient follow-up and management so as to curtail the complications of non-communicable diseases that lead to death in Ghana. There would be regular upgrading of physicians' knowledge on new and emerging trends of managing and treating non-communicable diseases to this effect.

Training of doctors:

This study has highlighted some common malpractices in causes of death certification in lieu of the WHO recommended standards for completing medical causes of death certificate. This suggests that regular workshops and review sessions targeted at physicians should be conducted to outline and emphasize the recommended standards. Also, to ensure good quality data on causes of death in Ghana and Africa, these recommended practices should be fused into and regularly evaluated in medical training curricula.

Research:

Finally, as causes of death data in Ghana and sub-Saharan Africa is scarce, this study has provided evidence based data that may serve as hypotheses for further research in Ghana, Africa and worldwide.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.0 Conclusions

In conclusion, generally the summarized findings and descriptive of causes of death at the University of Ghana Hospital over the 37 year period (1979-2015) is quite similar to those of studies done in sub-Saharan Africa and the world. The study supports well established findings and projections made on the Global burden of Disease and the epidemiological transition. However, as evidenced in the discussion section there are exceptional findings in the University of Ghana study setting. These relate to the overall temporal distribution of death in this setting. Another observation of interest was the temporal trend in deaths relating to the specified age groups (Under-fives, 6-12 years, 13-18 years, 19-59 years, 60 years and above). The overall common cause of death was not as for other sub-Saharan research studies. The study results indicated non-communicable diseases and in particular cardiovascular disease as the leading cause of death. This is suggestive that to deal with this issue, targeted public health interventions and planning strategies need to be put in place.

This study, though not representative of the whole nation in terms of sample size, has yielded results that may be applicable to the national populace as it is the longest retrospective study of its kind in Ghana. Another interesting finding based on this study was the temporal trend and proportion of deaths due to HIV/AIDS. It supported the projection of HIV/AIDS as the leading cause of burden of disease and thus death by 2030. There is the need for the University of Ghana Hospital to assess the burden of

HIV/AIDS amongst patients and in its environs. The findings on immunizable diseases such as measles, tetanus and tuberculosis are suggestive of effective public health measures put in place by the government. However, the re-emergence of Tetanus as a cause of death in 2011-2015 needs to be investigated. To conclude, this study has also unearthed, clarified and emphasized the need for good practices in the completion of medical cause of death certificates so as to ensure good quality data.

6.1 Recommendations

On the basis of the findings of this study and conclusions, it is recommended that:

1. More detailed investigations be carried out to ascertain the reasons behind the temporal patterns of death.
2. More detailed investigations be carried out to ascertain the reasons behind the age distribution of death with time.
3. More detailed investigations be carried out to ascertain the burden of HIV/AIDS amongst patients of the hospital as well as its environs.
4. The University of Ghana Hospital builds mechanisms and infrastructure targeted at prevention, early diagnostics and treatment of non-communicable diseases such as cardiovascular disease and cancers to decrease causes of death at the hospital. The same applies to all hospitals and health care facilities in Ghana, the basis of which is on the epidemiological transition as evidenced through this research study and which is applicable to our Ghanaian environment.

5. Established policies, procedures, and staff education be put in place to maintain a high level of health care data quality both at the University of Ghana Hospital and at all health facilities in Ghana.

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