

UNIVERSITY OF CAPE TOWN



MORBIDITY AND MORTALITY AMONG 5-17 YEAR OLD CHILDREN ADMITTED IN SIX HOSPITALS IN KENYA IN 2013

Master of Philosophy (Maternal Child Health)

OSNBON001

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August 2015

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DECLARATION

This dissertation is submitted as my original work in partial fulfilment of the requirements for the degree of Master of Philosophy (Maternal Child Health) at the University of Cape Town.

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EXECUTIVE SUMMARY

Background: Global morbidity and mortality trends have changed over time and are expected to continue changing. Preventable diseases, such as those caused by infectious agents, still account for a large proportion of morbidity cases in Africa. With increased survival of children under five years old, there is likely to be a change in morbidity and mortality patterns for children aged 6-18 years. However, there are few studies in Africa that explore the burden of disease (morbidity and mortality) and injuries in children above the age of five. This study aims to determine the morbidity and mortality patterns among children aged 5-17 years in six Kenyan hospitals in 2013.

Methods: This study is designed as a retrospective review of patients' medical records. Data was collected from all patient records at Kisii Level 5 Hospital (KL5H), Naivasha County Referral Hospital, Karatina Hospital, Garissa Provincial General Hospital, Mbagathi District Hospital, and Gertrude's Children's Hospital in Kenya, of patients who presented from the 1st day of January to 31st December 2013. Data was analysed to provide descriptive statistics and Pearson's chi-square test and odds ratios were calculated to explore differences in morbidity and mortality rates between age categories, gender and hospitals.

Results: 4 520 patient records were retrieved for patients who met the inclusion criteria. Among these admissions, 70% suffered from communicable diseases, maternal causes or nutritional diseases (32.3% were common infectious diseases, such as malaria and diarrhoea; 14.9% were respiratory infections; 24% were pregnancy related), 33.1% suffered from non-communicable diseases, while 13% of the admissions had injuries (mainly from falls/trips and road traffic accidents), with motorcycles causing the majority (58%) of road traffic accidents.. Injuries increased with age for males. The in-hospital mortality rate was 3.5%. Among deaths, 60% suffered from communicable diseases, maternal and nutritional causes; 41.3% suffered from non-communicable diseases and 11.9% had injuries. There were variations in admissions and deaths between the ages, genders and hospitals. There were more female (57%) patients admitted but more male (57%) deaths.

Conclusion: Infectious and maternal causes are the biggest contributor to morbidity while infectious causes have the highest proportion of causes of death. There is a need to understand why the high proportion of females under 18 years of age is admitted for maternal causes and to develop reproductive health services to better address the health care needs of adolescents on Kenya.

ABBREVIATIONS

AIDS:	Acquired Immunodeficiency Syndrome
BMI:	Body mass index
CHS:	College of Health Sciences
DALY:	Disability-adjusted life years
ERC:	Ethics and Research Committee
GoK:	Government of Kenya
HIS:	Health information system
HIV:	Human Immunodeficiency Virus
ICD:	International Classification of Disease
IRB:	Institutional Review Board
KAIS:	Kenya AIDS Indicator Survey
KDHS:	Kenya Demographic and Health Survey
KNBS:	Kenya National Bureau of Statistics
KNH:	Kenyatta National Hospital
KNH-UoN ERC:	Kenyatta National Hospital – University of Nairobi Ethics and Research Committee
LRTI:	Lower respiratory tract infection
MDGs:	Millennium Development Goals
MoH:	Ministry of Health
NCDs:	Non-communicable diseases
QALY:	Quality of adjusted life years
RCWMCH:	Red Cross War Memorial Children’s Hospital
RTA:	Road traffic accidents

STI:	Sexually transmitted illness
TB:	Tuberculosis
UCT:	University of Cape Town
UoN:	University of Nairobi
USA:	United States of America
WHO:	World Health Organization
YLL:	Years of life lost

1.0 BACKGROUND

In the year 2000, the United Nations (UN) developed eight Millennium Development Goals (MDGs), which were meant to enhance development and eradicate poverty. The MDGs were developed based on the recognition that problems of poverty, hunger, poor health, lack of education, social and economic discrimination, and environmental degradation are commonly interconnected and must be addressed coherently if sustainable improvements are to be achieved in the poor's health and wellbeing. Together, these goals aim to create a well-nourished, healthy, educated population, with adequate and equitable access to basic goods and services, and who live and work in safe and secure environments. Three of the eight MDGs address child health, maternal health, Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS), malaria, tuberculosis, and other diseases. The fourth MDG aimed at reducing the under-five mortality rate by two-thirds between 1990 and 2015. Evidence shows that there has been some progress in achieving some of the MDG targets both locally and globally (Habimana, Mwinga, Sagoe-Moses & Ketsela, 2010; World Health Organization, 2015). Thus, the MDGs may have contributed to improved child survival possible leading to more children living beyond five years of age (United Nations, 2013).

Burden of disease studies have shown that communicable diseases have been the greatest cause of global morbidity and mortality, although non-communicable diseases are on the rise. Due to improved global health standards, there are some regions where non-communicable diseases cause greater morbidity and mortality in children than communicable ones. However, this change is not yet evident in middle- and low-income countries where communicable diseases still account for the majority of morbidity and mortality cases (Mathers & Loncar, 2006; Patton, et al., 2009; Lozano, et al., 2012). There are numerous studies that provide data on burden of disease for children under five; most likely due to the monitoring and evaluation of the Millennium Development Goal 4 targets and the development of country-level targets and indicators. There is limited data available on children older than 15 years, as they have not been explored as a group on their own and are instead grouped with adults. In addition, there are few burden of disease studies based on Africa with a focus on children older than five (Viner, et al., 2011; Rudan, et al., 2005; Patton, et al., 2009). This is despite most childhood deaths occurring in developing countries, particularly in Sub-Saharan Africa. Developing countries, therefore, contribute a disproportionately large proportion of world deaths compared to the developed countries (Murray & Lopez 1997; Patton et al., 2009).

The MDGs set specific targets on maternal, child health and HIV/AIDS for under-five year olds and reproductive health for adolescents, which means countries focussed on attaining these goals at the expense of a focus on other causes of morbidity and mortality in all children. The few studies on adolescent health focus on major causes of death, which is influenced by gender. Reproductive health has been the focus for female adolescent health, and violence for males, while HIV has been explored for both genders, yet there are non-communicable and other infectious diseases that also affect adolescent health (Patton, et al., 2009; Blum, Bastos, Kabiru & Le, 2012).

The morbidity and mortality trends have changed over time and are expected to continue changing with an increase in diabetes, trauma, mental illness, drug abuse and poisoning (Mathers & Loncar, 2006; Patton, et al. 2009; Lozano, et al., 2012). There are many reasons for these changing trends, such as improved child survival, leading to a growing youth population of about 20% of the world population, demographic shifts, globalisation, the rising value of education, and economic and cultural changes that have altered the value system among teenagers and young people. In addition, there are a high percentage of young people who marry, especially females, and this has implications for their health (Blum & Nelson-Mmari, 2004). Although the causes of morbidity and mortality are shifting to non-communicable causes, the burden of communicable disease remains significant in Sub-Saharan Africa (Lozano, et al., 2012; Murray, 1997).

With increased survival of children under five years of age, there are likely to be more children aged 6-18 than before. The Kenya Demographic and Health Survey of 2008-2009 showed that children aged 5-19 years comprised 39% of the Kenyan population; yet there is little information on the health of this group. In order to plan appropriately, morbidity and mortality in this age group needs to be further understood (Viner, et al., 2011).

Although children aged 5-17 years are generally healthy and independent, they are still vulnerable. They should receive specific attention and care that is focussed on meeting their needs. Due to their developmental phase, they are at risk of acquiring habits and diseases that may have lifelong repercussions, such as smoking, substance abuse and sexually transmitted infection (STI), often with devastating effects on their future lives, such as malignancies and infertility (Blum & Nelson-Mmari, 2004; Santelli & Galea 2011; Resnick, et al., 2012). This period presents healthcare workers with an opportunity to intervene and prevent lifestyle diseases later on (Resnick, et al., 2012).

2.0 LITERATURE REVIEW

2.1 Causes of Adolescent Morbidity and Mortality in the World

There is great variation in causes of morbidity and mortality between world regions, age groups and gender. Communicable and non-communicable diseases' prevalence varies in the world (Lozano, et al., 2012; Patton, et al., 2009). Lozano, et al.'s (2012) study is based on data from 235 countries across the world, while Patton, et al. (2009) uses data from 182 WHO member countries. Both studies categorise age by five-year bands.

Global burden of disease studies show that mortality rates increase from 15 years for females and 20 years for males (Adazu, et al., 2005; Patton, et al., 2009; Viner, et al., 2011; Santelli & Galea, 2011). When causes of mortality are analysed, reproductive health issues (pregnancy and maternity related) are predominate in females, whereas injuries are a leading cause of mortality in males (Mathers & Loncar, 2006; Lozano, et al., 2012). Mathers and Lozano did projections of global mortality and burden of disease from 2002 to 2030, while Lozano did a systematic analysis of the 2010 Global Burden of Disease Study.

Barriers to adolescent health care, such as confidentiality concerns, are proposed factors that can significantly limit healthcare utilisation by adolescents throughout the world (Blum & Nelson-Mmari, 2004). It is argued that many healthcare facilities worldwide are not adolescent-friendly and adolescents need access to services that are "sensitive to their unique stage of biological, cognitive, and psychosocial transition into adulthood" (Tylee, et al., 2007). In a study in the USA among girls aged less than 18 years and attending family planning clinics, 47% reported that they would no longer attend if their parents were notified that they were seeking prescriptions for birth control pills or devices, and another 10% would delay or discontinue STI testing or treatment (Reddy, Fleming & Swain, 2002).

2.1.1 Communicable diseases

Globally, as children grow older the incidence of hospital admissions reduces, and the causes of morbidity and mortality change over time and age (Patton, et al., 2009). In a study in India, the major causes of death among 5-14 year olds were pneumonia and diarrhoea, with more deaths among girls than boys, probably due to cultural issues, with boys getting preferential care (Morris, et al., 2011).

2.1.2 Reproductive health causes

Globally, complications from pregnancy among teenagers account for a large number of women being admitted to acute gynaecological wards, thereby contributing to morbidity and mortality among adolescents (Patton, et al., 2009). Most teenage mothers are in developing countries (Mayor, 2004). Pregnancy and gynaecological complications among girls is one of the leading causes of morbidity in adolescents in the United States of America (USA) (Tylee, et al., 2007). Teenage pregnancy has also been associated with worse outcomes for mothers in India (Talawar & Venkatesh, 2013). Some of the complications that have been associated with teenage pregnancy include pregnancy-induced hypertension, eclampsia and premature rupture of membranes (Kumar, Singh, Basu, Pandey & Bhargava, 2007).

2.1.3 Non-communicable diseases

Patton, et al. (2009) analysed the global burden of disease studies and found that cardiovascular diseases, epilepsy, diabetes, leukaemia and mental illnesses are among the major causes of adolescent morbidity.

Epilepsy of all types contributes to morbidity among older children aged 5-14 years world over. This may be a result of earlier infections and trauma (Deen, Vos, Huttly & Tulloch, 1999). Such conditions have not been well described in Kenya.

2.1.3.1 Mental illness and substance abuse

It is proposed that mental illnesses will increase as a contributor to adolescent morbidity (Blum & Nelson-Mmari, 2004; Viner, et al., 2011; Lozano, Naghavi, Foreman, Lim, Shibuya, Aboyans, ... & Murray, 2012; Sawyer, et al., 2012). Suicide is one of the leading causes of death among adolescents in the United States of America and other high-income countries (Patton, et al., 2009; Blum & Nelson-Mmari, 2004). There are gender differences in morbidity and mortality associated with mental illness. In most regions of the world, suicide is more common in males than females (Blum & Nelson-Mmari, 2004; Bell & Clark, 1998; Patton, et al., 2012).

Substance abuse and its consequences have been on the rise (Lozano, et al., 2012), partly due to the effects of globalisation, advances in communication technology, and advertising (Blum & Nelson-Mmari, 2004).

2.1.4 Injuries

Intentional and unintentional injuries, such as assault, burns and road traffic accidents (RTA) are a major cause of morbidity and mortality among adolescents and young adults aged 15-24 years, and especially among males in Kenya (Phillips-Howard, et al., 2012), other low-income countries (Deen, et al., 1999), and globally (Blum & Nelson-Mmari, 2004; Patton, et al., 2009; Patton, et al., 2012; Viner, et al. 2011; Sawyer, et al., 2012). In developing countries, outdoor injuries from violence are more common amongst males, while in females indoor injuries, such as burns, are slightly more common (Deen, et al., 1999). There are some patients who die from injuries before they arrive in hospital. These deaths result from causes such as road traffic accidents (RTAs), assault, gunshots, suicide and burns. In Kenya, many of those who die before reaching hospitals die from intentional injuries, such as assault (Saidi & Oduor, 2013).

Road traffic accidents are a common cause of unintentional injury, especially in children – most of whom are pedestrians or motorcycle passengers. However, passengers on private and public transport are also involved (Hyder, Muzaffar & Bachani, 2008; Ameratunga, Hajar & Norton, 2006). Cyclists and pedestrians are more likely to be killed than car occupants (Ameratunga, Hajar & Norton, 2006; Saidi & Oduor, 2013). RTAs contribute to a large proportion of youth morbidity and, consequently, the quality of adjusted life years (QALY), disability-adjusted life years (DALY) and years of life lost (YLL), which are higher when the victims are children. This is based on their young age and their predicted life expectancy.

In addition, child abuse in any form is common but not well identified in adolescents. Many adolescents in the USA experience abuse from someone close to them (Center for Disease Control and Prevention, 2010). The reporting of abuse is increasing, but the true magnitude remains unknown due to many cases remaining unreported, and many of those who are sexually assaulted are less than 15 years old (Blum & Nelson-Mmari, 2004). Where it is reported, it is more likely to be from hospital records and the justice system. Some girls engage in sexual activities for financial rewards and gifts, and not purely due to their full consent; such should be considered sexual abuse if they are not of the age of consent. World over, both boys and girls are victims of sexual violence (Blum & Nelson-Mmari, 2004).

The Violence Against Children survey (VACs) conducted in Kenya among 13-24 year olds by the United Nations Children's Fund, Division of Violence Prevention, National Center for Injury Prevention and Control, U.S. Centers for Disease Control and Prevention and The Kenya National Bureau of Statistics (2010) found physical violence to be the most common abuse against children. The participants were asked to report on their experience of various forms of violence before the age of 18 years. In the Kenya

VAC survey, 32% of females and 18% of males experienced sexual abuse, 66% of females and 73% of males experienced physical abuse, and 26% of females and 32% of males experienced other violence. 13% of females and 9% of males had experienced all three forms of violence. Of note is that less than 10% of those who were abused sought health care in hospital or, if they sought it, were not admitted (United Nations Children's Fund Kenya Country Office, CDC & KNBS, 2012).

2.2 Causes of Adolescent Morbidity and Mortality in Sub-Saharan Africa

Studies from various regions in Africa show that most deaths in the hospitals occur early following admission; many within 24 hours. Many of these early deaths result from trauma and late presentation to hospitals (Menge, Esamai, Van Reken & Anabwani, 1995; Einterz & Bates, 2011; Ugare, et al., 2012; Gordon, Frenning, Draper & Kokeb, 2013). Menge, et al.'s study was conducted in a rural hospital in Western Kenya; Einterz and Bates studied causes and circumstances of death in a district hospital in northern Cameroon; Ugare conducted a study in Nigeria; and Gordon studied prevalence and burden of diseases in a general paediatrics ward in Gondar, Ethiopia.

In a Cameroonian study it was found that, although young people presented earlier than adults, the duration of symptoms before admission was still long (Einterz & Bates, 2011). This study also noted that the time from admission to death for a large number of patients was short, within a day or two after admission, and 56.8% of deaths occurred on the day of admission, or the day following. This may be a reflection of health-seeking behaviour, with patients delaying to seek treatment until it is too late.

In South Africa, paediatric mortality auditing is used to assess the quality of child health care and analyse the cause of death for children less than 18 years. This project covers 141 hospitals in all provinces of South Africa. The 5-18 year olds contributed 11.7% of deaths with 67% of these deaths being patients who were underweight or severely underweight on admission. The main causes of death are from infectious causes, namely pneumonia, diarrhoea, sepsis and meningitis. However, deaths from infectious disease were noted to be declining (Steinberg, 2013).

2.2.1 Communicable diseases

The main causes of morbidity and death in Sub-Saharan Africa are preventable diseases caused by infectious agents (Wang, et al., 2012; Stein, Inoue & Fat, 2004; Sawyer, et al., 2012). Infections have

been the leading cause of admissions and mortality (Petit & van Ginneken, 1995; Deen, et al., 1999; Patton, et al., 2009) and still remain so in Sub-Saharan Africa, unlike in developed countries where non-communicable causes are on the increase. These infectious diseases include malaria, HIV/AIDS, pneumonia, tuberculosis and diarrhoea, especially for younger children. Tuberculosis (TB) has also been found to be one of the major causes of morbidity and mortality in Africa (Patton, et al., 2009; Misganaw, et al., 2012).

In most of Africa, the causes of admission and pattern of deaths are also due to infections – malaria, lower respiratory tract infections, gastroenteritis and measles (Menge, et al., 1995; Patton, et al., 2009; Campbell, Sow, Levine & Kotloff, 2004). However, due to the manner in which age groups have previously been categorised, it is not easy to identify the leading causes of morbidity and mortality among the 5-17 years age group. A study in Cameroon found that the major causes of death in a rural hospital were acute lower respiratory tract infection (LRTI), malaria, diarrhoeal diseases, anaemia, malnutrition and HIV/AIDS (Einterz & Bates, 2011). However, this study also analysed all deaths in the hospital and did not specify the adolescent population, as it classifies them as children (<15 years) or adults (>15years). The study also did not specifically explore the causes for hospital admission.

2.2.2 Reproductive health causes

The high number of early marriages in Africa and the large proportion of girls under 18 years who are pregnant may contribute to the high maternal mortality in Sub-Saharan Africa (Nour, 2006; Kenya National Bureau of Statistics (KNBS) & ICF Macro, 2010).

2.2.3 Non-communicable diseases

Dalal, S., Beunza, J. J., Volmink, J., Adebamowo, C., Bajunirwe, F., Njelekela, M., . . . Holme, M. D. (2011) conducted a systematic review on non-communicable diseases in Sub-Saharan Africa and found few community studies on NCD's prevalence. They found chronic respiratory diseases, cardiovascular diseases, neuropsychiatric disorders, diabetes, and malignant and other neoplasms to be the common diseases (Dalal, et al., 2011).

Mental illness and substance abuse also play a role in adolescent morbidity and mortality in Africa; however, they are not well documented as in the high-income countries (Patton, et al., 2009). Self-harm is among the top 25 causes of morbidity in Africa, as reported by Lozano, et al. (2012).

2.2.4 Injuries

Injuries as a cause of mortality are expected to rise with increasing economic prosperity, more so in developing countries (Mathers & Loncar, 2006). Road traffic accidents are an emerging public health problem, especially from motorcycles as seen in a review of patients who were hospitalised in Tanzania following road traffic accidents (Chalya, et al., 2010).

Balme, et al. (2012) found poisoning to be a cause of childhood hospital admission. Accidental poisoning may be more common among the younger age groups but intentional poisoning (suicide attempts) as well as homicide may be more common with the older groups. Pesticides and household cleaning products have also increased as causative agents of poisoning (Balme, et al., 2012). Ingestion of paraffin is one of the common causes of poisoning among children, as shown in a South African study in which Balme, et al. (2012) reviewed records of children who presented at the Red Cross War Memorial Children's Hospital (RCWMCH) in Cape Town with exposure to toxins or poisoning. They found 2 872 incidents, of which the greatest exposure was by ingestion. The most common single substance was paraffin ingestion in close to a quarter of the cases. However, drugs as a group caused the largest proportion of the poisoning cases at 34% (Balme, et al., 2012).

2.3 Causes of Adolescent Morbidity and Mortality in Kenya

2.3.1 Communicable diseases

Communicable diseases are more common in less developed countries, such as Kenya (Patton, et al., 2009). In Kenya, infectious causes, such as malaria, lower respiratory tract infections and gastroenteritis, account for a large proportion of morbidity and mortality, as in the rest of Africa (Menge, et al., 1995; Patton, et al., 2009; Campbell, et al., 2004). In a retrospective study at Eldoret Hospital, 4 720 hospital records of children were reviewed (Menge, et al., 1995). This study only focuses on children admitted into the paediatric wards up to the age of twelve years, and not all children up to the age of 18 years. This situation arises because paediatric wards in Kenya generally only admit children up to the age of 12 years,

and older children are admitted into the adult and surgical wards. This study therefore excludes children older than 12 years.

Even though infectious agents are the leading cause of morbidity and mortality in Kenya, the exact infectious causes have varied over time and by age. For instance, in Kenya, diarrhoea is common in children under five years but it reduces as a cause of hospitalisation as they grow older (Tornheim, et al., 2010). HIV/AIDS predominated in the years of 2000-2005 before antiretroviral therapy was available to many people (Einterz & Bates, 2011; Lozano, et al., 2012; Wang, et al., 2012). This has also been reflected in the western Kenya region, where HIV as a cause of mortality among females has declined (Phillips-Howard, et al. 2012). Close to 8% of deaths in a rural area of the western region in Kenya were in late adolescents and young adults. 70% of these deaths were due to a communicable disease, such as HIV, TB and malaria (Phillips-Howard, et al., 2012). Wang's study on the global burden of disease excludes children younger than 15 years, and therefore a direct comparison is inappropriate.

2.3.2 Reproductive health causes

Pregnancy complications may partly explain the higher mortality amongst girls and women aged 15-19 years. There are a high number of teen pregnancies in Kenya where 17.7% of women aged 15-19 have begun childbearing (Kenya National Bureau of Statistics (KNBS) & ICF Macro, 2010). This may be as a result of the cultural practice of early child marriages for girls (Nour, 2006). The reproductive health and associated mortalities in this age group might be a reason why the mortality among women aged 5-18 years has not significantly dropped over the years.

2.3.3 Non-communicable diseases

There is limited published literature on morbidity and mortality from non-communicable disease in Kenya among children aged 5-17 years. Cardiac diseases have been documented in children aged 0-12 years seen at Kenyatta National Hospital (KNH) in Kenya by Gikonyo (1981). Gikonyo retrospectively reviewed records of 712 patients with heart disease seen from January 1975 to June 1980. Gikonyo documents the patterns of heart disease where 53.2% had congenital heart disease, 42.1% had rheumatic heart disease, 3.4% had cardiomyopathy and 1% had cor pulmonale (Gikonyo, 1981). Kenya, being part of Sub-Saharan Africa, is postulated to have a disease profile close to that of the region where cardiac

diseases, chronic respiratory diseases, endocrine disorders, such as diabetes malignant and other neoplasms as the common diseases have been documented (Dalal, et al., 2011).

2.3.4 Injuries

Injuries contribute to morbidity and mortality in Kenya. In a hospital study in the central part of Kenya, over 70% of head injuries were due to assault and road traffic accidents (Muyembe & Suleman, 1999). This study was conducted only in a surgical ward where, in practice, trauma and accident patients are admitted and not any other medical conditions. A longitudinal study at Kenyatta National Hospital in Nairobi found that children who fell from a height and were admitted to the hospital sustained injuries most commonly to the head and distal limbs, the majority of these being fractures. Most of the falls were from buildings and were preventable (Kihiko, et al., 2010). In another study conducted between October 2003 and July 2004 in the same hospital in Nairobi, Gome, Mutiso & Kimende (2005) found that 187 patients aged below 13 years were admitted. Traumatic burns accounted for the highest single cause of trauma at 34.8%, followed by falls (25.1%), foreign bodies (17.6%) and road traffic accidents (8%). Most of the burns occurred in homes and were preventable (Gome, et al., 2005; Kihiko, Mutiso, & Kiboi, 2010). Worth noting is that a community-based study in Kenya found that only a small fraction of children (4.4%) with injuries seek care at a healthcare facility. The community study found that injuries are common with most of them being mild. Cuts, scalds or burns, and falls were the most common injuries. Animal bites and being hit by moving or falling objects were also noted to contribute to the burden of injuries (Kihiko, et al., 2010).

3.0 RATIONALE AND JUSTIFICATION

There is limited information on morbidity and mortality in older children as opposed to those under five years of age. Most of the literature searches on adolescent health yield results on reproductive health and HIV, yet there may be other causes that affect adolescent health besides these two. With the increased survival of children under the age of five years of age, there are a growing number of older children (Viner, et al. 2011). The causes of morbidity and mortality are also expected to change, as seen in the developed countries (Petit & van Ginneken, 1995), with an increase in trauma and poisoning cases (Blum & Nelson-Mmari, 2004). In Kenya, prevention strategies from the Ministry of Health have shown a reduction in morbidity and mortality for some infectious diseases. For example, there is a reduction in morbidity and mortality from measles (Center for Disease Control and Prevention, 2007; Phillips-Howard, et al., 2012). Such findings are based on earlier studies (Gikonyo, 1981; Anabwani, Amoa & Muita, 1989; Petit & van Ginneken, 1995) using hospital mortality and may not be a true reflection of the current causes of morbidity and mortality in Kenya, especially in those aged 5-17 years.

Civil registration of births and deaths and hospital records has been used to estimate the morbidity and mortality from common illnesses and no proper surveillance system exists (Tornheim, et al., 2010; Wang, et al., 2012; Mung'ala & Snow, 1994). Further, civil registration of deaths is unreliable due to under-reporting and misclassification, with incorrect ICD-10 codes used in some instances, a fact which may necessitate dedicated studies to determine the true state of affairs in this area (Wang, et al., 2012; Mung'ala & Snow, 1994).

In addition, information on morbidity, and morbidity among 5-17 year old children in Kenya, is scanty. In view of the changes in burden of disease that appear to have taken place and the sparse information on older children, there is a need to determine the current causes of morbidity and mortality in children aged 5-17 years. This need has been indicated by an earlier study for some African countries, including Kenya (Petit & van Ginneken, 1995).

Previous studies have shown that burden of disease in Kenya is mainly due to infections and thus prevention is important. It is possible to reduce the morbidity and mortality with good planning and health education (Dupas, 2011; Viner, et al., 2011). To inform appropriate prevention strategies it is necessary to know the causes and magnitude of disease burden. Information from this study will be useful for planning purposes in order to address the health of children aged 5-17 years within Kenya.

4.0 STUDY QUESTION

What are the leading causes of morbidity and mortality among children aged 5-17 years admitted to six Kenyan hospitals for the year 2013?

4.1 Aim

This study seeks to establish morbidity and mortality patterns among 5-17 year old children admitted to six Kenyan Hospitals for the year 2013.

4.2 Specific Objectives

1. To determine the in-hospital mortality rate of children aged 5-17 years admitted in the six hospitals in the 2013 calendar year that died.
2. To determine causes of morbidity and mortality among children aged 5-17 years in six Kenyan hospitals in the 2013 calendar year.

4.3 Secondary Objective

To explore differences in morbidity and mortality by study hospitals, gender and age.

5.0 METHODOLOGY

5.1 Study Design

This was a retrospective study of patients' records (files) for children aged 5-17 years admitted to six Kenyan hospitals for the 2013 calendar year. Admission registers were used to identify study subjects and patient records were retrieved and reviewed for cause of morbidity. This study design was chosen due to cost and time constraints.

5.2 Definitions

A **child** is defined by the constitution of Kenya (National Council for Law Reporting, 2010) and the United Nations Convention of Rights of Children (UNCRC) (United Nations, 2010) as a person under the age of 18 years.

An **adolescent** is defined by the World Health Organization as a person aged between 10 and 19 years (WHO, 2001).

5.3 Study Area Description

The study was carried out in Kisii Level 5 Hospital (KL5H), Naivasha County Referral Hospital, Karatina Hospital, Garissa Provincial General Hospital, Mbagathi District Hospital (all public hospitals) and Gertrude's Children's Hospital (a private hospital). The five government hospitals were selected because they are the referral hospitals for the counties they serve and represent a wide geographical area within the country. The five public hospitals are generally at the same level of care with regard to staffing and what services they can offer. The Ministry of Health (MoH), Kenya, was mandated during the study period, to recruit and send staff to these hospitals from the national office. Therefore, ratios of patient per healthcare worker were more or less the same. If any of them were to refer, they would have referred patients to Kenyatta National Hospital in Nairobi. Gertrude's Children's Hospital was included to bring about the private hospital perspective for children of a higher socio-economic class.

Kisii Level 5 Hospital is in the Kisii region, which is in south-western Kenya about 305 kilometres (km) from Nairobi. Kisii town is the main urban and commercial centre in the Gusii Highlands where the

hospital is located. The county is considered to be a relatively rich area and it has great agricultural potential with good produce. Kisii municipality has a large dependent metropolitan population of over 100 000 residents, as per the latest national population and housing census of 2009. The hospital also serves as a regional referral hospital for nearby counties (E. Ondari, Medical Superintendent, Kisii Level 5 Hospital, personal communication, July 2014).

Naivasha County Referral Hospital is located in Naivasha town, which is about 90 km northwest of Nairobi on the main road connecting Nairobi to the western part of the country. Naivasha area has many flower farms and the hospital serves this population. The hospital serves a total population of slightly over 200 415 people, of which 82 171 are children under the age of 15 years and 41 066 are aged 15-24 years (J. Mburu, Medical Superintendent, Naivasha County Referral Hospital, personal communication, July 2014).

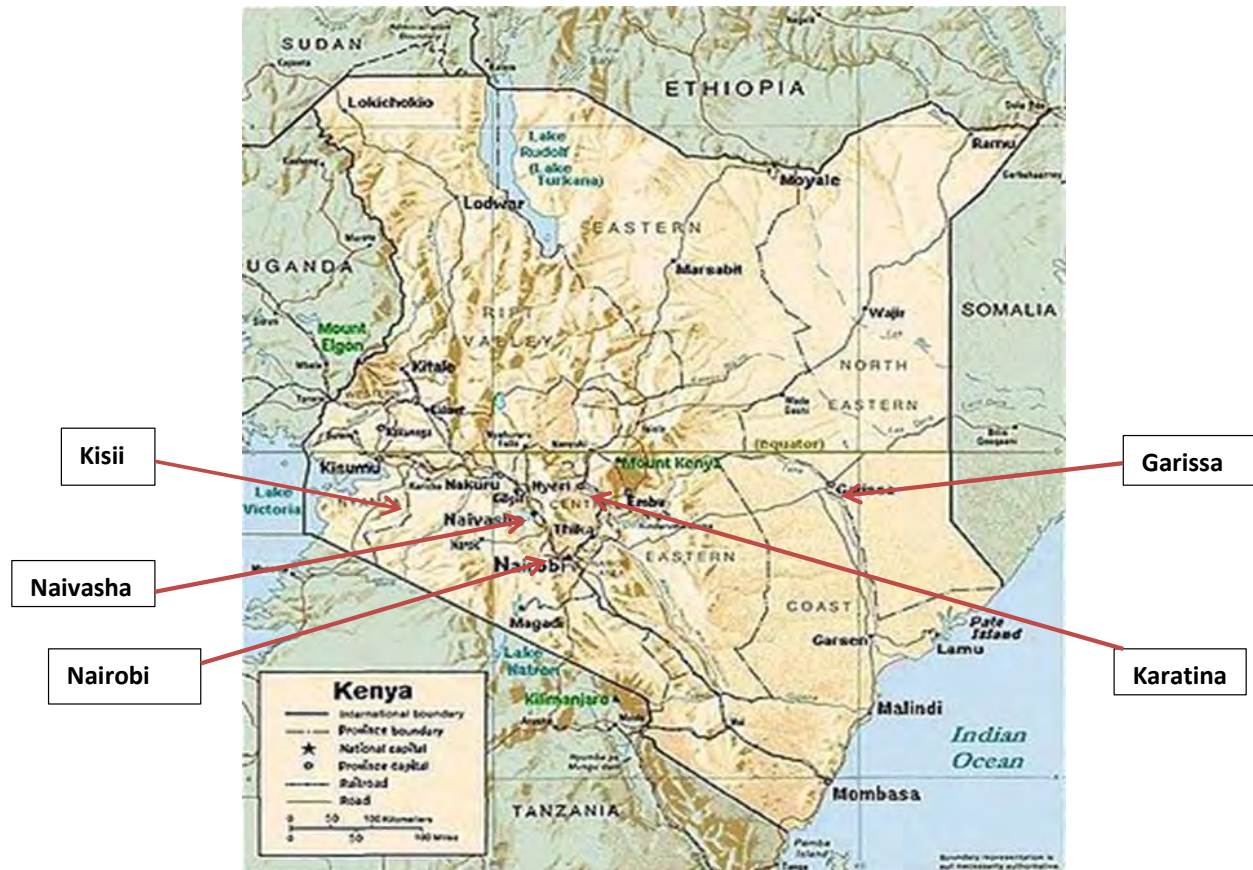
Karatina Hospital is located in the town of Karatina about 127 km to the North of Nairobi. It is near Mt. Kenya and the population nearby is mainly subsistence farmers, some growing cash crops, such as coffee and tea. The hospital serves a total population of slightly over 400 000 people, of whom 14 070 are children under the age of 15 years and 7 310 are aged 15-24 years (A. Ndegwa, Medical Superintendent, Karatina Hospital, personal communication, July 2014).

Garissa Provincial General Hospital is located about 300 kilometres from Nairobi, to the north-eastern part of Kenya towards Somalia. It is in a semi-arid area and the communities in the region are mainly pastoralists. The hospital serves a population of 19 341 children under the age of 15 years and 9 671 are aged 15-24 years. In addition to this, it also serves as a referral hospital for the entire north-eastern part of the country (Garissa Provincial General Hospital, 2015).

Mbagathi District Hospital is located within Nairobi county. It is located near Kibera, one of the largest slums in the continent. It serves mainly the low-income population in the city of Nairobi, mainly from Kibera and the surrounding low-income areas with a population of about two million people (A. Suleh, Medical Superintendent, Mbagathi District Hospital, personal communication, June 2014).

Gertrude's Children's Hospital is a private hospital located in Nairobi where only patients who are below 21 years of age are eligible for admission. Admission is only based on a child's medical needs at the time he/she is being admitted. It is a private hospital that serves the East Africa region. It is not funded by the government and thus serves those from the higher socio-economic status in society or those who have medical insurance and can afford to pay for the services rendered (Gertrude's Children's Hospital, 2015).

Figure 1: Map of Kenya and the study sites



5.4 Study Population

The study population comprised of all 5-17 year old children admitted to the selected hospitals from 1st January to 31st December, 2013.

5.5 Eligibility Criteria

5.5.1 Subject inclusion criteria

All children who had reached their 5th birthday but had not yet reached their 18th birthday were included, provided that they were admitted to the study hospitals between 1st January and 31st December, 2013 for medical, surgical and trauma care.

5.5.2 Subject exclusion criteria

Children who were in the wards during the study period for non-medical reasons were excluded, as they did not constitute part of those who contribute to morbidity and mortality. These children were in the wards for social reasons rather than on medical grounds. For example, if a child was in the ward for accommodation purposes after they were displaced due to insecurity in their homes. Children who were admitted for such elective procedures as circumcision that were not performed or that were postponed were also excluded. Children who were admitted for lodging purposes were thus excluded.

5.6 Study Period

The data collection for patients admitted between January 1st 2013 and December 31st 2013 took place between May and October 2014.

5.7 Sample Size

This was a whole population study and a sample size calculation was not necessary. There were 4 520 patients admitted to the six study hospitals that met the inclusion criteria for the study period and whose records could be retrieved. These subjects were included in the study and their records were reviewed.

5.8 Data Collection Procedures

Admission registers of the participating hospitals for the 2013 calendar year formed the sampling frame and were used to identify study subjects. The ages of all patients who were admitted under the review period were used to establish eligibility into the study. Those aged between 5-17 years were included as the study patients or subjects. In-patient files or records for all these patients were retrieved so as to get their discharge or death summaries. The patient data was abstracted from the discharge or death summaries and entered into a questionnaire (see Appendix 5). Where there were no such summaries, the researcher or his assistants reviewed the whole patient record to obtain the required data. This data was collected for all the patients who met the inclusion criteria in the six hospitals for the study period.

5.9 Study Variables

The data on study variables that was collected and analysed for all the patients included hospital of admission, age, gender, diagnosis and outcome (see the data collection form in Appendix 5). In this study, the outcome of interest was death, discharge or referral to other hospital. Some details were not documented for all patients, such as duration of symptoms before admission, duration of hospital stay, days until death following admission for those who died, HIV status, cause of injury where it occurred, and activities they were engaged in at the time of injury. This information was therefore not able to be collected for all patients.

5.9.1 Classification of diseases

The disease classification used was based on the study by Lozano, et al. (2010) on global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010; a systematic analysis for the Global Burden of Disease Study. This classification was chosen to make the study relevant and comparable to other international studies. Diseases were classified as follows.

Group 1: Communicable, maternal, neonatal, and nutritional disorders

- A. Infections, such as HIV/AIDS, diarrhoea, meningitis, and other common infectious diseases.
- B. Respiratory infections.
- C. Maternal causes: normal pregnancy with delivery and pregnancy-related illnesses, such as ante-partum haemorrhage, abortion, post-partum haemorrhage, puerperal sepsis and maternal mortality.
- D. Perinatal/neonatal disorders.
- E. Nutritional deficiencies.

Group 2: Non-communicable diseases

- A. Neoplasms.
- B. Haematological disorders and other neoplasms.
- C. Diabetes.
- D. Endocrine disorders.
- E. Neuropsychiatric conditions.
- F. Sense organ diseases, such as eye and ear, nose and throat (ENT).
- G. Cardiovascular diseases.
- H. Chronic respiratory diseases, such as asthma.
- I. Digestive diseases, such as liver disease.
- J. Genitourinary diseases.
- K. Skin diseases.
- L. Musculoskeletal diseases.

M. Congenital anomalies.

N. Oral conditions.

Group 3: Injuries

A. Unintentional injuries.

- i. Road traffic accidents.
- ii. Poisonings.
- iii. Falls.
- iv. Fires.
- v. Drowning.
- vi. Other unintentional injuries.

B. Self-harm and interpersonal violence.

- i. Self-inflicted injuries.
- ii. Violence.
- iii. War and legal intervention.
- iv. Other intentional injuries.

C. Forces of nature.

Patients admitted with injuries had very few details, and therefore the disease categorisation in this study does not reclassify them into group 3A, 3B or 3C, but all are grouped together as injuries. The diagnosis key used for data collection was based on the common morbidity and mortality reports in Kenya, as per Appendix 5. However, during data entry and analysis, the diagnoses were recoded and analysed as per the Lozano, et al. (2010) study classification of diseases. The primary researcher, who is a clinician, did this.

Anaemia was classified under non-communicable diseases in this study as a haematological/neoplastic disorder, since its cause could not be established. This is a study limitation since the anaemia could have been a complication of malaria, malnutrition or a sign of true haematological disorder, such as leukaemia.

Although the number of patients who were admitted was 4 520, the total ‘number of diseases’ was higher since some patients were admitted with multiple diagnoses. This is a normal finding as patients can have multiple diagnoses with some also appearing across disease classification categories; for example, a mother admitted for a delivery may also have been diagnosed with malaria and hence appears in more than one disease category.

6.0 STUDY PROCEDURES

6.1 Training Procedures

The researcher trained study assistants on how to identify children aged between 5-17 years, and how to extract data from the patient records and enter it into the study questionnaire. Training of research assistants was conducted prior to data collection with a practical session for the first day of data collection led by the researcher. The study assistants were clinical officers and one nurse with a master’s degree in public health. Medical records personnel assisted them in retrieving records. They were trained on the ethical principles to be followed during the study period, and the importance of patient confidentiality was emphasised.

6.2 Collection of Data

The research assistants entered the data from the patient records into the data-collection forms.

6.2.1 Quality assurance/quality control of data and collection

The researcher visited the research assistants during data collection and completed questionnaires alongside them to ensure that the data-collection procedures were adhered to. In addition, the data-collection forms were crosschecked for any inconsistencies during entry into the analysis software.

6.2.2 Patient safety considerations

Patient safety was not an issue in this study as there was no patient contact. The study strived to maintain patient confidentiality (this is further discussed under ethical considerations).

6.3 Data Entry

The data from the data-collection forms was entered into SPSS, which was designed with the questionnaire in mind and could detect any entry errors. A diagnosis for any disease that had not been given a key prior to data collection was assigned a specific computer-generated key. The diagnoses were recoded so that the output could tally with the Lozano (2010) study classifications.

7.0 STATISTICAL CONSIDERATIONS AND DATA ANALYSIS

7.1 Analysis

The data was analysed using SPSS 20.0. The descriptive analysis of data collected is summarised in tables and graphs, providing overall counts, proportions and rates. Results were summarised and differences were explored in the study in causes of morbidity, mortality and outcomes between the age groups (5-9, 10-14 and 15-17 years), gender (male and female), hospitals, and HIV status. The age categorisation is a modification of the age categories used in previous studies by Lozano (2012), Patton (2009), Wang (2012), and the Kenya Demographic and Health Survey ((KNBS) & ICF Macro, 2010) wherein subjects were categorised in five-year age groups of 5-9, 10-14, and 15-19 years. In this study, the upper age cut-off is 17 years old. Hence, the age classification for the oldest age group is 15-17 years. The mortality proportion was calculated as the total deaths in the age group divided by the age group total admissions, expressed as a percentage. This was done for each hospital and the total for the six hospitals. Pearson's chi-square test and odds ratios were calculated to explore differences in admissions and deaths between genders, age groups and hospitals at 95% significance levels.

8.0 VALIDITY AND RELIABILITY OF STUDY

This study depends on hospital records, which may not be very accurate in Kenya. For example, full details on injuries and accidents were not available. Although this holds implications for the study's reliability, the findings are still of importance as very limited data is available for this age group and it will be compared with findings from similar settings.

9.0 ETHICAL CONSIDERATIONS

9.1 Institutional Review Board (IRB)

Approval for the study was obtained from the Human Research Ethics Committee at the College of Health Sciences (UCT) and the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH-UoN ERC). The KNH-UoN ERC is a national review board and has authority to conduct ethical reviews for all health-related studies in the University of Nairobi, Kenyatta National Hospital, and other health facilities in Kenya.

Permission was obtained from the hospital administration to access hospital records and patient files after getting ethical approval for the study. Hospital review boards and administration permission was sought after receiving approval from the Human Research Ethics Committee at the College of Health Sciences (UCT) and the Kenyatta National Hospital – University of Nairobi Ethics and Research Committee (KNH-UoN ERC). All hospitals in Kenya recognise ethical approval from the KNH-UoN ERC.

The ethical approval letters are attached as Appendix 4.

9.2 Patient Consent

A waiver to access past medical records for research purposes without seeking individual patient consent was obtained from the KNH-UoN ERC. This was partly due to the time and cost challenges of tracing all the patients' guardians for consent.

9.3 Subject Confidentiality

Patient confidentiality was maintained at all times. Names of the patients/study participants were omitted in the data-collection forms. Once the hospital number was noted, it was de-identified by giving it a code that could not be traced back to the patients. Only coded data was transported to conceal identities. In addition, the data was stored in files kept under lock and key with restricted access in secured offices. Electronic databases were encrypted and stored in password-protected, secure computers.

10.0 RESULTS

10.1 Admissions

There were 4 520 patients aged 5-17 years admitted to the six hospitals in 2013. The females were 57% (2 576) while 43% (1 944) were male. The 5-17 year age group comprised 6.9% of total hospital admissions. Female admissions were more than males in all the hospitals, except for Gertrude's Children's Hospital in Nairobi. Males formed the majority of admissions for age groups 5-9 and 10-14 years, but for those aged 15-17 there were more females (80%). The detailed admissions, as per age group, gender and hospital are illustrated in Appendix 1. Kisii Level 5 Hospital had the highest number of admissions (42%) across all age groups, while Karatina Hospital had the least (6.6%). The proportion of patients admitted to Gertrude's Children's Hospital in comparison to the total of all hospitals admissions reduced as age increased.

As shown in table 1, the number of male admissions reduced with age throughout, while female admissions increased among those aged 15-17 years. Patients aged 5-9 years formed the largest proportion of admissions, followed by those aged 15-17. The increase in admissions among those aged 15-17 years was mostly due to the increase in number of females admitted for maternal reasons. Maternal reasons accounted for 42.1% of 5-17 year old (15.2% of 10-14 year old and 78.8% of 15-17) female admissions.

Table 1: Admissions by age group, gender and hospital

Age group	Gender	Kisii Level 5 Hospital	Naivasha County Referral Hospital	Karatina Hospital	Garissa Provincial General Hospital	Mbagathi District Hospital	Gertrude's Children's Hospital	Total
5-9 years	M	347 (52.3%)	148 (58.7%)	53 (55.8%)	86 (69.9%)	61 (57.5%)	325 (57.2%)	1 020 (56.4%)
	F	317 (47.7%)	104 (41.3%)	42 (44.2%)	37 (30.1%)	45 (42.5%)	243 (42.8%)	788 (43.6%)
Subtotal (N% of total hospital admissions)		664 (35.0%)	252 (35.7%)	95 (32.0%)	123 (30.8%)	106 (35.1%)	568 (61.9%)	1 808 (40.0%)
10-14 years	M	220 (48.7%)	87 (52.7%)	40 (52.6%)	47 (60.3%)	30 (49.2%)	179 (64.2%)	603 (54.3%)
	F	232 (51.3%)	78 (47.3%)	36 (47.4%)	31 (39.7%)	31 (50.8%)	100 (35.8%)	508 (45.7%)
Subtotal (N% of total hospital admission)		452 (23.8%)	165 (23.4%)	76 (25.6%)	78 (19.5%)	61 (20.2%)	279 (30.4%)	1,111 (24.6%)
15-17 years	M	133 (17.0%)	67 (23.2%)	24 (19.0%)	24 (12.1%)	28 (20.7%)	45 (64.3%)	321 (20.0%)
	F	650 (83.0%)	222 (76.8%)	102 (81.0%)	174 (87.9%)	107 (79.3%)	25 (35.7%)	1280 (80.0%)
Subtotal (N% of total hospital admission)		783 (41.2%)	289 (40.9%)	126 (42.4%)	198 (49.6%)	135 (44.7%)	70 (7.6%)	1 601 (35.4%)
HOSPITAL TOTALS (5-17 YEARS)								
	M	700 (36.9%)	302 (42.8%)	117 (39.4%)	157 (39.3%)	119 (39.4%)	549 (59.9%)	1 944 (43.0%)
	F	1 199 (63.1%)	404 (57.2%)	180 (60.6%)	242 (60.7%)	183 (60.6%)	368 (40.1%)	2,576 (57.0%)
	Total	1 899	706	297	399	302	917	4 520
Percentage for each hospital of combined hospital admissions for 5-17 year olds								
		42.0%	15.6%	6.6%	8.8%	6.7%	20.3%	100.0%
Total admissions for all ages by hospital								
		19 856	13 171	8 316	6 817	8 857	8 173	65 190
Percentage of 5-17 year olds of total hospital admissions for all ages by hospital								
		9.6%	5.4%	3.6%	5.9%	3.4%	11.2%	6.9%

10.1.1 Reasons for admissions

Reasons for hospital admissions are shown in table 2 below. Communicable and maternal causes were the main reason for admissions (71.7%), followed by non-communicable causes (33.1%), while injuries were the least likely cause (13.9%). Among communicable causes, common infectious diseases such as HIV, malaria, and diarrhoea were the most common (32.3%), followed by respiratory infections (14.9%). Maternal causes accounted for 24% of admissions to hospital; they were highest in Garissa (39.5%) and lowest in Gertrude's Children's Hospital (0.3%). The maternal causes were significantly different between the various hospitals ($P < 0.001$). Nutritional causes only accounted for 0.6% of the cases admitted.

Table 2: Reasons for admission by hospital N (percentage of 5-17 year olds per hospital)

Causes	Kisii Level 5 Hospital	Naivasha County Referral Hospital	Karatina Hospital	Garissa Provincial General Hospital	Mbagathi District Hospital	Gertrude's Children's Hospital	Total
Category 1: Communicable diseases, maternal and nutritional							
Common infectious diseases (e.g. HIV, malaria, diarrhoea)	707 (37.2%)	155 (22.0%)	71 (23.9%)	104 (26.1%)	179 (59.3%)	242 (26.3%)	1 458 (32.3%)
Respiratory infections	81 (4.3%)	61 (8.6%)	45 (15.2%)	33 (8.3%)	51 (16.9%)	402 (43.8%)	673 (14.9%)
Maternal causes	561 (29.5%)	177 (25.1%)	87 (29.3%)	158 (39.5%)	99 (32.8%)	3 (0.3%)	1 085 (24.0%)
Nutritional	13 (0.7%)	1 (0.1%)	1 (0.3%)	4 (1.0%)	3 (1.0%)	3 (0.3%)	25 (0.6%)
Category 1 total	1362 (71.7%)	394 (55.8%)	204 (68.7%)	299 (74.9%)	332 (109.9%)	650 (70.9%)	3 241 (71.7%)
Category 2: Non-communicable diseases							
Category total	577 (30.4%)	215 (30.5%)	71 (23.9%)	103 (25.8%)	106 (35.1%)	423 (46.1%)	1 495 (33.1%)
Category 3: Injuries							
Category total	257 (13.5%)	144 (20.4%)	69 (23.2%)	42 (10.5%)	7 (2.3%)	111 (12.1%)	630 (13.9%)
Total	1 899	706	297	399	302	917	4 520

Many patients had multiple diagnoses appearing across the disease categories and hence the row totals are not a case of simple addition. This means that if patients in each disease category are summed up, the total will exceed the 4 520 patients admitted.

Non-communicable (category two) diseases were diagnosed in 33.1% of all patients admitted in the hospitals. The main illnesses in non-communicable diseases were anaemia in 276 (6.1% of all 5-17 year old patients admitted); genitourinary problems, such as renal injuries and nephrotic syndrome in 152 (3.4% of all 5-17 year old patients admitted); epilepsy or convulsive disorder in 124 (2.7% of all 5-17 year olds admitted patients); sickle cell disease in 81 (1.8% of all 5-17 year old patients admitted); eye, ear, nose and throat illnesses in 73 (1.6% of all 5-17 year old patients admitted); rheumatic fever or heart disease in 44 (1.0% of all 5-17 year old patients admitted), and diabetes in 42 (0.9% of all 5-17 year old patients admitted). A detailed breakdown is provided in Appendix 1.

10.2 Deaths

Table 3 shows deaths by hospital. There were 160 deaths out of the total number of admissions (4 520) at the six hospitals, among children aged 5-17 years. The in-hospital mortality rate was 3.5%. The deaths in 5-17 year olds were 3.9% of all hospitals' total deaths. The in-hospital mortality rate was highest in Kisii Level 5 Hospital (5.7%) and least at Gertrude's Children's Hospital (1%). Two-thirds of deaths were in Kisii Level 5 Hospital (68%), even though it contributed less than half of the total admissions (42%). The male (57.3%) deaths were significantly higher than female (42.7) deaths ($P < 0.001$), this is illustrated in Appendix 2. The gender difference was reflected in four of the six hospitals. No difference in death by gender was found at Mbagathi District Hospital and Gertrude's Children's Hospital, which had more female deaths (57.1%). The category-specific mortality proportion was 4.4% for non-communicable diseases and 3.0% for both communicable diseases and injuries.

Table 3: Deaths by age group and hospital

		5-9 years	10-14 years	15-17 years	Total
Kisii Level 5 Hospital	Deaths	44	39	26	109
	Total admissions for age group	664	452	783	1 899
	In-hospital mortality rate	6.6%	8.6%	3.3%	5.7%
Naivasha County Referral Hospital	Deaths	5	3	5	13
	Total admissions for age group	252	165	289	706
	In-hospital mortality rate	2.0%	1.8%	1.7%	1.8%
Karatina Hospital	Deaths	4	3	2	9
	Total admissions for age group	95	76	126	297
	In-hospital mortality rate	4.2%	3.9%	1.6%	3.0%
Garissa Provincial General Hospital	Deaths	4	3	2	9
	Total admissions for age group	123	78	198	399
	In-hospital mortality rate	3.3%	3.8%	1.0%	2.3%
Mbagathi District Hospital	Deaths	5	3	2	10
	Total admissions for age group	106	61	135	302
	In-hospital mortality rate	4.7%	4.9%	1.5%	3.3%
Gertrude's Children's Hospital	Deaths	2	5	0	10*
	Total admissions for age group	568	279	70	917
	In-hospital mortality rate	0.4%	1.8%	0.0%	1.0%
Total	Deaths	64	56	37	160*
	Total admissions for age group	1 808	1 111	1 601	4 520
	In-hospital mortality rate (95%CI)	3.5% (2.7-4.5)	5.0% (3.8-6.5)	2.3% (1.6-3.2)	3.5% (3.0-4.1)

*Includes three patients from Gertrude's Children's Hospital whose records could not be obtained.

10.2.1 Causes of death

Table 4 shows the causes of mortality among children aged 5-17 years admitted at the six hospitals in 2013. Overall communicable causes were the main cause of death (60%). However, the category-specific in-hospital mortality rate was highest for non-communicable diseases at 4.4%, while it was 3.0% for both communicable diseases and injuries. This was reflected in all the hospitals, except for Gertrude's Children's Hospital and Naivasha Hospital. Kisii Level 5 Hospital had the highest in-hospital mortality rate for all disease categories. It also had the highest contribution of deaths disproportionate to its share of

admissions: it contributed more deaths than its relative portion of 5-17 year old patients who were admitted in all hospitals.

Table 4: Causes of deaths (Number, percentage and category-specific in-hospital mortality rate for 5-17 year olds)

Causes	Kisii Level 5 Hospital	Naivasha County Referral Hospital	Karatina Hospital	Garissa Provincial General Hospital	Mbagathi District Hospital	Gertrude's Children's Hospital	Total
Communicable diseases, maternal and nutritional (category 1)							
Category 1 deaths	59	8	8	6	10	5	96
Percentage of 5-17 year old specific in-hospital deaths	54.1%	61.5%	88.9%	66.7%	100.0%	50.0%	60.0%
Category in-hospital mortality rate (deaths in category as % of category admissions)	4.3%	2.0%	3.9%	2.0%	3.0%	0.8%	3.0%
Category admissions	1 362	394	204	299	332	650	3 241
Non-communicable diseases (category 2)							
Category 2 deaths	49	3	4	3	4	3	66
Percentage of 5-17 year old specific in-hospital deaths	45.0%	23.1%	44.4%	33.3%	40.0%	30.0%	41.3%
Category specific in-hospital mortality rate (as % of category admissions)	8.5%	1.4%	5.6%	2.9%	3.8%	0.7%	4.4%
Category admissions	577	215	71	103	106	423	1 495
Injuries (category 3)							
Category 3 deaths	13	3	1	1	0	1	19
Percentage of 5-17 year old specific in-hospital deaths	11.9%	23.1%	11.1%	11.1%	0.0%	10.0%	11.9%
Category specific in-hospital mortality rate (as % of category admissions)	5.1%	2.1%	1.4%	2.4%	0.0%	0.9%	3.0%
Category admissions	257	144	69	42	7	111	630
Total deaths in 5-17 year olds	109	13	9	9	10	10*	160*

*Includes three patients from Gertrude's Children's Hospital whose records could not be obtained.

There were four maternal deaths. Two of them were in Kisii Level 5 Hospital from post-partum haemorrhage after normal deliveries. The others were in Garissa Provincial General Hospitals from severe eclampsia and post-partum haemorrhage. Poisoning contributed to 42% of deaths from injuries, while head injuries contributed 10.5%; and fractures and soft tissue injuries contributed 21.3% of injury patient deaths.

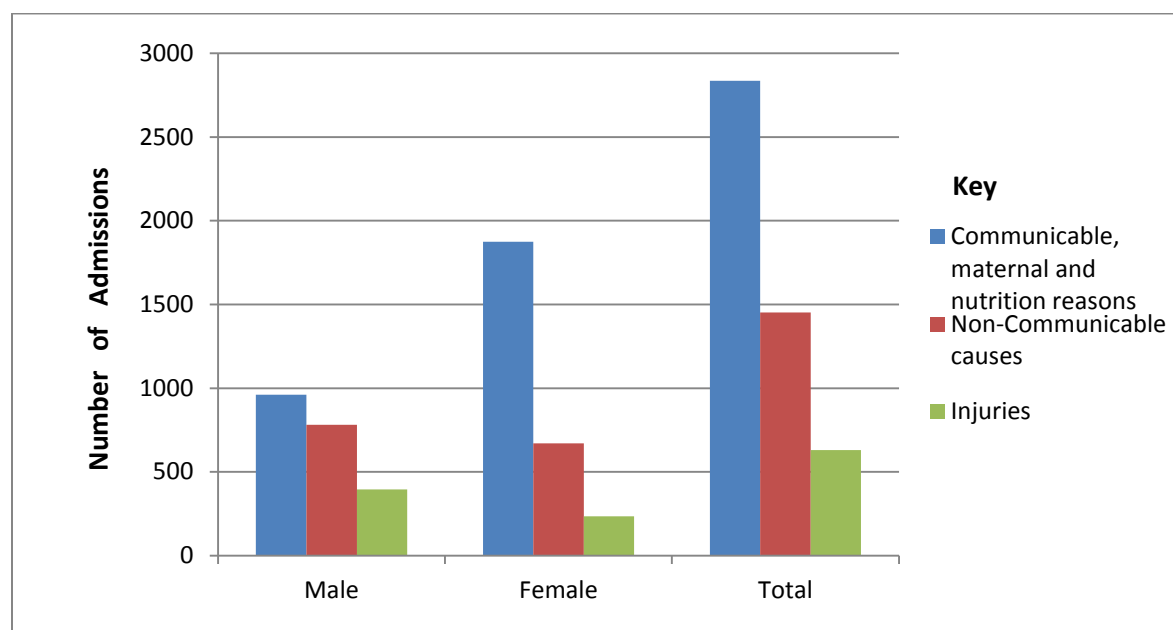
Some patients who died had multiple diagnoses across disease categories and hence the column totals are not a simple addition. However, the row totals add up to the final figure. Therefore, if the patients in each disease category who died are summed, they will exceed the 160 deaths among 5-17 year olds.

10.3 Morbidity

10.3.1 Gender and disease category

There were more males than females admitted for non-communicable diseases and injuries, as illustrated in figure 2. However, there were more females admitted for communicable maternal and nutritional reasons than males. A large proportion of the females were admitted for maternal reasons (42.1%). None of the females aged 5-9 years were admitted for maternal reasons but seventy-seven of the 508 females (15.2%) aged 10-14 years were admitted for maternal reasons, while 1 008 of 1 280 (78.8%) of the females aged 15-17 years were admitted for maternal reasons, indicating an increase in maternal reasons as girls became older.

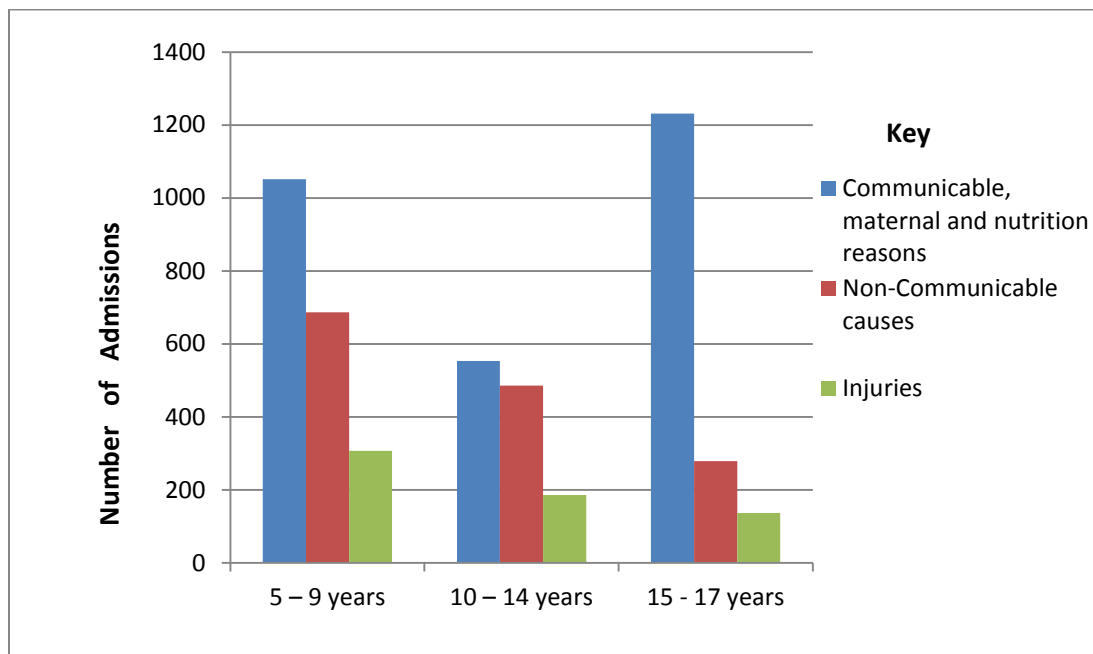
Figure 2: Comparison of disease category and gender



10.3.2 Age and disease category

Communicable, maternal and nutritional causes were the highest cause of admission in those aged 15-17 years, followed by the age group 5-9 years, as illustrated in figure 3. Non-communicable diseases and injuries decreased with age.

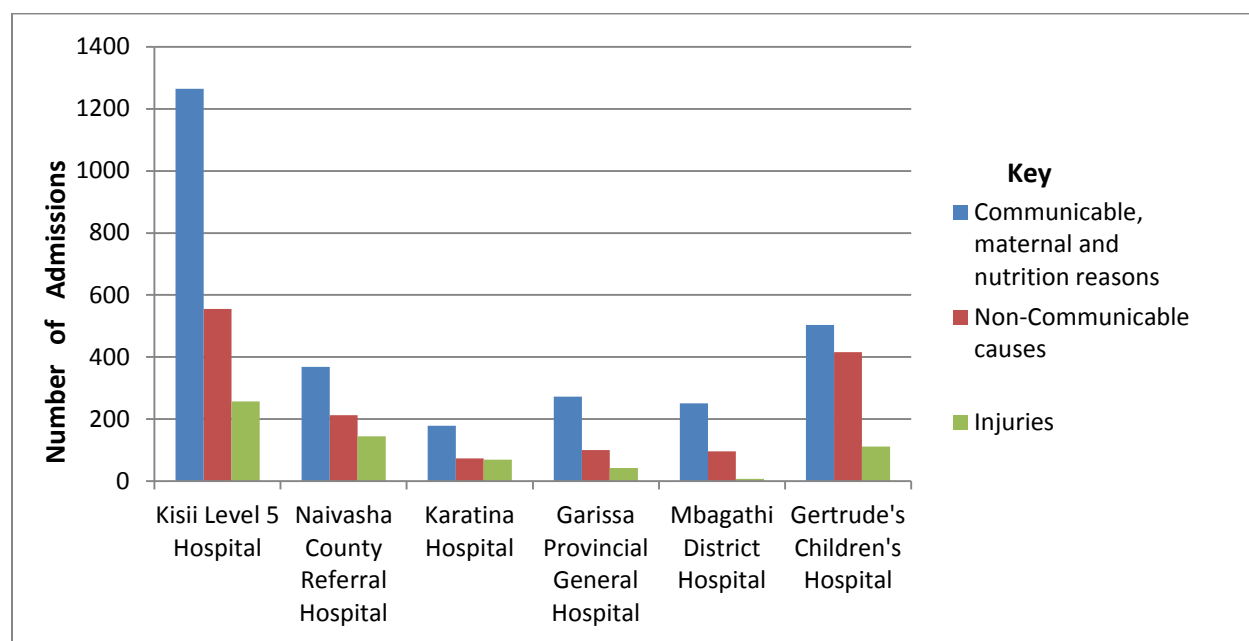
Figure 3: Comparison of disease category by age groups



10.3.3 Hospital and disease category

Figure 4 shows that Kisii Level 5 Hospital had the highest number of patients admitted for communicable, maternal and nutritional reasons, whereas the least were from Karatina Hospital. Gertrude's Children's Hospital had a relatively high number of admissions for non-communicable disease. Very few injury patients were admitted to Mbagathi Hospital while Naivasha County Referral Hospital had a high proportion of injury patients, based on each hospital's admissions.

Figure 4: Comparison of disease category across hospitals (N = 4 520)

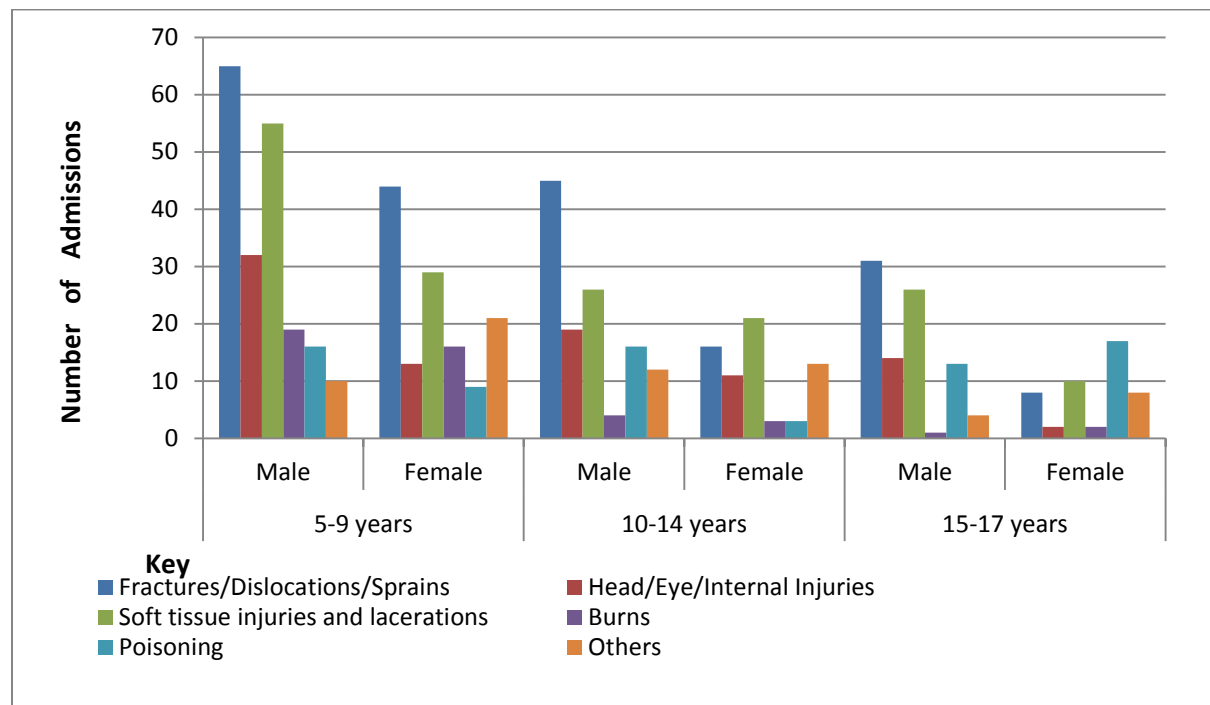


10.3.4 Injuries

There were 630 patients who were admitted with injuries. Of these admissions, there was documentation of site of injury in only 473 cases (75%), cause of injury in 460 (73%), and intent of injury (accidental versus non-accidental) in 431 (68%). Figure 5 shows the various forms of injuries and how they varied by age and gender. There were more males with injuries than females and the difference was larger as age increased, except for burns and poisoning. However, this difference was not significant, using the chi² test ($p = 0.322$), suggesting that there was no real difference in injuries between male and female.

In the few records where external cause of injury was documented, the most common cause of injury was a fall or trip (27.8%), followed by road traffic accident (16.5%).

Figure 5: Pattern of injuries by age and gender (N = 630)



10.3.4.1 Child abuse

There were five (three males and two females) who reported physical abuse and 15 (one male and 14 females) who reported sexual abuse. However, not all details were available for the physical and sexual abuse cases. Parents, teachers or friends/acquaintances were the perpetrators in 75% of cases while strangers were the perpetrators in 25% of the cases. Head and limb injuries were the most common body sites of child abuse injuries (65%). There was no documented death from child abuse injuries.

10.3.4.2 Burns

A total of 30 patients were admitted with burns, with no gender difference. Most of the burns were in the 5-9 years age group, namely 22 (73.3%), and only two (6.7%) were aged 15-17 years. Hot liquids caused most of the burns, in 22 (73.3%), and fires/flames in four (13.3%).

10.3.4.3 Road traffic accidents (RTAs)

Records were obtained of 104 patients involved in RTAs, with more males (66%) than females (34%). RTAs patients comprised 16.5% of injury patients and 2.3% of all 5-17 admissions. The RTA patients were mostly passengers (58.7%) and pedestrians (25%). Motorbikes (53.3%) were by far the greatest cause of RTAs, followed by motor-vehicles (38%). There were 11 children who were reported to be 'drivers' during the accident. Of those who were 'driving', six were riding motorbikes (54.5%) while five were riding bicycles (45.5%). They were mainly males (81.8%) in the 15-17 year age group. Table 5 shows that there were more injuries in the younger age groups compared to the older age group. Age was not documented for six children who were reported being involved in an RTA. More than half of RTA admissions had a head, face or neck injury (8.6% of all injured patients).

Table 5: Description of road traffic accident (RTA) patients (N = 104)

	Number	Percent
Age group (years)		
5 – 9	47	45.2
10 – 14	24	23.0
15 – 17	27	26.0
Unknown	6	5.8
Total	104	100.0
Site of injury		
Head, face or neck injury	54	51.9
Chest and abdominal injury	6	5.7
Limb injuries	39	37.5
Others	5	4.8
Total	104	100.0

10.4 Outcomes

Most of the patients were discharged home alive (94.4%). Of all the patients admitted, one hundred and sixty died (3.5%). Twenty-six (0.6%) patients absconded from the hospital, while 70 (1.5%) patients were referred to another hospital. Most of the deaths occurred in younger children aged 5-9 years of age (40.8%), although the age specific mortality proportion was highest in those aged 10-14 years, as shown in table 6.

Table 6: Comparison of outcomes across age groups

Outcome	Age (years)			Total
	5-9 years	10-14 years	15-17 years	
Death	64 (3.5%)	56 (5.0%)	37 (2.3%)	160* (3.5%)
Discharge/alive	1 701 (94.1%)	1 029 (92.6%)	1 535 (95.9%)	4 265 (94.4%)
Referred to other hospital	31 (1.7%)	22 (2.0%)	17 (1.1%)	70 (1.5%)
Absconded/unknown	12 (0.7%)	49 (0.4%)	12 (0.7%)	28 (0.6%)
Total	1 808 (100%)	1 111 (100%)	1 601 (100%)	4 520 (100%)

*Includes 3 patients from Gertrude's Children's Hospital whose details were not obtained.

Mortality was highest in the non-communicable causes group (4.4%). Most referrals were for patients who suffered from injuries, at 3% of all those diagnosed with injuries. The least referred patients were those who were admitted with communicable diseases.

10.4.1 Outcome by age, gender and hospital

Table 6 compares outcomes across age groups, showing that those aged 15-17 years had the best outcomes with a 2.3% in-hospital mortality rate and 95.9% of the admissions discharged alive. Those aged 10-14 years had the worst outcomes, with a 5.0% in-hospital mortality rate and 92.6% of the admissions discharged alive in this age group.

Table 7 shows a comparison of outcomes across hospitals, and 94.4% of patients were discharged home alive. The outcomes for those who were referred, absconded and unknown were combined. There was a significant difference between the hospitals' outcomes ($P < 0.001$). Mbagathi District Hospital had the most referrals/absconders at 10.3% of their admitted patients and the smallest fraction of patients who were discharged home alive (86.4%). Kisii Level 5 Hospital had the highest in-hospital mortality rate (5.7%) while Gertrude's Children's Hospital had the least (1%). There were no patients who absconded from Gertrude's Children's Hospital, where 99% of the patients who were admitted were discharged alive.

Table 7: Comparison of outcome across hospitals, N (percentage within the hospital)

	Kisii Level 5 Hospital	Naivasha County Referral Hospital	Karatina Hospital	Garissa Provincial General Hospital	Mbagathi District Hospital	Gertrude's Children's Hospital	Total
Death	109 (5.7%)	13 (1.8%)	9 (3.0%)	9 (2.3%)	10 (3.3%)	10* (1%)	160* (3.5%)
Discharge/Alive	1 776 (93.5%)	670 (94.9%)	275 (95.6%)	373 (93.5%)	261 (86.4%)	910 (99%)	4 265 (94.4%)
Referred to other hospital, absconded or unknown outcome	14 (0.7%)	23 (3.3%)	13 (4.4%)	17 (4.3%)	31 (10.3%)	0	98 (2.2%)
Total	1 899	706	297	399	302	920	4 520

* Includes 3 patients from Gertrude's Children's Hospital whose details were not obtained.

10.4.2 HIV status and outcome

Most of the patients' HIV statuses were not documented. Only 33.9% of patients were tested for HIV, and only 2.2% of all admissions tested HIV positive. There were 29 (17.6%) deaths among the HIV positive patients and 21 (1.5%) in those who were HIV negative. There was a 14 times increased odds for HIV positive patients to die, compared to HIV negative patients (95% CI 8.2-25.8, $P < 0.001$). There was an 85% reduction in odds (95% CI 78-90%, $P < 0.001$) of being discharged alive with a 1.9 times increased odds (95% CI 8.2-25.8, $P < 0.009$) of being referred to other hospital, absconding or having an unknown outcome for HIV positive patients compared to HIV negative patients.

Table 8: Comparison of HIV status against outcome

Outcome	HIV Positive N = 165	HIV Negative N = 1 367	OR (95% CI)	P value
Death	29 (17.6%)	21 (1.5%)	14.0 (8.2-25.8)	<0.001
Discharge/alive	128 (77.6%)	1 310 (95.8%)	0.15 (0.10-0.22)	<0.001
Referred to other hospital, absconded or unknown outcome	8 (4.8%)	36 (2.6%)	1.9 (1.1-3.2)	0.009

11.0 DISCUSSION

The study aimed to determine the in-hospital mortality rate, reason for hospital admissions and cause of mortality among children aged 5-17 years admitted in six hospitals in Kenya for 2013. Based on international research it is shown that there is an increase in survival of children beyond five years of age, it is thus anticipated that there should be an increased proportion of 5-17 year olds in the general population (Habimana, Mwinga, Sagoe-Moses & Ketsela, 2010; United Nations, 2013; World Health Organization, 2015). Children aged 5-18 comprise about 39% of the total general population in Kenya (Kenya National Bureau of Statistics (KNBS) & ICF Macro, 2010). Yet, very little is known about reasons for admissions and causes of deaths in this age group.

11.1 Admissions

There were a low proportion of admissions in this age group (6.9%), compared to their proportion in the total population (39%) in Kenya (Kenya National Bureau of Statistics (KNBS) & ICF Macro, 2010). The total number of 4 520 patients (6.9% of total hospital admissions) aged 5-17 years was admitted for the study period. Admissions due to communicable causes were the highest (70%), with injuries being the least likely causes for admissions at 13%. This is in keeping with the global burden of disease studies where communicable diseases still account for the bulk of morbidity in Sub-Saharan Africa, as discussed below (Patton, et al., 2009).

Overall there were more female (57%) than male (43%) admissions. This is in keeping with a high proportion of females, based on the female: male ratio in the general population. The female proportion of admissions was much higher in the older age group of 15-17 years, as shown in figure 2. More females were admitted with communicable, maternal and nutritional causes than males, due to the high number of women admitted with maternal causes among those aged 15-17 years (24% of all admissions). The high proportion of female admissions in this study, unlike others, may be due to the high maternal causes of admission in this study, at 42.1% of admissions of females aged 5-17 years. The other studies excluded children who were admitted in maternity/labour wards and therefore the proportion of females was lower (Menge, et al., 1995; Kihiko, et al., 2010).

11.2 Deaths

The proportion of deaths among 5-17 year olds in relation to total hospital deaths (3.9%) is lower than the age group's contribution to overall hospital admissions (6.9%). This was lower than in a study in a rural area of the western region in Kenya where close to 8% of deaths were among adolescents aged 15-19 years and young adults aged 20-24 years (Phillips-Howard, et al., 2012). The higher proportion in Western Kenya may be due to the inclusion of young adults where mortality rates are expected to start rising based on the findings from global burden of disease studies (Lozano, et al., 2012; Patton, et al., 2012). The Phillips-Howard (2012) study in Western Kenya drew on a sample aged 15-24 years and therefore a direct comparison is not possible. In addition, the western part of Kenya has a different disease pattern, such as higher rates of malaria than the regions included in this study (Phillips-Howard, et al., 2012).

Although the study found a higher admission rate for females, there were significantly more male than female deaths. As discussed earlier, females were admitted mainly due to communicable diseases and maternity-related causes, with this gender difference noted in four of the six study hospitals. There was no difference in deaths by gender at Mbagathi and in Gertrude's Children's Hospital where there were more female deaths compared to males. This variation was probably due to the differences in populations served and case-mix differences.

Mbagathi District Hospital had 10% of their patients referred. This may have resulted in severely sick patients who are more likely to die than to be transferred to other hospitals. Mbagathi hospital also had a low proportion of injury patients yet most of the injury patients were male. The few injury patients admitted at Mbagathi may have also contributed to the low proportion of male deaths. Gertrude's Children's Hospital is a private hospital and has a different clientele and a better infrastructure, and these factors may have contributed to different outcomes. Two-thirds of deaths were in Kisii Level 5 Hospital (68%), even though it contributed to less than half of the total admissions (42%). This may be a reflection of the referral status of Kisii Level 5 Hospital where the seriously sick patients are referred. The Kisii Level 5 Hospital should, therefore, be given more staffing and infrastructure support in order to handle the high number of patients and in order to reduce the mortality. At the time of this study the process of staffing, training and equipping Kisii Level 5 Hospital had already started so as to be converted into a regional training and referral hospital (E. Ondari, Medical Superintendent, Kisii Level 5 Hospital, personal communication, July 2014).

11.3 Communicable, Maternal, Neonatal, and Nutritional Disorders

Communicable and maternal causes account for over 70% of the patients admitted and 60% of deaths. The main admission diagnoses were common infections in 32.3%; respiratory infections in 14.9%; and maternal causes in 24%, while HIV infection was diagnosed in 2.2% of admitted patients. Communicable diseases such as HIV, TB and malaria have previously been shown to account for a large fraction of mortalities – close to 70% of the deaths in a rural area of the western region in Kenya (Phillips-Howard, et al., 2012). The high proportion of communicable disease admissions is an expected finding, since Kenya is a low-income country, where communicable diseases are still a large contributor to overall morbidity and mortality, similar to the rest of Sub-Saharan Africa (Petit, and van Ginneken, 1995; Deen, et al., 1999; Mathers & Loncar, 2006; Patton, et al., 2009; Lozano, et al., 2012; Misganaw, Haile Mariam, Araya & Ayele, 2012; Phillips-Howard, et al., 2014). The high proportion of communicable disease may also be a reflection of the poor hygiene or living standards for a majority of the population. The living conditions, such as overcrowding and poor sanitation, may be enhancing the spread of communicable diseases.

Infectious diseases disproportionately caused mortality, with the leading ones being malaria and pneumonia. Malaria accounted for 17.2% of deaths, even though it was only diagnosed in 12.4% of admissions while pneumonia accounted for 14.0% of deaths and only 6.1% of admission diagnosis. The major causes of death in this study are the common causes of admissions and death in prior studies in similar settings (Menge, et al., 1995; Patton, et al., 2009; Campbell, et al., 2004). Poor health seeking behaviour, in which patients come to formal healthcare facilities when it is very late and illnesses have complicated and thus become more difficult to cure, may contribute to a high number of deaths from preventable and curable illnesses. In addition, poor health service delivery systems with poor leadership, little human personnel, and poor infrastructure and supplies management in public facilities may also influence outcomes of admissions.

Only 0.6% of the patients were diagnosed with malnutrition, even though the levels of malnutrition are expected to be higher than this (Kenya National Bureau of Statistics (KNBS) & ICF Macro, 2010). The KNBS survey reported that 35% of children under five years were stunted, and 12.5% of women aged 15-49 years had a body mass index (BMI) less than 18.5. Malnutrition was at 1% of admissions in Mbagathi Hospital and Garissa General Hospitals. These two hospitals serve poorer patients from an urban slum and a semi-arid area respectively and hence the relatively higher rates of malnutrition. The low levels of malnutrition in this study could be as a result of poor documentation or undiagnosed, as clinicians were

not looking for this. Twenty-four percent of those who were documented to suffer from malnutrition died. This underscores the great contribution of malnutrition to mortality. This is in keeping with the study by Pelletier, et al. (1995) who reported that 56% of mortalities in developing countries were attributed to malnutrition's potentiating effects. The individual country levels ranged from 13-66%. They further stated more than 75% of these deaths were due to mild to moderate malnutrition.

The HIV positive patients were 2.2% of all those who were admitted and 6.5% of those tested. This is lower than the national HIV prevalence of 6.7% (KAIS, 2012). It should be noted that only 33.9% of all admissions were tested for HIV, and it is therefore probable that many were undiagnosed. Even with such a low known occurrence of HIV/AIDS infection, 18.5% of those who died were HIV infected. The HIV-positive patients had significantly worse outcomes compared to those who were not HIV positive. This is in keeping with the known pathophysiology of HIV infection, which lowers the body's immunity and thus reduces protection from infections. The low fraction of patients whose HIV status was documented indicates a missed opportunity for early HIV diagnosis and enrolment into care for those who are HIV positive. This is in spite of a government policy on testing all patients for HIV. There is a need to find out why this guideline is not being followed and work out ways of ensuring every patient is tested for HIV.

11.3.1 Maternal causes

Just over 40% of females admitted were due to maternal reasons. A high proportion of maternal or pregnancy-related causes of admission were in the 5-17 year age group (24% of all 5-17 year olds admissions). This highlights the problem of early sexual activity and pregnancy in children under the age of 18 years. There were four maternal deaths in this study. Young maternal age is considered a risk factor for poor pregnancy outcomes for both mother and baby (Kumar, et al., 2007; Talawar & Venkatesh, 2013). The proportion of 5-19 year old females who have started child bearing is higher than that found in prior studies and surveys. For example, in Kenya 17.7% of women aged 15-19 have begun child bearing (Nour, 2006; Kenya National Bureau of Statistics (KNBS) & ICF Macro, 2010). This figure increased slightly to 18% as per the 2013 KDHS ((KNBS) & ICF Macro, 2014). The proportion of under 18 year olds with pregnancy-related causes in the hospital could be higher than that in the general community, since they are already seeking care. It is expected that pregnant women will seek hospital care more often than non-expectant ones. Pregnant teenagers are therefore more likely to be part of a hospital-based study, compared to population-based community surveys. The differences in the denominator and characteristics of the study population would thus give a higher proportion of in-hospital based studies as opposed to the

community-based studies. There were significant regional differences in maternal causes, with the highest rates in Garissa Provincial General Hospital (39.5%) and lowest in Gertrude's Children's Hospital (0.3%). Garissa is in the northern part of Kenya in a semi-arid area with low literacy levels and high poverty levels, while Mbagathi District Hospital in Nairobi serves the urban poor who live in a slum.

There were four maternal deaths in two hospitals. Three maternal deaths were from post-partum haemorrhaging and one from severe eclampsia. There were two maternal deaths from post-partum haemorrhaging in Kisii Level 5 Hospital while the others were in Garissa Provincial hospital. These may be because the two hospitals serve as referral hospitals in their regions. The high proportion of female children aged 5-17 years admitted for pregnancy-related causes (42.1%) may be a reflection of a failure of the healthcare system in Kenya to address the reproductive health needs of this population. The barriers to health care for young people need to be considered when planning health services. Adolescents need to have services that are "sensitive to their unique stage of biological, cognitive, and psychosocial transition into adulthood" (Tylee, et al., 2007). From other studies, such as in the USA among girls younger than 18 years old attending family planning clinics, 47% would no longer attend if their parents were notified that they were seeking prescription birth control pills or devices, and another 10% would delay or discontinue STI testing or treatment (Reddy, et al., 2002). Thus, Kenya needs to develop an understanding of the barriers to seeking reproductive health services and how to improve sexual and reproductive health services for youth in order to prevent early pregnancy and reduce mortality.

11.4 Non-Communicable Diseases

The non-communicable causes accounted for 33.1% of all admissions and were diagnosed in 41.3% of the deaths. Anaemia was diagnosed in 6.1% of the patients admitted. Most of the anaemic patients were in Kisii Level 5 Hospital, which lies in the western part of the country. This area lies in a malaria zone and the anaemia may be as a result of prior malaria infection. The anaemia may also be a manifestation of nutritional deficiency or hookworm infestation. In this study there were 52 (0.6%) malnourished patients with 52% of them being in Kisii Level 5 Hospital. Up to 35% of children aged less than five years suffer from malnutrition in Kenya and it is unclear how many of the older children have nutritional deficiencies (Kenya National Bureau of Statistics (KNBS) & ICF Macro 2010).

Gertrude's Children's Hospital had 28% of patients suffering from non-communicable illness even though it contributed to only 20% of admissions. The private hospital had a higher representation of this

class of illnesses as it serves a slightly wealthier society, which is not primarily inflicted by infections but rather other ailments, including elective surgical procedures, and only had three (0.3%) admissions for maternal disorders.

Anaemia, diabetes and neoplasms, which were the top causes of NCDS in the six hospitals, have been documented in Sub-Saharan Africa by Dalal, et al. (2011).

11.5 Injuries

Injuries contributed to 630 (13.9%) of admissions and attributed to 11.9% of deaths. There were more males than females admitted and this is in keeping with other studies on injuries (Outwater, Webster & Mgaya, 2007; Patton, et al., 2009). Males were more likely to die due to injuries but this difference was not significant. The lack of a gender difference in injury deaths in this study was probably because the injuries were analysed as grouped and were not specified by type or cause. Some injury types, such as interpersonal violence, may increase with age and are more common in males whereas others, such as accidental non-intentional burns from hot fluids, may decrease with age and not have gender differences. There could also be regional differences, for example neonates formed the largest group of children who died from homicides in a study in Tanzania by Outwater (2010). A focus on injury types and outcomes by age and gender may result in similar findings to the Tanzanian study by Outwater (2010). In the current study, road traffic accidents and falls or trips were the leading cause of injuries as opposed to violence. These causes of injuries in our study are not gender specific and it may explain why the difference between male and female injury numbers was not significant. The causes of injury may be different between the different regions. With the exception of interethnic conflicts where the study age group is not usually involved there is little interpersonal violence reported in most parts of Kenya. Thus the causes of injury would be different from that in other countries or regions where interpersonal violence starts rising in this age group. For example, South Africa's injury pattern has a distinct gender profile with an increase in male homicide from the age of 15 years (Mathews, Abrahams, Jewkes, & Martin, 2013). However, taking note of the low proportion of patients who seek medical care after assault, as reported in the Violence Against Children survey (VACs) conducted in Kenya by the United Nations Children's Fund in 2010, and the poor documentation of causes or extent of injury, research at both community and hospital settings should be conducted in the country to capture the true aetiology, types and magnitude of injuries in children aged 5-17 years.

Of the injured patients, there was documentation on site of injury in 473 (75%), cause of injury in 460 (73%), and intent of injury in 431 (68%). Fractures were the most likely cause of admissions due to injuries, contributing to 4.2% of all admissions. The injuries sustained were most commonly to the head and distal limbs fractures; this was also noted by Kihiko, et al. (2010).

Injuries were mainly from road traffic accidents and falls or trips. This is in keeping with other studies in Africa and in Kenya where injuries, such as assault, burns and road traffic accidents are a major cause of morbidity and mortality among the young, especially males (Chalya, et al., 2010; Phillips-Howard, et al., 2012; Deen, Vos, Huttly & Tulloch, 1999; Blum & Nelson-Mmari, 2004; Patton, et al., 2009; Viner, et al., 2011; Sawyer, et al., 2012). Among those involved in RTAs in this study, motorcycles contributed to more than half of the injured patients. Motorcycle accidents are a rising cause of injury in Tanzania as well (Chalya, et al., 2010).

Burns were mainly caused by hot liquids and were more common in those aged 5-9 years or in females. At this age, the children may be starting to assist in household chores and culturally in Kenya, females take on a more domestic role like cooking. This could account for the fire and hot liquid burns among admissions.

Mbagathi District Hospital in Nairobi had the least number of injury patients. This could partly be due to the fact that it is close to a national referral hospital, where most patients self-refer in case of injury. Naivasha County Referral Hospital had only 15% of admissions but it had a 22.9% of injury patients, many of them from RTAs with soft tissue injury and fractures. This is probably due to the fact that the Naivasha County Referral Hospital is on a major highway in Kenya and patients from RTAs occurring in the area are taken to the hospital as the nearest health facility.

11.5.1 Child abuse and sexual assault

Any child who reported assault was treated as child abuse, since they are younger than 18 years. Although sexual assault was only reported in 0.4% of all admissions, 2.9% of those injured were due to sexual assault. In cases where there was documentation, physical child abuse was mostly by a person known to the child and abuse took place in the home.

Sexual abuse was documented across all the age groups. The Kenya VAC survey findings for abuse are much higher than what was found in this study, as only cases reported to the hospital were drawn on. The

low numbers detected in this study may be due to non-disclosure and under-reporting when admitted to hospitals, unlike the survey findings where children in households were directly asked. In both studies, the most common perpetrators were familiar people or those in authority with parents being the largest group of perpetrators of physical violence. Some studies have reported that most sexual assault occurs in children under 15 years but this study was not able to show this pattern (Blum & Nelson-Mmari, 2004). The lack of a pattern in sexual abuse associated with age might be due to non-disclosure by caretakers and poor documentation in the health facilities. This problem requires further research to be fully understood.

11.6 Age Effect

In most hospitals, admissions for females aged above 15 years rose due to maternal reasons, while the proportion of male admissions decreased. The in-hospital mortality rate for admitted patients was highest among 10-14 year olds overall in all hospitals, except in Naivasha District Hospital. The 10-14 year olds contributed 24.6% of all admissions yet they had 35.7% of the deaths. The gender-dependent increase in mortality rates seen globally (from 15 years for females and 20 years for males) was not noted in the study (Adazu, et al., 2005; Patton, et al., 2009; Viner, et al., 2011; Santelli & Galea, 2011).

11.7 Inter-Hospital Variations

Children aged 5-17 years old comprised less than 10% of total hospital admissions or deaths, except for Gertrude's Children's Hospital where they formed 11.2% of admissions and 10% of deaths. Gertrude's Children's Hospital has a higher fraction of children aged 5-17 years when compared to the total hospital admission as it serves only children aged 21 years and below and thus the older population with other ailments are not part of the denominator. This leads to the higher proportionate contribution of the age group under study.

The hospitals with the least referrals or absconders were Gertrude's Children's Hospital (0%) and Kisii Level 5 Hospital (07%). Non-communicable causes and injuries were referred more than communicable causes, probably for more diagnostic work up and/or management in higher level care hospitals. Kisii Level 5 Hospital had the highest number of admissions and the highest mortality among the hospitals. While it contributed 42% of all admissions, it accounted for a higher proportion (69.7%) of the deaths. Kisii Level 5 Hospital serves a densely populated area in the western region. Since it is a regional referral

hospital, it has a larger catchment area. This might explain why Kisii Level 5 Hospital had more admissions and fewer referrals to other hospitals. Gertrude's Children's Hospital is a private hospital that is considered a regional referral hospital for paediatric cases from other private hospitals.

Gertrude's Children's Hospital has more of the non-communicable causes of admissions, unlike the other hospitals, since it is a private facility that serves a population of a different socio-economic status. Gertrude's Children's Hospital's contribution among those aged 15-17 years was drastically reduced and it had more males than females. This is probably due to the fact that Gertrude's Children's Hospital does not usually admit women for pregnancy-related health problems like the rest of the study hospitals. Gertrude's Children's Hospital had more than 99% of their patients discharged alive. This may be due to the fact that their clientele are from a higher socio-economic class and their health-seeking behaviour is better. They may seek health services and get diagnosed and treated early before complications arise. It may also be a reflection of better quality care. Gertrude's Children's Hospital did not refer any patients as it is considered a referral facility for private hospitals in Nairobi and the region. This was not the case in Naivasha County Referral Hospital, which had the highest fraction of referred patients probably because it had more injury patients and most referrals were from injuries.

There are variations of burden of morbidity and mortality among the six hospitals. This information is useful in prioritising and managing the causes of morbidity and mortality, planning for supplies, commodities, and staff allocation.

12.0 STUDY LIMITATIONS AND THEIR MINIMISATION

The records did not have full documentation for all patients for the cause of injury, exact injuries sustained, intent (intentional or accidental), and extent of injuries. Such information, which may not have been written in the patient notes, was deduced by going through the rest of the patient records and inferring from the investigations done and the management plan for each of those patients whose documentation was not complete, including the actual diagnosis. However, since most files were missing data on the duration of hospital stay to death, the duration of stay to death could not be calculated.

The patients whose medical records could not be retrieved and whose age could not be ascertained ($n = 114$ for admissions from all six hospitals and $n = 3$ for deaths) were excluded from morbidity and mortality patterns of the study even if they were labelled as aged 5-17 years. The three deaths whose records were not obtained were all from one hospital but their admission details including the ages were ascertained from the electronic medical records.

Mortality rate was not calculated because of the unavailability of population data for each district and the catchment areas.

It was not possible to provide exact numbers of dual diagnosis because the data entry was not initially coded to capture this aspect.

13.0 CONCLUSION

Children aged 5-17 years form 6.9% of all hospital admissions and contribute 3.5% of all deaths. These children are dying prematurely or missing school due to illness, which should be prevented.

Infectious and maternal causes are still the leading cause of hospital admissions (70%) and deaths (60%) among the hospitals studied. The ratio of communicable and maternal reasons: non-communicable illnesses: injuries is approximately 5:2:1. The admissions and deaths are mainly from preventable and curable diseases, which should not be causing mortality with appropriate preventive and curative services.

A large proportion of patients aged 5-17 years were admitted for maternal (pregnancy related) reasons (42.1% of females aged 5-17 years). This is an indication of early sexual activity, which has long-term public health outcomes. This might also be an implication of a failure to provide adolescents with appropriate and accessible reproductive health services.

14.0 RECOMMENDATIONS

Further research needs to be conducted into the underlying factors impacting on teenage pregnancy in Kenya. It raises concerns regarding the availability of reproductive health services and care to children under the age of 18 years, as it needs to target reducing early pregnancies. These services should also be accessible and youth friendly to attract this age group. Reproductive health education, as well as where and when to seek health services should be included and emphasised in the school health programmes.

The Ministry of Health should strengthen the school health programme focused on prevention of the non-communicable and common infectious causes of admissions and deaths, such as pneumonia and malaria among 5-17 year olds. This is because almost all of these children are in school and it is the easiest place to reach them. The health workers should also improve diagnosis and documentation for illnesses, especially in injuries to capture the true aetiology, types and magnitude of injuries in children aged 5-17 years.

The health information system (HIS), in particular disease indexing and diagnosis, should be strengthened and adhered to in view of the lack of full details about patients in their records. Better information may be useful for disease morbidity and mortality patterns in all age groups with adequate monitoring and evaluation of implemented interventions. This will guide best practises and assist in determining what is effective and should be rolled out and sustained in the healthcare delivery systems.

15.0 DATA DISSEMINATION PLAN AND KNOWLEDGE TRANSFER

The findings of the study will be disseminated to relevant stakeholders and target audiences, including the Ministry of Health and paediatricians in Kenya. This will be done through conferences and the publication of findings in open access journals. The Ministry of Health will use the research findings in policy formulation.

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17.0 APPENDICES

Appendix 1A: Category 1 Reasons for Hospital Admission (number and percent of all hospital admissions for 5-17 year olds)

COMMUNICABLE DISEASES, MATERNAL AND NUTRITIONAL (CATEGORY 1)														
1A: Common infections (such as HIV, diarrhoea, and meningitis)														
Causes	Kisii Level 5 Hospital		Naivasha County Referral Hospital		Karatina Hospital		Garissa Provincial General Hospital		Mbagathi District Hospital		Gertrude's Children's Hospital		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Malaria	395	70.5	44	7.9	1	0.2	30	5.4	42	7.5	48	8.6	560	12.4
Gastroenteritis	51	23.4	20	9.2	21	9.6	17	7.8	24	11.0	85	39.0	218	4.8
Typhoid	5	50.0	0	0.0	0	0.0	1	10.0	3	30.0	1	10.0	10	0.2
HIV/AIDS	37	37.8	10	10.2	8	8.2	0	0.0	41	41.8	2	2.0	98	2.2
Meningitis/encephalitis	91	48.7	14	7.5	19	10.2	20	10.7	36	19.3	7	3.7	187	4.1
UTI	16	21.9	8	11.0	6	8.2	5	6.8	4	5.5	34	46.6	73	1.6
Tuberculosis	25	30.1	14	16.9	6	7.2	11	13.3	22	26.5	5	6.0	83	1.8
Abscess	11	21.2	20	38.5	2	3.8	3	5.8	1	1.9	15	28.8	52	1.2
Cellulites	38	60.3	9	14.3	1	1.6	7	11.1	1	1.6	7	11.1	63	1.4
Others in 1A	38		16		7		10		5		38		114	2.5
Total in 1A	707		155		71		104		179		242		1458	32.3
1B: Respiratory infections														
Pneumonia/ respiratory tract infections	59	21.5	24	8.8	25	9.1	19	6.9	49	17.9	98	35.8	274	6.1
URTI/ pharyngitis /tonsillitis	1	0.8	0	0.0	0	0.0	0	0.0	0	0.0	132	99.2	133	2.9
Otitis media	2	12.5	1	6.2	0	0.0	2	12.5	0	0.0	11	68.8	16	0.4

Other respiratory infections	16	6.5	36	14.6	20	8.1	12	4.9	2	0.8	161	65.2	247	5.5	
Others in 1B	3	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	3	0.1	
Total in 1B	81		61		45		33		51		402		673	14.9	
1C: Maternal causes/reasons															
Abortion	38	43.7	18	20.7	8	9.2	13	14.9	10	11.5	0	0.0	87	1.9	
Delivery (normal)	373	50.6	120	16.3	65	8.8	107	14.5	72	9.8	0	0.0	737	16.3	
Delivery (C/S)	105	64.8	19	11.7	8	4.9	23	14.2	7	4.3	0	0.0	162	3.6	
Haemorrhage (APH/PPH)	5	23.8	1	4.8	2	9.5	5	23.8	7	33.3	1	4.8	21	0.5	
Others in 1C	40		19		4		10		3		2		78	1.7	
Total in 1C	561		177		87		158		99		3		1.085	24.0	
1E: Nutrition or Malnutrition	13	52.0	1	4.0	1	4.0	4	16.0	3	12.0	3	12.0	25	0.6	
Category 1 Total	N	1362		394		204		299		332		650		3.241	71.7
	%		42.0		12.2		6.3		9.6		10.2		20.1	100.0	

Appendix 1B: Category 2 Reasons for Hospital Admission (Number and percent of all hospital admissions for 5-17 year olds)

NON-COMMUNICABLE DISEASE (CATEGORY 2)														
Causes	Kisii Level 5 Hospital		Naivasha County Referral Hospital		Karatina Hospital		Garissa Provincial General Hospital		Mbagathi District Hospital		Gertrude’s Children’s Hospital		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Anaemia	206	74.6	18	6.5	5	1.8	5	1.8	34	12.3	8	2.9	276	6.1
Sickle cell disease	50	61.7	10	12.3	0	0.0	2	2.5	9	11.1	10	12.3	81	1.8
Other blood disorders	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	7	100.0	7	0.2
2A: Neoplasms														

Leukaemia	3	21.4	1	7.1	0	0.0	3	21.4	1	7.1	6	42.9	14	0.3
2B: Other neoplasms														
	16		4		1		8		0		9		38	0.8
2C: Diabetes														
Diabetes	10	23.8	10	23.8	2	4.8	13	31.0	4	9.5	3	7.1	42	0.9
2D: Endocrine disorders														
Thyroid disease	0	0.0	2	33.3	0	0.0	3	50.0	0	0.0	1	16.7	6	0.1
2E: Neuropsychiatric conditions														
Epilepsy/ convulsive disorder	24	19.4	24	19.4	20	16.1	6	4.8	7	5.6	43	34.7	124	2.7
Psychosis	1	25.0	0	0.0	0	0.0	1	25.0	1	25.0	1	25.0	4	0.1
Others in 2E	63		13		1		4		1		4		86	1.9
2F: Sense organ diseases														
	36		2		1		3		0		31		73	1.6
2G: Cardiovascular diseases														
Rheumatic fever/ heart disease	26	59.1	8	18.2	4	9.1	3	6.8	2	4.5	1	2.3	44	1.0
Others in 2G	9		3		0		0		4		4		20	0.4
2H: Chronic respiratory diseases such as asthma														
	14		12		4		10		3		102		145	3.2
2I: Digestive diseases														
Hernia	15	36.6	15	36.6	1	2.4	1	2.4	0	0.0	9	22.0	41	0.9
Constipation/ faecal impaction	1	2.6	0	0.0	1	2.6	0	0.0	0	0.0	37	94.9	39	0.9
Others in 2I	53		52		20		24		32		51		232	5.1
2J: Genitourinary diseases														
	29		31		7		9		7		69		152	3.4
2K: Skin diseases														

		5		5				2		1		19		32	0.7
Musculoskeletal disorders															
		6		2		3		0		0		4		15	0.3
Congenital anomalies															
		10		3		1		6		0		4		24	0.5
Category 2 total	N	577		215		71		103		106		423		1495	33.1
	%		38.6		14.4		4.7		6.9		7.1		28.3	100.0	

Appendix 1C: Category 3 Reasons for Hospital Admission (Number and percent of total hospital admissions for 5-17 year olds)

INJURIES (CATEGORY 3)															
Causes		Kisii Level 5 Hospital		Naivasha County Referral Hospital		Karatina Hospital		Garissa Provincial General Hospital		Mbagathi District Hospital		Gertrude’s Children’s Hospital		Total	
		N	%	N	%	N	%	N	%	N	%	N	%	N	%
Animal bites		12	80.0	0	0.0	0	0.0	3	20.0	0	0.0	0	0.0	15	0.3
Sexual assault		11	73.3	2	13.3	1	6.7	1	6.7	0	0.0	0	0.0	15	0.3
Head injuries		25	69.4	0	0.0	0	0.0	8	22.2	0	0.0	3	8.3	36	0.8
Eye injuries		42	87.5	0	0.0	1	2.1	3	6.2	1	2.1	1	2.1	48	1.1
Fractures		61	32.4	56	29.8	22	11.7	8	4.3	0	0.0	41	21.8	188	4.2
Open wounds		20	28.2	2	2.8	1	1.4	6	8.5	2	2.8	40	56.3	71	1.6
Soft tissue injuries and lacerations		13	13.5	38	39.6	25	26.0	2	2.1	0	0.0	18	18.8	96	2.1
Burns		22	48.9	13	28.9	5	11.1	1	2.2	0	0.0	4	8.9	45	1.0
Poisoning		33	44.6	23	31.1	12	16.2	3	4.1	2	2.7	1	1.4	74	1.6
Others in 3		19		10		7		8		2		19		65	1.4
Category 3 Total	N	257		144		69		42		7		111		630	13.9
	%		40.8		22.9		11.0		6.7		1.1		17.6		100.0

Appendix 2: Deaths by Age Group, Gender and Hospital (percentages across the hospital)

Age group	Sex	Kisii Level 5 Hospital	Naivasha District Hospital	Karatina District Hospital	Garissa Provincial General Hospital	Mbagathi District Hospital	Gertrude's Children's Hospital	Total
5-9 years	M	24 (54.5%)	4 (80.0%)	2 (50.0%)	2 (50.0%)	2 (40.0%)	1 (50.0%)	35 (54.7%)
	F	20 (45.5%)	1 (20%)	2 (50.0%)	2 (50.0%)	3 (60.0%)	1 (50.0%)	29 (45.3%)
Hospital age group total		44 (40.4%)	5 (38.5%)	4 (44.4%)	4 (44.4%)	5 (50.0%)	2 (28.6%)	64 (40.8%)
10-14 years	M	24 (61.5%)	2 (66.7%)	1 (33.3%)	3 (100%)	2 (66.7%)	2 (40.0%)	34 (60.7%)
	F	15 (38.5%)	1 (33.3%)	2 (66.7%)	0	1 (33.3%)	3 (60.0%)	22 (39.3%)
Hospital age group total		39 (35.8%)	3 (23.1%)	3 (33.3%)	3 (33.3%)	3 (30.0%)	5 (71.4%)	56 (35.7%)
15-17 years	M	13 (50.0%)	5 (100%)	2 (100%)	0	1 (50.0%)	0	21 (56.8%)
	F	13 (50.0%)	0	0	2 (100%)	1 (50.0%)	0	16 (43.2%)
Hospital age group total		26 (23.9%)	5 (38.5%)	2 (22.2%)	2 (22.2%)	2 (20%)	0	37 (23.6%)
Hospitals all study ages totals	M	61 (56.0%)	11 (84.6%)	5 (55.6%)	5 (55.6%)	5 (50.0%)	3 (30.0%)	90 (56.2%)
	F	48 (44.4%)	2 (15.4%)	4 (44.4%)	4 (44.4%)	5 (50.0%)	4 (40.0%)	67 (41.9%)
	Unknown	0	0	0	0	0	3 (30.0%)	3 (1.9%)
	Total	109 (100%)	13 (100%)	9 (100%)	9 (100%)	10 (100%)	10* (100%)	160* (100%)

* Details could not be obtained for three patients from Gertrude's Children's Hospital

Appendix 3: Mortality Proportion by Sex and Hospital

	Kisii Level 5 Hospital		Naivasha District Hospital		Karatina District Hospital		Garissa PGH		Mbagathi DH		Gertrude's Children's Hospital		Total	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Total deaths														
	1 793		613		558		311		685		70		4 030	
Deaths for 5-17 year olds														
Male	61	56.0	11	84.6	5	55.6	5	55.6	5	50.0	3	30.0	90	57.3
Female	48	44.0	2	15.4	4	44.4	4	44.4	5	50.0	4	40.0	67	42.7
Total	109	100.0	13	100.0	9	100.0	9	100.0	10	100.0	10*	100.0	160*	100.0
Fraction for each hospital to total 5-17 year olds deaths														
	69.4%		8.3%		5.7%		5.7%		6.4%		4.5%		100.0%	
Fraction of 5-17 year old to total deaths (%)														
		6.1%		2.1%		1.6%		2.9%		1.5%		14.3%		3.9%

* Includes three patients whose records could not be obtained.

18.0 ETHICAL APPROVAL LETTERS

Appendix 4A: University of Cape Town IRB Approval



UNIVERSITY OF CAPE TOWN
Faculty of Health Sciences
Human Research Ethics Committee



Room 342-48 University Building
Groote Schuur Hospital
Observatory 7925
Telephone: (021) 406 0452 • Facsimile: (021) 406 0411
Email: hsf.ethics@uct.ac.za / hsf@uct.ac.za
Website: www.healthsciences.uct.ac.za/observatory/hsf-humanethics/observatory

29 May 2014

HREC/REF:347/2014

A/Prof S Mathews
Children's Institute
46 Sawkins Road
Rondebosch

Dear A/Prof Mathews

Project Title: MORBIDITY AND MORTALITY AMONG 5-17 YEAR OLD CHILDREN ADMITTED IN SIX HOSPITALS IN KENTA IN 2013-Mphil- B Osano

Thank you for submitting your study to the Faculty of Health Sciences Human Research Ethics Committee for review.

It is a pleasure to inform you that the HREC has formally approved the above mentioned study.

Approval is granted for one year until the 30 May 2015.

Please submit a progress form, using the standardized Annual Report Form, if the study continues beyond the approval period. Please submit a Standard Closure form if the study is completed within the approval period.

We acknowledge that the following student/s:- Bonface Osano is also involved in this project.

Please note that the on-going ethical conduct of the study remains the responsibility of the principal investigator.

Please quote the HREC REF in all your correspondence.

Yours sincerely

PROFESSOR M BLOCKMAN
CHAIRPERSON, HSF HUMAN ETHICS

Federal Wide Assurance Number: FWA00001637.

HREC/REF:347/2014

Appendix 4B: Kenyatta National Hospital – University of Nairobi ERC Approval



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P.O. BOX 19676, Nairobi
Telephone: 254-20-2726300 Fax: 44155

KNH/UoN-ERC
Email: knh_erc@uonbi.ac.ke
Website: www.uonbi.ac.ke



KENYATTA NATIONAL HOSPITAL
P.O. BOX 24723, Nairobi
Tel: 254-20-2726300
Fax: 725272
Telegram: MEDNET, Nairobi

Ref: KNH-ERC/A/206

Link: www.uonbi.ac.ke/activities/KNHUoN

24th June 2014

Dr. Bonface Ombaba Osano
Dept. of Paediatrics and Child Health
School of Medicine
University of Nairobi

Dear Dr. Osano

RESEARCH PROPOSAL: MORBIDITY AND MORTALITY AMONG 5-17 YEAR OLD CHILDREN ADMITTED IN SIX HOSPITALS IN KENYA IN 2013 (P210/D4/2014)

This is to inform you that the KNH/UoN-Ethics & Research Committee (KNH/UoN-ERC) has reviewed and approved your above proposal. The approval periods are 24th June 2014 to 23rd June 2015.

This approval is subject to compliance with the following requirements:

- Only approved documents (informed consents, study instruments, advertising materials etc) will be used.
- All changes (amendments, deviations, violations etc) are submitted for review and approval by KNH/UoN-ERC before implementation.
- Death and life threatening problems and severe adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH/UoN-ERC within 72 hours of notification.
- Any changes, anticipated or otherwise that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH/UoN-ERC within 72 hours.
- Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. *(Attach a comprehensive progress report to support the renewal)*.
- Clearance for export of biological specimens must be obtained from KNH/UoN-Ethics & Research Committee for each batch of shipment.
- Submission of an executive summary report within 90 days upon completion of the study. This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/or plagiarism.

For more details consult the KNH/UoN-ERC website www.uonbi.ac.ke/activities/KNHUoN.

Yours sincerely

PROP: M.C. CHINDIA
SECRETARY, KNH/UoN-ERC

- s.d:
- The Principal, College of Health Sciences, UoN
 - The Deputy Director CS, KNH
 - The Chairperson, KNH/UoN-ERC
 - The Assistant Director, Health Information, KNH
 - The Dean, School of Medicine, UoN
 - The Chairman, Dept. of Paediatrics & Child Health, UoN
 - Supervisors: Prof. Dr. Shanzu Mathews, University of Cape Town
 - Prof. Fred N Wani, Dept of Paediatrics & Child Health, UoN

Appendix 4C: Kisii Level 5 Hospital Approval

KISII COUNTY GOVERNMENT



MINISTRY OF HEALTH

Telegrams:-
Telephone:-
E-mail:-
Ref:-
Date: 18th July 2014

DEPARTMENT OF RESEARCH
KISII LEVEL 5 HOSPITAL
P.O. BOX 93-40200
KISII

Dr. Bonface Osano

RE: Data a Collection at Kisii Level 5 Hospital

This is to inform you that the department of research at Kisii Level 5 Hospital has reviewed your proposal titled: **Morbidity and Mortality among 5-17 year old Children admitted in six Hospitals in Kenya in 2013**. The following are our comments:

You are authorized to proceed with data collection upon payment of Kshs.2000.

Please ensure a copy of final Study report is sent to us for retention, information and use.

Dr. Crispus Nyongesa MBChB (NRB), MPH(Med), dip-si/trn-aids (NRB)
Head, Department of Research

CC: 1.Medical Superintendent-Kisii Level 5;

Appendix 4D: Naivasha County Referral Hospital Approval

MINISTRY OF HEALTH

Telegrams Medical –Naivasha

Telephone: 030 - 2020053
050 - 2020576



Medical Superintendent
Naivasha County Referral Hospital
P. O. Box 141
NAIVASHA

Our Ref: NYA/ADM/66/YOL/P57

3rd July 2014

Bonface O. Osano

RE: APPROVAL TO CONDUCT RESEARCH IN NAIVASHA COUNTY REFERRAL HOSPITAL

Thank you for choosing to conduct research at our hospital. We note you have received ethical approval from the KNH-UoN ERC and the University of Cape Town IRB.

Your research entitled ***MORBIDITY AND MORTALITY AMONG 5 – 17 YEARS OLD CHILDREN ADMITTED IN SIX HOSPITALS IN KENYA IN 2013,*** Your study has been approved by the Hospital Administration.

We look forward to receive a written feedback of your findings.

Thank you.



DR. MBURU J. M.
MEDICAL SUPERINTENDENT
NAIVASHA COUNTY REFERRAL HOSPITAL

Appendix 4E: Karatina Hospital Approval

REPUBLIC OF KENYA



COUNTY GOVERNMENT OF NYERI DEPARTMENT OF HEALTH SERVICES

karatinahospitalnyeri.com

MEDICAL SUPERINTENDENT
KARATINA HOSPITAL
P.O. Box 133-10101
KARATINA

OUR REF: KRT/ST//11/VOL.8/119

Date: 3rd July, 2014

Dr. Boniface Osano
Lecturer Department of paediatrics
University of Nairobi
P.O BOX 19676
KENYA

RE: APPLICATION TO CONDUCT RESEARCH IN KARATINA DISTRICT HOSPITAL

Your request to conduct research in Karatina District Hospital entitled " MCREIDITY AND MORTALITY AMONG 5-17 YEARS OLD CHILDREN ADMITTED IN SIX HOSPITALS IN KENYA IN 2013" has been approved by the hospital training committee.

You are therefore required to commence collection of data for your research immediately.

You are also required to provide a copy of your research findings by the end of your research period.

SUPERINTENDENT
DISTRICT HOSPITAL
BOX 133 KARATINA

DR. B M NGARI-CHAIRMAN TRAINING COMMITTEE
FOR: MEDICAL SUPERINTENDENT
KARATINA HOSPITAL NYERI COUNTY

CC
KENYATTA NATIONAL HOSPITAL

MINISTRY OF HEALTH



Telegrams: "MEDICA" Garissa
Telephone: (046) 2264/2147
Fax: PGP/GSA/STI/ATT/DIR (1901)

PROVINCIAL GENERAL HOSPITAL
P.O. Box 29
GARISSA
4th July, 2014

Dr. Boniface Osano
Lecturer
Department of Paediatrics and Child Health
0722646720

**RE: MORBIDITY AND MORTALITY AMONG 5-17 YEAR OLD CHILDREN ADMITTED
SIX HOSPITAL IN KENYA.**

Yours letter dated 30th June, 2014 on the above subject refers.

Your request to conduct the above research I hereby granted

You are required to share the finding of the research with our institution.

Good luck.

Dr. Hussein Osmat
Ag. Medical Superintendent
Garissa Provincial General Hospital

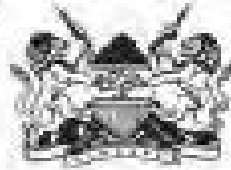
Appendix 4G: Mbagathi District Hospital Approval

MINISTRY OF MEDICAL SERVICES

Tel: 2724712, 2725791, 3721 311808

Email: medicalaffairs@kenya.com

Our Ref: med/sup/rsc/1/7-14



Mbagathi District Hospital

P.O. Box 20725- 00202

Nairobi

1 July 2014

Boniface Ominah Omondi
University of Cape Town

Dear Sir:

RE: APPLICATION FOR RESEARCH AUTHORIZATION

This is in reference to your application for authority to carry out research on "Morbidity and mortality among 5-17 year old children admitted in six hospitals in Kenya."

I am pleased to inform you that your request to undertake the research in the hospital has been granted.

And on completion of the research you are expected to submit one hard copy and one soft copy of the research report / thesis to this office.


Dr. Josephine Mwangi
Secretary Hospital Research Committee
Mbagathi District Hospital

Appendix 4H: Gertrude's Children's Hospital Ethical Approval



August 14, 2014

REF: GCH/ERB/VOLXIV/25

Dr. Boniface Osano
Department of Paediatrics and Child Health
School of Medicine
University of Nairobi

Dear Dr. Osano,

RE: REQUEST TO UNDERTAKE RESEARCH

We are in receipt of your proposal requesting to conduct a study: **"Morbidity and Mortality among 5-17 year old children admitted in six hospital in Kenya in 2013 (P210/04/2014)"**

The Hospital's Ethical Review Board has reviewed and **approved** your request to conduct the study

However, the Board has made the following observations which you should nevertheless address even as you commence your study:

- i). ERC approval by University of Cape Town, referred to in the application, has not been provided and should be availed for record
- ii) Provide a clear method of how you will address missed data including total number of patients between age of 5 and 17 and where diagnosis may have been omitted.
- iii) It is inaccurate to state that in Kenya we allow collecting retrospective data without consent. Rather, rephrase the sentence to read that you will request ERC's to waive consent
- iv) The primary objective should be amended to read: "To determine the morbidity and mortality rates among children aged 5 -17 years admitted in six hospitals in Kenya in the 2013 calendar year" in order to be consistent with other sections of the protocol and also reflect the true purpose of the study.

Please note that this approval is only to conduct the study and is not an approval for publication or presentation of findings. A separate approval will be required for this purpose.

The Hospital will require the write up of your study findings upon completion as this will form part of our database for future references. **Meeting this requirement will be a**

condition for granting approvals for publications or presentations of research findings in the future.

On behalf of the Hospital I wish you a fruitful research.

Regards,

Dr. Thomas Ngwiri
**SECRETARY
GERTRUDE'S CHILDREN'S HOSPITAL
ETHICAL REVIEW BOARD**

Appendix 5: Data Collection Forms

Study subject unique number		Response						
Data collector code								
Date of collection	___/___/20___ (DD/MM/YY)							
In patient number								
Hospital name								
Total number of patients admitted in hospital in 2013								
Date of birth (If unknown write 99/99/9999)	___/___/___ (DD/MM/YYYY)							
Age (completed years)	_____ years							
Gender	Male.....1 Female.....2							
Date of admission	___/___/20___ (DD/MM/YY)							
Number of admissions in year	<table border="1"><tr><td>1</td><td>2</td><td>2</td><td>4</td><td>5</td><td>6</td></tr></table>	1	2	2	4	5	6	
1	2	2	4	5	6			
Date of discharge/death/referral	___/___/20___ (DD/MM/YY)							
Outcome	Death 1 Discharged/Alive 2 Referred 3 Absconded 4 Unknown 5							
Duration of symptoms (circle unit of measure)	Days 1 Weeks 2 Months 3							
Diagnosis at discharge	(Enter correct key number) Refer to key at end of questionnaire, if not on key, write full diagnosis. Other not in Key (specify).....99							
HIV status	Positive.....1 Negative.....2 Unknown.....3							
For trauma patients please fill the section below								
Site of injury (enter all that apply)	Head injury.....1 Chest injury.....2 Abdominal injury.....3 Upper limb injury.....4 Lower limb injury.....5 Genital injury.....6 Others (Please specify).....7							
Type of injury	Abrasions.....1 Soft tissue injury.....2 Fractures.....3							

	Others.....4 (Please specify)		
Cause of trauma (enter all that apply)	Road traffic accident.....1 Assault.....2 Gunshot wounds.....3 Burns.....4 Drowning 5 Sexual assault.....6 Child abuse 7 Unknown.....8		
Road traffic accident involvement as	Pedestrian.....1 Passenger.....2 Driver.....3 Unknown 4		
Road traffic accident caused by	Motor vehicle.....1 Motorbike.....2 Bicycle.....3 Others.....4 (Please specify)		
Assault caused by (enter all applicable)	Friends.....1 Family.....2 Strangers.....3 Others.....4 (Please specify)		
Assaulted in (place)	School.....1 Home.....2 In a social place such as restaurant/bar.....3 Others 4 (Please specify)		
Site of gunshot wound	Limbs.....1 Head.....2 Chest.....3 Abdomen.....4 Others 5 (Please specify)		

Diagnosis Key:

DISEASE DIAGNOSIS			KEY NUMBER
HIV/AIDS			1
Malaria			2
Anaemia			3
Sickle cell disease			4
RS	Tuberculosis		5
	Pneumonia		6
	Other respiratory tract infection		7
	Asthma		8
GIT	Diarrhoea/gastroenteritis		9
		Shigella	10
		Cholera	11
	Typhoid		12
	Intestinal worms		13
	Hepatitis		14
	Peptic ulcer disease (PUD)		15
	Appendicitis		16
	Hernia		17
CVS	Rheumatic fever/heart disease		18
	Cerebrovascular accident		19
	Congenital heart disease		20
	Endocarditis		21
CNS	Meningitis		22
	Epilepsy		23
Pregnancy related (RH)	Haemorrhage		24
	Sepsis		25
	Abortion		26
	Normal delivery		27

	Caesarean section		28
Sexually transmitted disease (STD)			29
Neoplasms	Leukaemia		30
	Liver cancer		31
	Stomach cancer		32
	Cervical cancer		33
Mental illness	Schizophrenia		34
	Drug abuse	Alcohol	35
		Marijuana	36
Diabetes			37
Kidney disease			38
Urinary tract infection			39
Skin/muscle	Abscess		40
	Cellulitis		41

Filled by:

Name Signature Date