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DESCRIBING PAEDIATRIC BURN INJURIES AT AN ACADEMIC HOSPITAL IN BLANTYRE, MALAWI

Idah Mzama

A research report submitted to the Faculty of Health Sciences, University of the Witwatersrand, Johannesburg in partial fulfillment of the requirements for the Degree of Master of Science in Medicine Child Health Community Pediatric

DECLARATION

I, Idah Mzama declare that this research report is my own work. It is being submitted for the Degree of Master of Science in Medicine Child Health Community Pediatrics at the University of Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other University.



Mrs. Idah Mzama

5 October 2016

DEDICATION

This dissertation is dedicated to my mother, Mrs. Agnes Jack Phiri who was critically ill during the first year of my study. I thank God almighty for His healing hand that touched her.

ABSTRACT

Introduction and back ground

Burn injuries in children remain one of the leading causes of deaths and disabilities worldwide. It is estimated that 5 million children die from burn injuries every year. In Malawi burn injuries are reported to be the third leading cause of deaths in children. No known study has been conducted at Queen Elizabeth Central Hospital (QECH) Burns Unit to describe the characteristics of children with burn injuries and their outcomes. However, an observation study was conducted previously that looked only at the aetiology, presentation and management of all the burn injuries that were being attended to at QECH. On the other hand, the current descriptive, retrospective, quantitative study aimed at describing the characteristics of the paediatric burn injuries at an academic hospital in Blantyre, Malawi.

Methodology

The study used descriptive, retrospective design that employed quantitative data collection and analysis methods. The study reviewed 148 patients' files of paediatrics with burn injuries admitted during the period from September 2011 to August 2012 at the Burns Unit of QECH in Malawi.

The study used a checklist to extract information on demographics, causes, anatomical distribution, depth, place of incidence of the burn injury, period taken from time of incidence to time of arrival to hospital, season of the year when the incidence occurred, whether the child had been admitted straight to QECH or referred, complications that occurred, period of hospitalisation and outcomes. Data was analysed using Microsoft Excel 2007® (Microsoft, Seattle, USA). For the purpose of descriptive analysis, data was then exported to Statistical 9.1® (Stat soft, Tulsa, USA) which was utilised for all other analysis.

Results

Results of the study showed that 51% (n=75) of the children admitted with burns over the period of the study were boys while 49% (n=73) were girls. Furthermore, males admitted with burn injuries were significantly younger than the females (p = 0.001 [Figure 2]). The median age for boys was 3 years (IQR: 2-4 years) whereas the median age for girls was 4 years (IQR: 2-6 years). Hot liquids and open fire were the only sources of burn injuries with hot liquids affecting 68% of children. The Arms and hands were the most affected body parts with about 59% while the least was the back. The depth of the burns were 17.2% (n=25) superficial, 52.7% (n=78) superficial partial, 7.5% (n=11) deep partial and 22.6% (n=34) full thickness burns. The incidents of burn injury that occurred in the home premises were 96.6% (n=143), 2% (n=3) at school and 1.4% (n=2) in the surrounding gardens. There were 42.5% (n=63) incidents of burn injuries that occurred in cool dry winter season, 43.8% (n=65) in warm wet and 13.7% (n=20) in hot dry season. The outcome of the burn injuries were that the median length of hospitalisation was 14 days (IQR: 7-27).The children who were discharged were 75.7% (n=112) and had median of 16 days (IQR: 11-29 days) in hospital. The children who died were 24.3% (n=36) and had median of hospital stay of 5 days (IQR: 3-10 days). Children who died spent significantly less number of days in hospital than those that were discharged. Out of 148 children, 59 were referred from other health centres to QECH representing 40%. Children that were admitted directly to QECH were associated with a 57% decreased odds of mortality compared to those referred from other health facilities OR 0.43 (95% CI: 0.20-0.93).

Conclusion

The study concluded that the male and female children were almost equally vulnerable to burn injuries. Hot liquids and open fire were found to be the only sources of burn injuries in

this study. This was due to cooking places that were at ground level which were easily accessible by the children.

Those that were referred from other health facilities were associated with 4 times odds of death from burn injuries compared to those that were admitted straight to Queen Elizabeth Central Hospital (OR 3.79 (95% CI: 1.33-10.79), $p<0.001$. Based on the results, it could also be concluded that burn injuries in children mostly affected the under five year children. The mortality was greatly influenced by the referral systems, total burnt surface area (TBSA), depth of the burns, and age of the child.

Results of the study have implications on improving the referral system and community sensitisation on the prevention of burns.

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LIST OF ABBREVIATIONS

DALY: Disability Adjusted Life Years

EMI: Emergency Medicine International

Hr: Hour

HREC: Human Resource Ethics Committee

IQR: Interquantile Ranges

Kg: Kilogram

Ml: Millitres

NHSRC: National Health Sciences Research Committee

OR: Odds Ratio

QECH Queen Elizabeth Central Hospital

SIRS: Severe Inflammatory Response Syndrome

TBSA: Total Burnt Surface Area

WHO: World Health Organisation

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CHAPTER ONE

1.0 Introduction

Burns are traumatic injuries to the skin and other epithelial surfaces as a result of contact with fire, chemicals, electricity, steam and hot liquids. Chapter one presents the background and literature review of the study on burn injuries in children globally, regionally and Malawi.

1.1 Background

Burn injuries affect millions of children worldwide and they result in disruption to the skin's various physiologic functions mainly in two ways. The loss of the skin's infection barrier function thus placing the individual at risk for infections due to the damage to the skin's epithelium which often leads to potentially disastrous loss of fluids and electrolytes and allow locally invading organisms (1).

Patients with burn injuries are at risk of developing severe inflammatory response syndrome (SIRS) which leads to further intravascular fluid losses, thus, potentiating systemic complications such as shock and anaemia (1). Shock and anaemia comes about due to increased generalised permeability of the blood capillaries (2). This occurs due to systemic inflammatory mediators and hypo proteinemia which causes oedema of the surrounding non burnt tissues as well (2). This leads to excessive leakage of plasma especially in the first hours after burnt resulting into hypovolaemia, hypoproteinimia, heamoconcentration acid base disturbances and electrolyte imbalance (2). Because of this, plasma volume and cardiac output are reduced while peripheral vascular resistance increase. In the absence of prompt fluid replacement, hypovolaemic shock becomes imminent (2). Amount of fluids required to resuscitate the child can be estimated by using the total burnt surface area (TBSA) and the weight of the child (2). The depth and extent of the burn injuries depend on the duration of

the exposure to the source of heat or chemical (3). The depth of burn wound refers to number of skin layers and other structures that have been destroyed by the heat entering into the body(3). The extent of burn injuries refers to the surface area that has been affected by the burns (3). The outcome of the burn injuries are influenced by the TBSA, depth of the burns, age of the child, nutritional status, and the quality of assessment and management of the burn injury by the care provider (3). Age of the child influences the outcome because the child has a small surface area as a result the burns which appear to be minor to an adult can be regarded as severe to the child (3). Therefore the younger the child, the less are the chance of survival to burn injuries (4). On the other hand good nutrition status boosts up immunity while malnutrition lowers immunity resulting in the body's failure to fight the infections which might infect the burn wound and chances of survival are reduced (4). Inadequate assessment informs inappropriate resuscitation and management resulting in poor outcomes. It is essential to a thorough assessment and apply appropriate resuscitation measures, surgical interventions, and infection prevention measures to prevent sepsis and secondary complications which may lead to loss of children's lives (4).

Burn injuries in children represent an international public health problem in both developed and developing countries. It is noted that different countries report similar challenges with respect to prevention and management of burn injuries in children (5). Although the numbers of burn injuries have decreased in developed countries, challenges on prevention remain the same (5). Burn injuries in children are the leading cause disabilities and deaths worldwide. It is estimated that each year approximately 950,000 children under the age of 18years die from burn injuries every year (6). Furthermore, millions of children develop a temporary or permanent disability, which creates a burden for the individual, family and society (6).

According to Outwater et al., (2013), about 43,000 children die from burn injuries in Africa each year. The burden placed on developing countries is greater, especially in Sub-Saharan Africa than in developed countries due to limited burn care resources (7). It has been reported that at QECH Burns Unit in Blantyre, Malawi, children with burn injuries who die every year those who are referred from other health facilities and those who are admitted straight to the burns unit range from 16.8% - 29% (8). This is the biggest Burns Unit in Malawi. However, no study has been done to describe the characteristics of children with burn injuries at the burns unit of QECH hence the need to conduct the study.

1.1.1 General description of burn injuries

Burn injuries have long been recognized as the most painful and devastating injuries a child can sustain and yet survive. The pain comes about due to the involvement of the nerves, regardless of the type of burns (4). The severity of burn injuries mostly depends on the depth and percentage of the TBSA. Burn injuries are classified according to depth. There are four categories, such as superficial, superficial partial, deep partial and full thickness burns (9). Superficial burns are always very painful, as they expose the nerve endings on the epidermis and do not cause blisters. They do not cause much fluid loss and they heal without scarring (3).

Superficial partial burn injuries are very painful. They involve partial destruction of the dermis, penetrating about 50%, affecting the nerve fibres causing more pain (9). They give the skin a red appearance with blister formation and some fluid loss. The healing process occurs within 7-10 days causing minimal scarring. The deep partial burns are white and pale, whereby the nerves are destroyed and are less painful but with excess fluid loss. The healing process takes 2-3 weeks (9). The full thickness burns are the most severe type. There is destruction of the epidermis and dermis; and penetrate more deeply into underlying

structures. The sensory nerves in the dermis are destroyed; with no pain hence the sensation to a pinprick is lost**.** The appearance is white and waxy. There is critical fluid loss and there is coagulated dead skin which has a leathery appearance, called Escher (2). This renders the child potential for sepsis (9).

1.1.2 Sources of burn injuries

Burn injuries in children are due to a variety of sources. For example, it may result from hot liquids spillage, flow or/and immersion. This is common in places where cooking activities often occur at ground level (10). Burns that occur as a result of hot liquids are known as scalds. In Africa scalds are the commonest type of burn injuries among children under the age of five years, accounting for over 65% (4). The other source of burn injuries are open fires. This occurs when the child comes into contact with the flame or burning charcoal. The other source is flame which is associated with increased incidents. This is common in times when a house catches fire. There are fumes and carbon dioxide that can be inhaled which causes inhalation injury. This results in increased morbidity and mortality due to carbon dioxide intoxication (11). In addition, the other source of burn injuries is direct contact with hot objects such as household appliances which include pressing iron, cooking hot plates (4).

Another source of burn injury is electricity that causes electrical burn injuries. These are sustained by electrical objects which are connected to the power outlets that are located within the house that are within children's reach or at the floor level (3).

Children can also sustain burns due to chemicals. Chemical burns are as a result of contact with or consumption of corrosive chemicals that are placed within the reach of the children such as acid (10). Chemical burn injuries involve prolonged tissue damage even after removal from the source such as hydrofluoric acid.

1.1.3 Assessment of a child with burn injuries

The comprehensive assessment of a child with burn injuries is needed for the proper management (12). In the burnt child, regardless of the cause of the burn injury, airway patency, breathing and circulation should be assessed (ABC approach) (12-13). The assessment should proceed with obtaining data about when, where, source, then estimation of the TBSA and head to toe examination. The common methods used to estimate the TBSA in the assessment of children with burn injuries include the rule of 9, Lund and Browder chart and use of child's palm to represent 1% TBSA. The rule of 9 is not preferred due to its inaccuracy. Instead, Lund and Browder chart is the method commonly used since it is user friendly and accurate, one can relate the part of the body affected and the same part on the chart. At QECH the Lund and Browder chart is used as shown in appendix E (13). According to WHO, the TBSA and the depth of the wound determine the severity of the burn injury. similarly the morbidity and mortality rise with the increased TBSA and depth (12). WHO considers any burn injury in children with TBSA that is greater than 10% to be serious (12). WHO also recommends hospitalisation of a child with burn injuries that are of full thickness, inhalation, circumferential and those that are associated with trauma or significant pre illness such as diabetes (12).

1.1.4 Management of burn injuries in children

The way in which initial management of a burn injured child is carried out, caries a very important role in the progression, healing and outcome of the burn wound (14). According to the protocol by Emergency Medicine International (EMI), the management of burn injuries starts during assessment (15). Consideration for patients to be managed at the burn centre includes: all children less than one year, all children with burn injuries from 1 year to 2 years of age with >5% TBSA, children of any age group with deep partial burns and children older than 2 years with superficial partial thickness burns of more than 10% (15). children with

burn injuries of special areas such as face, hands, feet, genitalia, perineum and major joints and children of any age with full thickness burns are also considered to be managed at the Burns unit (15). The list also includes all children with circumferential burns, burns with pre-existing medical disorders that could complicate management or prolong recovery and all the children with septic burn wounds (15).

1.1.4.1 Treatment Protocol

The application of simple basics of resuscitation measures and meticulous wound care lead to achievement of favourable outcomes (15). The management of burn wounds mainly focus on stabilisation and resuscitation, facilitation of speedy healing, infection prevention and optimising functional recovery (2).The first and foremost thing to do is to remove the child from the source of burns (15). This is followed by cooling the affected area with cold water of about 18 degrees Celsius for at least 30 minutes (15). The child is then covered with warm cloth or blanket to prevent hypothermia (15). Interventions/ management depend on the findings during ABC approach of assessment. On airway and breathing, any obstructions have to be removed for patency and oxygen may be commenced basing on need (2). If breathing is compromised because of tight circumferential burns; surgeons may be consulted to perform escharotomy (2). On circulation, any external bleeding has to be arrested and any source of internal bleeding has to be established (2). Stabilisation of the patient involves fluid resuscitation. Accurate estimation of TBSA is very important on this (15). This aims at maintaining fluid balance in the body thereby maintaining vital organ function (15). The fluid of choice is Ringers lactate. Any child with burns with TBSA of <10% can be resuscitated with oral fluids unless has an associated trauma (15). Any child with burn injuries with TBSA of 10 – 40% have to be commenced on a large bore intravenous fluids and those with burns of > 40% have to be commenced on 2 large bore IV line (15). The rate of fluid resuscitation should always be administered in such a way that it maintains urine outputs of between 0.5

ml/kg per hr. and 1.5 ml/kg per hr.(15). Parkland formula can be used to calculate the required amount of fluids to be given i.e. %TBSA x weight x 3.5 Millitres (mls.) = Amount of fluids to be given to the child in 24 hours (15).

After fluid resuscitation, medications such as ant tetanus drugs, pain relievers, and antibiotics may be given or instituted basing on hospital protocols (14). Wound care/management follows which include wound cleaning, debridement and topical application of creams like sulfadiazine depending on hospital protocols as well (14).

1.2 Burn injuries in children in Malawi

Burn injuries are a major and frequent cause of injury to young children in Malawi. It has been reported as being the third most frequent cause of injury in the country (8). QECH in Blantyre is the largest referral hospital in Malawi offering tertiary care and is located in Blantyre district, in the southern region of Malawi (8). It is also a referral hospital for district hospitals in the southern region of Malawi, as well as health centres that are within the district. In addition to this, QECH is an academic hospital that offer practical experiences for medical and nursing students from various colleges in Malawi (8).

In the past children with burn injuries were being admitted to the general paediatric wards at QECH which were overcrowded and understaffed (16). These circumstances led to the development of complications such as infections. In 1993 the rate of sepsis was at 75.4% (16). Due to lack of essential resources such as dressings, drugs and adequately trained staff, nursing and medical staff became reluctant to treat the patients with burn injuries. Doctors and nurses described burn injury patients as being “smelly and dirty”(16). Consequently, many patients died of sepsis, which is the combination of SIRS in the presence of or as a result of suspected or proven infection (16).

In response to the high burn wound infection rates, the Burns Unit was established at QECH in September 1993 to address the neglected burden of burn injuries in children in Blantyre, Malawi (16). The unit has a male ward, female ward, two children's wards, a kitchen, shower rooms and toilets for patients. The unit has a staff office, toilets and change rooms (16). It has a theatre, recovery room, treatment room, and a four bedded Intensive Care Ward. In total the unit has 32 beds (16).

The establishment of the Burns Unit led to an improvement in management of burn patients (16). In 2009, care of burn patients improved as evidenced by the reduction of the rate of sepsis from 75.4% to 31% (16). Despite the improvement on sepsis, the mortality rate had paradoxically increased at the QECH Burns Unit, from 16.8% in 2002 to 30% in 2006 (8, 13). The possible explanations for the increased mortality rate could be the late referrals of the severely injured patients from other health centres thus compromising the condition of the patients upon arrival at burns unit (13). The sub-optimal baseline health status of the burnt child could likely have contributed to the poor outcomes (16). Additionally, the Burns Unit's status as the only referral burn centre in Malawi ensured that the most critically ill patients across the whole country were attended to (13). The selection process may also have played a role in the counter-intuitive increase in the mortality rate of some patients (13, 16).

1.3 Literature review

As the study focused on burn injuries in children, literature was sought to understand the concept of burns in children as regards to age, source, place of burns incident, and the outcomes. Previous studies on burn injuries in children globally, regionally, nationally and QECH were reviewed to get what other people have already researched on and the findings to identify the gap. The search engines used for literature review were Google scholar, Pub med, Nursing Journals and Hinari and Library Nursing Books. The search words used were, Burn

injuries and children in Malawi OR causes of burn injuries in Blantyre, OR classification and management and classification of burns, outcomes in burn injuries.

1.3.1 Burns and Age

Globally, with the search engines used, there was little literature on burns and age in developed countries probably due to increased awareness on prevention. However a retrospective study on burn injuries in children was conducted at Bergen Accident and Emergency Department of National Burns Centre Hauk eland University Hospital in Norway. The results revealed that children under two years were the most vulnerable to burn injuries (12). While an Iranian study reported that 60% of burn patients were children less than 7 years of age (17).

However, in Africa studies reveal that the majority of burn injuries were among children below five years of age. It was estimated that between 17,000 and 30,000 children under the age of five years die each year due to burn injuries in Africa (18). The number of injuries decreased as age increases (18). Research studies which were conducted in various countries in Africa, such as Tanzania, Mozambique, Ghana and Malawi confirm that burn injuries are prevalent among children who are below five years. It was reported in Dar-e-salaam, Tanzania that 54% of burn patients were children between 1 and 2 years of age (19). Another study conducted at Kilimanjaro Christian Medical Centre in Tanzania found that the largest age group affected by burns were children below five years accounting for 18% (18).

The study conducted in Tanzania on morbidity and mortality in children revealed that the highest risk factor for burn injuries was young age (19). It was further revealed that the most vulnerable age was 1-3 years. It was found that burns were the commonest cause of deaths among children under five years (19). Dean den Hollander's study conducted in 2014 on epidemiology and referral pattern of burn patients found that 58% of the patients with burn

injuries were children who were under five years (20). Similarly a study conducted in Maputo, Mozambique found that under five children were commonly affected by burn injuries (6). A retrospective study which was conducted in Ghana on paediatric burns mortality and risk factors in a developing country's tertiary burns intensive care unit revealed that 73% of the children with burn injuries were children under five years (21). It was further revealed that the mean age of the patients who died of burn injuries was 3 years and the most vulnerable age group was 0-13 years (21).

At Kamuzu Central Hospital, Malawi, a study was conducted on the epidemiology, management, and outcomes of burn injuries (22). The study found that 75% of burn patients were children under the age of 15 years (22). The literature review reveals that burn injuries in African countries are common in children under the age of 5 years. This could be due to parental neglect and cooking areas that are at ground level.

1.3.2 Burns and common sources and places of incidents

Studies have shown that there is a variety of causes and places where burns actually occur. Most of the burns occur in the home. Most of the burn injuries in children that occur in low income countries usually happen within home premises with scalds taking the lead (23). This is because most of the cooking places and equipment are accessible to children, especially in the circumstances where cooking, living and sleeping take place in one room which is common in developing countries (23).

A retrospective study conducted in Ghana found that 73% of the children with burn injuries were due to scalds and happened within home premises (14). It was then concluded that children under five years get burn injuries in the homes accounting for 50% - 80% of all childhood burns with scalds as common source (14, 23). It was also concluded that scalds are the type of burns that commonly occur in the home environment (14). A study by Gevaart on

energy related injuries in 16 regional hospitals of South Africa revealed that only 30% of the burns were scalds sustained within the home premises (24). South Africa is considered as a country better than others in developing countries hence they register less scalds (24).

A study by Agbenorku at Kwame Nkruma University in Uganda on paediatric burn risk factors in 2013, indicates that scalds account for 73.8%(21). Similarly, a study by Outwater in Tanzania concluded that most of the burns in children were scalds (19). To be specific, 70% of the burns among children in Tanzania were related to scalds from hot water and food (19). Furthermore, a study at Kamuzu Central Hospital in Malawi on epidemiology, management and outcome of burn care reported that 67% of the burns were due to scalds (22). In Mozambique a study revealed that 82.8% of burns in children were due to scalds (6). The studies cited above indicate that scalds are the common type of burns in children globally, regionally and nationally. This could be due to parental neglect.

1.3.3 Burns outcomes

World Health Organisation (WHO) states that more burns occur in middle and low income countries with prolonged hospitalization, disfigurement, and death (5). Burn injuries may result in physical, psychological and economic impact on individual, family and community level. Additionally, outcomes of burn injuries may be short and long-term (5).

Physically, children as individuals may report tremendous suffering caused by disfigurement and contractures secondary to extensive scaring (23). Some children have to undergo amputation of limbs following circumferential burns. These negative outcomes affect them psychologically by loss of self-esteem and failure to cope with friends and studies at school among fellow children (23). Economically burn injuries in children may also increase costs to families, communities, the nation, and entire world through health care bills and also lack of earning income ability (23).

1.3.3.1 Long period of stay in hospital and burns

One of the outcomes that children with burn injuries experience is long period of stay in the hospital. An overview of Sub Saharan paediatric burn injuries revealed that the children who were admitted into the different hospitals due to burn injuries had an average length of stay in hospital of about 23 days (7).

Another study of energy related injuries conducted in 16 regional hospitals of South Africa showed that among all the injuries experienced by children who are under five years, burn injuries resulted in longer period of stay than any other injuries (18). Similarly a 2003 study in Malawi revealed that the average period of stay in the hospital for burnt children was 25 days (25). The above mentioned studies indicated that children are hospitalized for not less than 20 days. This can have an impact on a child psychologically since the hospital is not a conducive environment for the children to develop. Children can also suffer lack of attendance at school and can contract other infections whilst in the hospital.

1.3.3.2 Nature of complications

Other outcomes of burn injuries in children include severe complications which depend on severity of the injury as regards to depth, TBSA, age and management (22). Burn injuries in children can result in undesirable complications which may not be reversed for the rest of the child's life such as amputation (22). Amputation of any body part brings a permanent disability. A study in Tanzania found that out of 49 children who suffered amputation of their limbs, 16% of them were as a result of burn injuries (18). Apart from amputation, children with burn injuries may suffer sepsis and contractures among others (18).

An epidemiology study conducted at Inkosi Albert Luthuli Central Hospital in Durban in 2010 found that 21.6% had severe complications such as severe sepsis, contractures and skin graft failure (20). The Chi-squared test showed that age was significantly related to depth,

type and severity of burns which result in the stated complications (20). Another study conducted in Tanzania found that 53.7% of burn injured children, developed sepsis while 24.4% developed contractures (18). Over 95% of burn injuries occur in middle and low income countries and are among the leading causes of disability adjusted life years (DALYs) (19).

1.3.3.3 Mortality

Burn injuries in children contribute to child mortality (19). Children remain the most vulnerable group of people with highest mortality related to burn injuries (15). A retrospective cohort study that was conducted in Australia between 1980 and 2012 found that burn injuries are one of the causes of deaths among children younger than 15 years of age (26). The study also found that burn injuries contributed about 38% of all paediatric deaths that occurred in the period of study (26)

It is estimated that a number of deaths in burn injured children in middle and low income countries is eleven times higher than in high income countries (19). A study conducted in Norway indicated 90% of burn deaths and many incidents continue to occur in low income countries (5). This is because in these places the prevention programs are uncommon and quality of acute care is inconsistent (5).

1.4 Significance of the study

Although burn injuries contribute to the morbidity and mortality of children in Malawi at QECH, little is currently known about the causes, and outcomes. In some previous studies that were conducted about burn injuries in Malawi, the focus was on epidemiology, management and outcome.

QECH is a referral hospital for district hospitals in the southern region of Malawi, as well as health centres that are within the district and is the only burn centre in Malawi where burn

injured patients national wide are referred to. The results of this study give a good representation of description of burn injuries in Malawi as a whole. In addition to this, QECH is an academic hospital that offers practical experiences for medical and nursing students from various colleges in Malawi. Therefore it was important to conduct the study at QECH.

CHAPTER TWO

2.0 Research Methodology

2.1 Aim of the study

The purpose of this retrospective descriptive quantitative study was to describe the characteristics of children with burn injuries at QECH.

2.3 Study objectives

1. To describe the demographics of the children with burn injuries attended to at the QECH Burns Unit.
2. To describe the causes of burn injuries.
3. To describe the anatomical distribution, depth and characteristics of the burn injuries.
4. To describe the place of incidence.
5. To compare the prevalence of burn injuries between seasons.
6. To determine the nature and rate of complications arising from the burn injuries.
7. To describe the short term outcomes of the children with burn injuries.

2.4 Study design

The study used a descriptive and retrospective design that used quantitative methods of data collection and analysis. The patients' files were reviewed. A retrospective study design in medicine looks backward in time and usually uses medical records.

2.5 Site of study

The study was conducted at the QECH Burns Unit.

2.6 Study Period

The records of children that were admitted at the QECH Burns unit with burn injuries from September 2011 to August 2012 were reviewed. The complete year ensured that all seasons in Malawi were captured.

2.7 Study population

The study population included all children from birth to 14 years, admitted directly at QECH with burn injuries, and those referred from other health facilities.

2.8 Study sample

The sample comprised of 148 children with burn injuries

2.9 Data instruments

A data collection tool, check list (Appendix A) was used to obtain the required data from patients' records. Demographic variables were: age, sex, weight. Other variables were place and time of injury, cause of burn, part of the body affected, TBSA, depth of burn, complications of the injury and outcomes.

2.10 Data collection

With permission from the Hospital Director, the researcher approached the nurse in-charge of the QECH Burns Unit. The nurse in-Charge directed the Records Officer to provide the files of the burn injured children as per criteria. Data were extracted from the files using a structured checklist. The patient's records were returned to the records stores upon completion of data collection.

2.11 Data Management

Data were coded and captured using Microsoft Excel 2007® (Microsoft, Seattle, USA). For the purpose of descriptive analysis, data were then exported to Statistical 9.1® (Stat soft, Tulsa, USA) which was utilised for all other analysis.

2.12 Data Analysis

For descriptive purposes, medians together with (inter-quartile ranges (IQR) were reported for all variables related to age, while proportions (percentages) were reported for categorical variables. Chi-squared tests and multiple regressions were done to analyse and assess associations between characteristics of the children, mortality and other factors key to describe the nature and outcomes of burns in children. All analyses considered a value of $p<0.05$ as significant with 95% confidence intervals reported for estimates. Individual associations were determined by univariate analysis.

2.13 Ethical consideration

Ethical clearances to conduct the study were sought from the Human Research Ethics Committee (HREC) of the University of the Witwatersrand, Johannesburg (**Ethics clearance number: M130651**, **[Appendix B]** and from the National Health Sciences Research Committee (NHSRC) of Malawi Ministry of Health **Certificate number NHSRC 1205**, **[Appendix C].** Written permission to conduct the study and use of the patients' records at QECH Burns Unit was sought from the Hospital Director. **[Appendix D]**

Patients were not directly involved. No identifying data fields (such as name, patient number) had been used in the data collection tool thereby upholding privacy and anonymity. A separate list was kept with patient's name and hospital number linked to a unique numerical identifier which appeared on the data collection sheet. Only the researcher and her

supervisors had access to this list. The list and completed data collection tools were kept under lock.

2.14 Limitations

The limitations of the study included the study design which was retrospective thus record review, use of observation could have enriched the data. Only one site was used, as multiple sites could have enriched the data. Missing of some important information i.e. period of stay in the Health Centre before referral to QECH was also another challenge of the design. Time became a limitation since the study was part of Master Degree requirements and the researcher had to work within the given time frame.

CHAPTER THREE

3.0 Results

3.1 Demographic Characteristics of the participants

3.1.1 Burns and sex

A total of 148 medical records of children under 1 to 14 years were reviewed. Out of the 148 patients, 51% (n=75) were boys and 49% (n=73) were girls.

3.1.2 Burns age and weight

The median age of the children was 3 years (inter quartile range [IQR]: 2-5 year) with a median weight of 13kg (IQR: 10-17kg).

3.1.3 Nutritional status

Having calculated weight for age Z-scores based on the 2006 WHO Child Growth Standards, 30.1% (n=43) were malnourished, 66.4% (n=95) had normal nutritional status and 3.5% (n=5) were over nourished as shown in figure 3.1

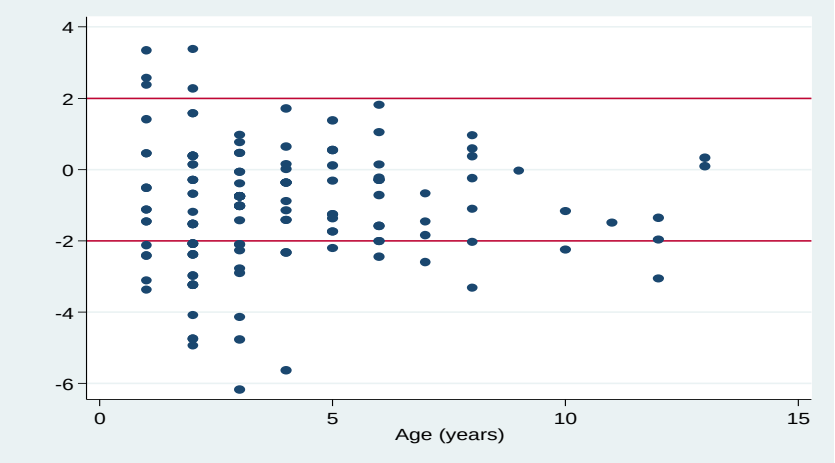


Figure 3.1: Scatter plot of Weight for Age Z-scores in the study (reference 2006 WHO Child Growth Standards)

3.1.4 Relationship of Burns, Sex and age

Results of the study showed that males admitted with burn injuries were significantly younger than their female counterparts (p = 0.001 [Figure 3. 2]). The median age for boys was 3 years (IQR: 2-4 years) whereas the median age for girls was 4 years (IQR: 2-6 years).

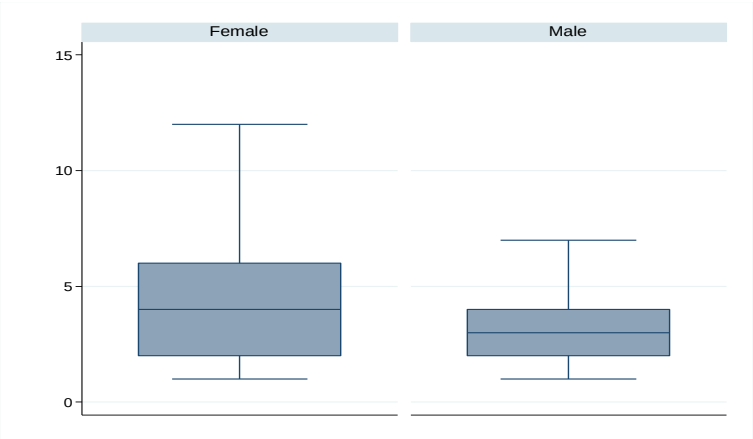


Figure 3.2: Relationship of Burns, age and sex

3.2 Causes /Sources of burn injuries

The results found that 148 children 68% (n=100) had hot liquids as source of burns while 32% (n=48) had open fire as source.

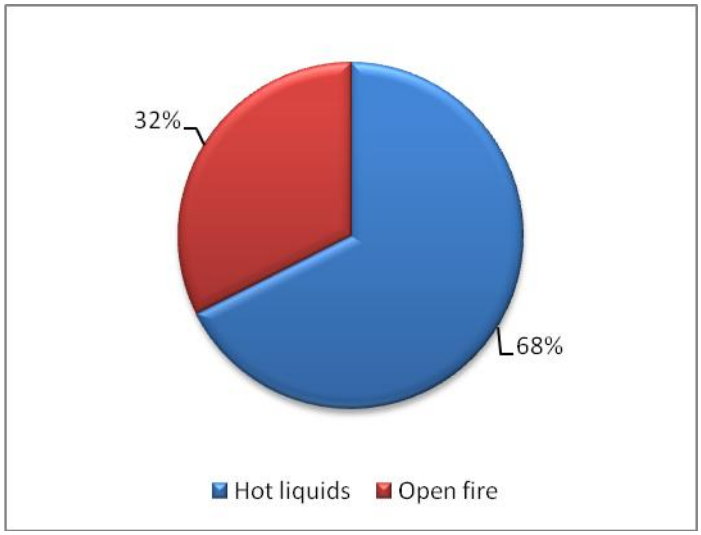


Figure 3.3: Causes of burn injuries

3.2.1 Relationship of Burns, causes and sex

Out of 100 children who sustained burn injuries due to hot liquids, 55% (n=55) were males while 45% (n=45) were females. Out of 48 children who sustained burn injuries due to open fire 37.5% (n=18) were males and 62.5% (n=30) were females.

3.2.2 Relationship of Burns, cause and age

The study showed that out of 100 children who sustained burn injuries due to hot liquids 69% (n=69) were less than or equal to 3 years and 31% (n=31) were children above 3 years. Out of 48 children who sustained burn injuries due to open fire, 33% (n=16) were children of less than or equal to 3 years while 67% (n=32) were 3years and above.

3.3 Anatomical Distribution of burns

The study indicated that all the parts of the body were affected by burns except the back. Most of the children had more than one part of the body affected by burns as shown in the table 3.1 below.

Table 3.1 Anatomical distribution of burns (body parts involved)

It was noted that 147 out of 148 children had their parts of the body affected indicated in their files

Part of the body involved	Yes	%	No	%
Face	37	25.2	110	74.8
Neck	17	11.6	130	88.4
Trunk	78	53.1	69	46.9
Hands and Arms	87	59	61	41.5
Abdomen	66	44.9	81	55.1
Back	0	0	147	100
Buttocks	42	28.6	105	71.4
Thighs	3	2	144	2
Legs	71	48.3	76	51.7
Feet	2	1.4	145	98.6
Perineum and genitalia	24	16.3	123	83.7

3.4 Depth of the Burn injuries

The results showed that 17.2% (n=25) had superficial burns, 52.7% (n=78) had superficial partial burns, while 7.5% (n=11) had deep partial burns and 22.6% (n=34) had full thickness burns as shown in Figure 3.4.

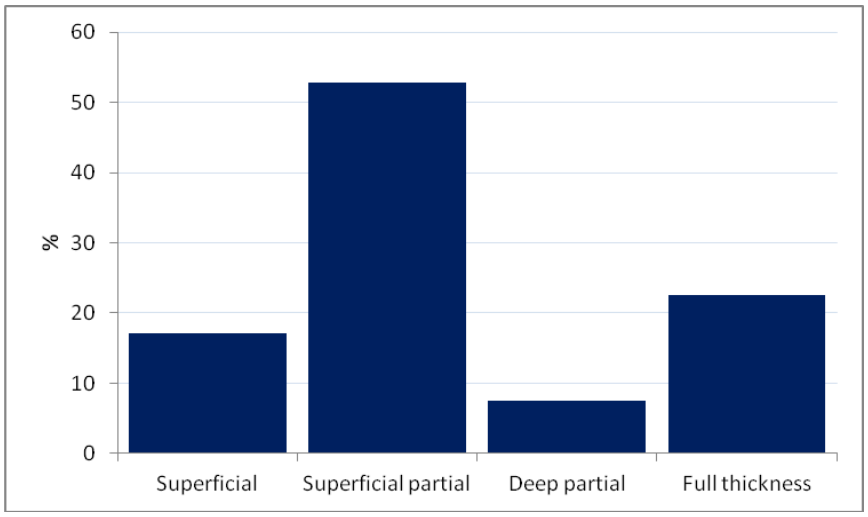


Figure 3.4: Depth of burn injuries

3.4.1 Relationship of Depth of burn injuries with sex and age

There was no significant association between depth of the burn wound with sex or age with p=0.090 and p=0.354, respectively as shown in Table 3.2

Table 3.2: Depth of burns, age and sex

	Full thickness		**Deep partial**		**Superficial partial**		**Superficial**			
	N	**%**	**N**	**%**	**N**	**%**	**n**	**%**	**P-value**	
Male	21	28.4	7	9.5	38	51.3	8	10.8	0.090	
Female	12	16.7	4	5.5	39	54.2	17	23.6		
<=3 years	16	18.8	5	5.9	47	55.3	17	20.0	0.354	
> 3 years	17	27.9	6	9.8	30	49.2	8	13.1		

3.5 Burns and TBSA

The study showed that of 148 children, only 133 had % TBSA indicated in their files. The results indicated that the TBSA% for the 133 children ranged from 3% - 19% with median (IQR) 13(3-19)

The median was used as a cut off as shown in table below:

Table 3.3 Burns and TBSA

Categories	N	%
3-13% (≤ 13%)	72	54
14-19% (> 13%)	61	46

3.6 Burns and place of incidents

The results showed that 96.6% (n=143) happened in the home premises, 2% (n=3) happened at school and 1.4% (n=2) happened in the surrounding gardens.

3.7 Burns and seasons

The results indicated that 42.5% (n=63) of burn injuries in children occurred in cool dry winter and 43.8% (n=65), in warm wet seasons only 13.7% (n=20) of burn injuries occurred in hot dry season, as shown in Figure 3.5.

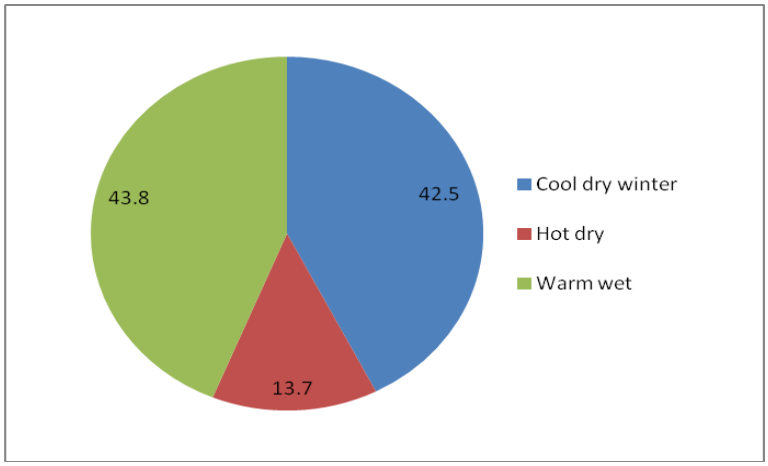


Figure 3.5: Burns and seasons

3.8 Referrals

It was shown that children with burn injuries that were referred from other health centres to QECH Burns Unit were 59 out of the 148 children representing 40%.

33.9% (n=20) referred cases died while 18% (n=16) that presented directly to QECH died. Presenting directly to QECH was associated with a 57% decreased odds of mortality compared to being referred from other Health facilities OR 0.43 (95% CI: 0.20-0.93).

3.9 The outcome of burn injuries

The outcome of the burn injuries included discharges, complications and deaths.

3.9.1 Discharges

It was noted that out of 148 children, 75.7% (n=112) children were discharged to go home.

3.9.2 Complications of burn injuries

The results indicated that out of 148 children with burn injuries 51% (n=75) had complications some of which required a surgical intervention. The leading procedure was skin graft and was performed on 31.3% (n=46) children, and 15.6% (n=23) had blood transfusion. Other complications included sepsis 2.7% (n=4) and contractures 1.4% (n=2)

3.9.2.1 Complications of burn injuries by age and sex

The proportions of boys and girls who experienced any sort of complications from burn wounds did not significantly differ with P=0.320. Similarly, there was no association between having any complication from burn wounds and the age of the child; P=0.056 as shown in Table 3.3.

Table 3.4: Complications of burn injuries by age and sex

	Any complication				
	Yes **N**	**%**	**No** **N**	**%**	**P-value**
Male	36	52.9	32	47.1	0.320
Female	33	44.6	41	55.4	
<=3 years	45	55.6	36	44.4	0.056
> 3 years	24	39.3	37	60.7	

3.9.3 Length of stay in hospital due to burn injuries

The median length of hospital stay for children who were admitted with burn wounds was 14 days (IQR: 7-27).

The results indicated that 30 children had hospital stay of about 3days to 1 week, 35 children had hospital stay of about 8 days to 2 weeks, and 11 children had stayed in hospital for 2 weeks. About 25 children had hospital stay of about 19days while 32 children had stayed for 21 days and 19 children stayed for 30 days. One child's file did not have data as regards to hospital stay.

3.9.4 Burns Mortality

A total of 24.3% (n=36) children out of the 148 died.

3.9.4.1 Burns Mortality and TBSA

It was found that out of 133 children who had their TBSA indicated, 72 had their TBSA ranging from 3% - 13% and 11of them died representing 15.3% while 61out of 133 had their TBSA ranging from 14% - 19% and 25 of them died representing 41%

3.9.4.2 Bivariate associations between burn injury mortality with demographics and other characteristics.

Results showed that there was no significant difference between children who died from burn wounds and children who were discharged alive in terms of sex of the child (0.44-2.2, age (years); 95% CI:0.33-1.59, weight (kg); 95% CI:0.55-2.53 and nutritional status; 95% CI:1.14-1.04. Table 3.6 showed that anatomical distribution of the burn injuries that were significantly associated with mortality.

A number of demographic characteristics of the study population were assessed for association with mortality from burn injuries as shown in Table 3.5

Table 3.5: Bivariate association between Burns Mortality with demographic characteristics

Characteristic	Total N	Deaths n (%)	Unadjusted OR†	95% CI
Female	75	19 (25.3)	1.00	
Male	73	17 (23.3)	0.94	0.44-2.02
Age ≤ 3 years*	86	23 (26.7)	1	
Age ≤ >=3 years	62	13 (21.0)	0.73	0.33-1.59
Weight ≤ 13kg*	76	18 (23.7)	1	
Weight > 13kg	67	18 (26.9)	1.18	0.55-2.53
Normal	95	28 (29.5)	1	
Malnourished	43	6 (14.0)	0.39	0.14-1.04
Over nourished	5	2 (40.0)	1.60	0.25-10.19
† From Mantel-Haenszel Chi-square Test * Based on median				

3.9.4.3 Bivariate association between burns Mortality with anatomical distribution (parts of the body)

It was noted that children with burn wounds that affected the trunk (s) had 3 times increased odds of dying from burn wounds (OR 2.95 [95% CI: 1.27-6.85]). Burn wounds that involved the abdomen was associated with a 5 fold increased risk of mortality (OR 4.62 [95% CI: 1.93-11.04]). Mortality from burn wounds was higher in children whose burn wounds affected the buttocks with OR 2.22 (95% CI: 0.99-4.95), p=0.047.

Table 3.6: Bivariate association between burns Mortality with anatomical distribution (parts of the body)

Part of the body	N	Died n (%)	Unadjusted OR	95% CI
Facial wound				
No	110	29 (26.4)	1	
Yes	37	7 (18.9)	0.65	0.26-1.65
Neck wound				
No	130	31 (23.9)	1	
Yes	17	5 (29.4)	1.33	0.43-4.09
Wound on the trunk (s)				
No	69	10 (14.5)	1	
Yes	78	26 (33.3)	2.95	1.27-6.85
Wound on the arms and hands				
No	61	12 (19.7)	1	
Yes	86	24 (27.9)	1.58	0.71-3.50
Wound on the abdomen				
No	81	10 (12.3)	1	
Yes	66	26 (39.4)	4.62	1.93-11.04
Wound on the buttock (s)				
No	105	21 (20.0)	1	
Yes	42	15 (35.7)	2.22	0.99-4.97
Wound on the leg (s)				
No	76	14 (18.4)	1	
Yes	71	22 (31.0)	1.99	0.91-4.33
Wound on perineum and the genitalia				
No	123	28 (22.8)	1	
Yes	24	8 (33.3)	1.70	0.65-4.41

3.9.4.4 Bivariate association between Burns Mortality with depth of burns, % TBSA and duration of hospital stay

The study found that mortality from burn wounds was significantly higher among children with burn wounds classified as deep partial compared to children with wounds classified as superficial OR 5.34 (95% CI: 1.32-21.60); p=0.008. The odds of death from burn wounds increased nearly 4-fold for children whose wounds covered TBSA of 14% to 19% as compared to children whose wounds covered TBSA of 3% to 13% with OR 3.85 (95% CI%: 9.10), p<0.001. Children who died from burn wounds spent significantly less number of days in hospital with median hospital stay of 5 days (IQR: 3-10 days) compared to those who were discharged alive with median of 16 days (IQR: 11-29), p<0.001 as indicated in Table 3.7

Table 3.7: Bivariate association between Burns Mortality with depth of burns, % TBSA and duration of hospital stay

Characteristic	**N**	**Died n (%)**	**Unadjusted OR†**	**95% CI**
Depth of burn wound				
Superficial partial	77	19 (24.7)	1	
Deep partial	11	7 (63.6)	5.34	1.32-21.6
Full thickness	33	10 (30.3)	1.33	0.53-3.30
TBSA				
3%-13% (≤13%) TBSA	72	11 (15.3)	1	
14%-19% (> 13%) TBSA	61	25 (41.0)	3.85	1.63-9.10
HOSPITAL STAY				
3-14 days hospital stay*	76	28 (36.8)	1	
15- 30 days hospital stay	71	8 (11.3)	0.22	0.09-0.54

3.9.4.5 Adjusted association between various factors and mortality and discharges

Being referred from another health facility was associated with 4 times odds of death from burn injury compared to going to QECH directly (OR 3.79 (95% CI: 1.33-10.79), p<0.001. Odds of death from burn injury increased 3-fold if the referred child had a wound that covered TBSA of 14%-19% OR 3.14 (95% CI: 1.09-9.04), p=0.034. The odds of burns mortality increased 3-fold for children whose wounds affected the abdomen OR 3.23 (95% CI: 1.19-8.75), p=0.021. Independent risk factors for mortality due to burns were investigated using multivariate logistic regression and results are shown in Table 3.8

Table 3.8: Adjusted association between various factors and mortality and discharges

	Crude		**Adjusted**		
Characteristic	**OR**	**95% CI**	**OR**	**95% CI**	**†*P***
Referred case‡					
Yes	2.3	1.07-5.10	3.79	1.33-10.79	0.012
No	1				
TBSA					
TBSA (3%-13%) ≤13%	1				
TBSA (14%- 19%) > 13%	3.9	1.63-9.10	3.14	1.09-9.04	0.034
Wound on the trunk (s)					
Yes	3	1.27-6.85	1.88	0.67-5.30	0.231
No	1				
Wound on the abdomen					
Yes	4.6	1.93-11.04	3.23	1.19-8.75	0.021
No	1				
Wound on the buttock (s)					
Yes	2.2	0.99-4.97	1.71	0.56-5.25	0.349
No	1				
Wound on the leg (s)					
Yes	2	0.91-4.33	1.04	0.35-3.07	0.940
No	1				

The results of the study showed that the number of boys represented were about 51% (n=75) of the children that were admitted with burns over the period of the study while the girls

represented were about 49% (n=73). Males were significantly younger than their female counterparts (p = 0.001 [Figure 2] that were admitted with burn injuries. The median age for boys and girls was 3 years (IQR: 2-4 years), and 4 years (IQR: 2-6 years) respectively. This study also showed that presenting directly to QECH was associated with a 57 percent decreased odds of mortality due to burns injury compared to being referred from other health facilities OR 0.43 (95% CI: 0.20-0.93). This indicated that being referred from another hospital was associated with nearly 4 times odds of death from burn injury compared to going to Queen Elizabeth Central Hospital directly (OR 3.79 (95% CI: 1.33-10.79), p<0.001.

CHAPTER FOUR

4.0 Discussion

4.1 Demographic data

4.1.1 Sex

The frequency of burn injuries between the two sexes showed a slight difference with boys having a 2% higher incidents than girls (51% vs. 49%) with p value of (P = 0.001). Similarly a study that was conducted in some district hospitals of Dar-es salaam showed a slight difference with boys having 1% higher than girls. Out of 126 under 15 years children with burn injuries 50.5% (n=64) were boys while 49.5 % (n=62) were girls (10). Another study in Ghana that was conducted at Komfo Anokye teaching hospital found that boys were 54% (n=23) outnumbered the girls who were 45.2 (n=19) (14). The same was the case in another study that was conducted at Prince Charles Hospital in Brisbane Australia (1). The male children are vulnerable to burns because they are more active than girls as they would want to discover things (12) . Furthermore, male children are naturally curious and impulsive which increase their likelihood of sustaining burn injuries (12). Sometimes male children would want to exercise power of independence, and would want to dominate in activities that happen among the children (22).

The girl children on the other hand are equally vulnerable like boy children to burn injuries. (4) In Malawi just like any other country girl children spend most of their times in the kitchen with their mothers, therefore burn injuries might be a result of spending much time in kitchen where they imitate what their mothers do such as cooking (8). The female children have high probability of exposing themselves to open fire, hot liquids such as tea, porridge and other substances (22). The study in England at Birmingham Hospital, concluded that

girls are the most vulnerable to burn injuries because they are always in the kitchen (27). In another study which was conducted in United States of America, found that female children in the kitchen attempted to reach up and pull a pot of hot water off the stove or from the fire place and ending up spilling the contents over themselves resulting into burn injuries (28). These studies, though conducted in African and western culture found similar results on sex distribution of burn injuries.

The results indicate that there is no significant gender difference for burn injuries that occur in children of under five years of age (5). They are equally exposed to the same sources of burn injuries such as fire and hot liquids (5).The slight difference and equal vulnerability of boy child and girl child to burn injuries indicate that burn injuries in children are not mainly influenced by the sex (10).

4.1.2 Burns and Age

The findings indicate that the common age group affected by burn injuries was 0-5 years. The finding concurs with another retrospective study conducted in Ghana on paediatric burns mortality and risk factors in a developing country's tertiary burns intensive care unit (14). The study found that 73% of the children with burn injuries were children under the age of five (21). Similar results were found in another study in Tanzania (10). The explanation was that some young children sustained the injuries while carried by their mothers on the lap while they were taking hot beverages and accidentally spilled over them (10).

Children of this age group are pre-schoolers and they spend their time at home. This puts them at risk of accessing the sources of heat if not supervised (22). In addition, the children of this age group are active and discover new things on their own (4). Sometimes they lack patience to wait and be served by adults (4). They have high self-esteem as they test their capability of doing things on their own such as making fire, exposing themselves to sources

of burns (19). Sometimes this age group of children would pull table cloths or loose table mats from the table with hot food or beverages on them resulting in hot spillage. These circumstances give some of the explanations of why young children are involved in burn injuries. This finding is congruent with other studies across the nations because it is influenced by the developmental issues of the child (5).

4.1.3 Burns by sex and age

This study found that the male children who were affected by burn injuries were younger than girls. The same results were found in the study that was conducted in Australia (1). The study found that the boys were younger than their girl counterparts (1). Similarly another study that was conducted in South Africa found that the mean age for boys that suffered from burn injuries was 2.7years while the mean age for the girls was 3years (5). Explanation was that the male child is always a risk taker than a female child. Boys would start discovering things while very young than girls who might be fearful (1). Boy child naturally become very unstable than girl child as he would like to discover and investigate his environment (5).

4.2 Sources of burn injuries

In the current study hot liquids such as hot porridge, boiled water meant for tea or for bathing were the leading cause of burn injuries. This result is similar to findings of the studies that were conducted in other countries. In Maputo in Mozambique where a study found that hot liquids were the leading source of burn injuries in children (6). In Tanzania a study found that most burn injuries in children were scalds (19). It was concluded that burn injuries were related to hot water and food like porridge (19). In Ghana, a retrospective study on epidemiological study on burns found similar results.

The explanation for this is that Malawi just like other low income countries, the commonest cooking place is on the ground level using firewood and charcoal burner (10). The children

under study were in the age group in which they start walking while not knowing anything harmful to them (14). The setting of Malawi and other countries mentioned, exposed most of the children to sources of burn injuries (10). Most burns happened when children were carried by their mothers and care takers during cooking or sometimes the children might be found on the floor crawling or making some steps, towards open fire or hot liquids and food (10). Children could also easily access cooking equipment such as kettles, pots, which upon touching them, the contents spilled over them. These mostly happened while there was inadequate parental supervision or when the children were left unattended (12).

This is because most of the mothers get more occupied with house hold chores forgetting to supervise their children as they play. This contributed to the vulnerability of children to the burn injuries (29). Similarities in the findings in these countries could be due to similarities in settings, cultures, as they are all in Sub-Saharan Africa (29). Another study that was conducted in China found that hot liquids was by far the most predominant source of burn injuries in children (30).It was then concluded that scalding was the most source of burn injuries in children globally (30).

4.2.1 Sources of burn injuries and sex

The results indicated that male children exceeded female children who sustained burn injuries through hot liquids because they were active and wanted to do things independently. They did not persevere when hungry and would go to kitchen in search for food where they met the tragedy. Similarly, female children exceeded the males in burn injuries due to open fire in the effort to cook. Contrary to this finding, another study conducted in South Africa found that girls outnumbered the boys in sustaining burn injuries due to hot liquids while boys outnumbered the girls in open fire as source of burn injuries (5). The explanation was that girls were more likely to be with their mothers in the kitchen assisting them with some chores such as cleaning and cooking. This exposed them to pots and other containers of hot liquids.

On the other hand boys of about 4-10 were potentially accessing substances that caused fire such as matches and lighters.

4.2.2 Source of burn injuries and age

This study indicated that the risks of burns due to open fire were increasing as the age increased. The vulnerability of burn injury due to hot liquids/scalds was decreasing as the age was increasing. Thus the younger the age of the child, the more vulnerable to scalds it became. As the age increased, vulnerability to scalds decreased while vulnerability to open fire increased. The explanation is that young children from birth to about 3 years are always dependent on their care givers and are being carried from one point to another. They were immobile and cannot reach out to some substances that cause fire such as matches. On the other hand older children are mobile and access substances that cause fire, try to make fire on their own. Female older children's cloths catch fire while warming themselves during cold weather when they are left unattended to.

4.3 Anatomical distribution of burn injuries (the body parts involved)

The findings indicate that the parts of the body which were affected most were the arms, trunk, abdomen and the legs. This concurs with what was found in a study that was conducted at Red Cross Children's hospital in Cape Town South Africa. It was found out that the extremities and the trunk were the parts of the body which were mostly affected by the burn injuries (31).

The explanation is that children under the age of five years like to discover things on their own. Malawi just like other low income countries, cooking mostly happens on the ground level which was easily accessible to children. They touch cooking equipment like pots by the handles which are placed on the fire. While pulling the pot from fire by the handle, the contents spill over them starting from the hands and arms then trunk and abdomen going

down to the legs. This is the same when the child pulls the table cloth while there are some containers of hot liquid such as Tea. The hot liquid spills over the child starting from the hand which the child uses to pull the cloth. The least exposed part becomes the least to be affected by the burns such as the back. The findings further indicate that the back was the only body part that was not affected by the burns. The explanation remains the same that the least exposed part to the source of the burns became the least to be affected by the burn injuries.

4.4 Depth of burns

The study results indicate that the children suffered different types of depth of burn wounds. The depths included the superficial, superficial partial, deep partial and full thickness burns. The leading type was the superficial burns. The variations in depth of wound were usually due to factors such as source of heat, length of time of exposure to heat source, delayed first aid treatment and length of time before reaching the hospital or receiving the right treatment. The young children are vulnerable to full thickness burns due to the nature of their skin which is very soft and can also allow the heat to penetrate deeper (12).

The mortality related to burn injuries was due the complications that arose when the heat penetrated deep into the body of the child. The heat penetrated deeply into the underlying structures (9). The sensory nerves in the dermis were destroyed and sensation was lost, there was critical fluid loss and sepsis which led to death (9).

4.5 Burns TBSA

The study indicated some correlation between TBSA and outcome of the burn injuries. The smaller the TBSA, the greater were the chances of survival. The results of this study had shown that as the TBSA of the burnt children increased, the chances of survival decreased. The results were consistent with findings of other studies which concluded that TBSA determine the outcome of burn injuries (4, 30-31). Another study in America found that any

burn injuries which had TBSA of 20% or more resulted in acute systemic response known as shock (2). The explanation was that the increased surface area that was affected by burn injuries resulted in increased permeability of the blood capillaries. This led to fluid and protein movement from intravascular space into interstitial space causing increased systemic vascular resistance and reduced cardiac output (2). This situation needed urgent fluid resuscitation. The TBSA became the basis of the amount of fluid needed for resuscitation (2).

4.6 Burns and place of incident

The results showed that 143 out of 148 children sustained the burn injuries in the home premises. The explanation is that the children were preschoolers who spent most of their time at home with their mothers. Similarly the retrospective study in Ghana concluded that burn injuries in children happen in the homes (14). An Iranian study on paediatric burn injuries concluded that burn injuries occur within home environment (4). These results correlate with the findings on the causes of the burn injuries in children. Globally, regionally and nationally the commonest cause of burn injuries in children are hot liquids and food which are found in the home premises (19).

4.7 Burn injuries and seasons

High prevalence of burn injuries in children were in cold dry season. Cold dry season was the most cold period where by children are found in the kitchen around the fire place for warmth. This is the explanation for many children sustaining burn injuries during the period. Many studies have not given much effective data on seasonal distribution of burn injuries (30).

4.8 Outcome of Burns

The outcome of the burn injuries were categorised into discharges, complications and mortality.

4.8.1 Discharges

The study findings indicate that the number of discharges outweighed the number of deaths. Some children though they suffered some complications, they still survived, while some they died of the complications. The survival of the children with burn injuries totally depended on the care that was given starting from soon after the incident and throughout hospitalisation. Some procedures were conducted to facilitate the healing such as skin grafting and debridement. Infection prevention measures also played a big role to minimise cases of sepsis. Every month nurses and other health workers in the Burns Unit of QECH, Blantyre are given some incentives as a reward for working hard and provision of quality nursing care that includes observing infection prevention measures to minimise cases of sepsis. The study also indicated that most of the children that were discharged home alive, had a long period of stay in the hospital. This was due to processes and procedures that happened to facilitate the healing of the burn wound. This concurs with the findings of a study on the management of minor burns and scalds in children which concluded that burn injuries accounts for long stay in hospital (32).

4.8.2 Burn complications and surgical procedures used in management of the burn injuries

The study indicated that 75 out of 148 children had complications. This included all the surgical procedures that were performed such as debridement, skin grafting and blood transfusion. Only the cases that were diagnosed to have systemic infection as a complication were categorised as having complication of sepsis. The study indicated few cases of sepsis as a complication of about 2.7%.Cases of sepsis were reduced because of strict infection prevention precautions that were carried out by trained staff in the QECH Burns Unit (13). Members of staff that worked in Burns Unit of QECH were trained and also given some incentives every month as a motivation to strictly follow precautions and standards of

infection prevention throughout. Contrary to the finding, a study that was conducted at Inkosi Albert Luthuli Central hospital of Durban indicated large number of severe sepsis which developed in 21.6% of patients with burn injuries. On the other hand the study found that only 1.4% of the children had contractures. Reduced cases of contractures were due to the proper management of burn wounds and early ambulation. QECH Burns unit implemented emergency resuscitation, nutrition, infection prevention, wound care, physiotherapy, rehabilitation and reconstruction (13). Reconstruction included the contracture release. Contractures are noticed in a patient usually after some time on a follow up after discharge. Many cases might have been easily missed out hence only few were reported. Contrary to this the study in Tanzania on management and outcome of burns which that a number of patients had contractures (18).

The study found that 31.3% of children had undergone the procedure of skin graft. Skin graft is the procedure where by the burn wound is covered using the meshed skin from the uninjured donor site of the same patient (auto graft). Most studies have proven that skin graft is associated with reduction of blood loss, long period of stay in hospital, infection and mortality if done as early as within 24 to 48 hours after the injury (2). The procedure was done when the wound was clean and showed signs of good blood supply for easy graft uptake. The finding was contrary to what was found in Tanzania where leading surgical procedure was amputation of the limbs. The study found that about 16% of the children had their limbs amputated due to burn injuries.(19) It was further indicated that the amputation of the body part due to severe burn injury could not heal properly due to sepsis. The variation could be due to the differences in severity of the problem between the two countries, availability of healthcare resources and surgical experience.

Blood transfusion was given to some of the children with burn injuries to correct anaemia. It was one of the common emergency actions. Most of the severe burns that resulted in anaemia

were corrected with blood transfusion. This was consistent with the findings of Stander (2011), on his study on emergency management and treatment of severe burns, which found that blood transfusion was one of the emergency actions in managing severe burns (15).

4.8.3 Burns and mortality

The study findings indicated that 36 out 148 children died representing 24.3%. Mortality in the burn injuries was associated with several factors.The study indicated that severity of the burn wounds, age of the child and referrals are the factors that were associated with mortality of the children with burn injuries. TBSA and the depth of the burn wounds determine the severity of the burn injuries (19). This study found that the greater the TBSA and the depth of burn wound, the greater was the risk of death. These results concur with the results of most of the studies which found that burns was one of the causes of deaths that are caused by injury especially when the TBSA and depth of wound are high and the child is very young (19, 26, 33).

4.8.3.1 Burns referrals and mortality

Referred cases contributed to high number of children who died regardless of the small number of referred patients from other health facilities. The increased number of deaths was due to the fact that the patients reached at QECH Burns unit in a very critical state. This could also mean that initial care may not have been adequately provided due to lack of skill or health care worker attitude towards burn injuries (13). In addition, time taken from site of injury to a health facility and to QECH might have been long, exposing patient to infection and long suffering (13).

4.8.3.2 Relationship of Burns mortality with Anatomical distribution and TBSA

Burn injuries that affected the trunk contributed to high mortality due to wide TBSA of 26% hence classified as severe burn injury (See appendix E (TBSA) (4). Similarly, burn injuries

that involved the abdomen contributed to high risk of mortality because abdomen has large TBSA of 13%. The higher the TBSA, the greater are the chances of dying. Out of 36 children who died, 11 had their TBSA ranging from 3% to 13% representing 30% of total number of deaths while 25 children who died had TBSA ranging from 14% to 19% representing 69%. High TBSA was associated with mortality due to critical fluid loss resulting into hypovolaemia, sepsis and anaemia. This concurs with the study by Lionelli (2005) who found that high TBSA increases rate of mortality (34). Wassermann (2001) concluded in his study that Burns covering more than 10% TBSA can represent a vital risk in any case and are responsible for systemic perturbations which can lead to patients' death (33).

CHAPTER FIVE

5.0 Conclusion

This study employed a descriptive retrospective design with quantitative method of collecting and analysing data. The study was conducted at an academic hospital in Blantyre, Malawi. The study aimed at describing the demographic characteristics and the outcomes of children with burn injuries. The study focused on the objectives: To describe the demographics of the children with burn injuries attended at the QECH Burns Unit, to describe the causes of burn injuries, to describe the anatomical distribution, depth and characteristics of the burn injuries, to describe the site to compare the prevalence of burn injuries between seasons, to determine the nature and rate of complications arising from the burn injuries and to describe the outcomes of the children with burn injuries.

All the objectives were achieved. The male child was almost equally vulnerable to burn injuries just like a female child. Hot liquids were the major cause of the burn injuries seconded by open fire. The study revealed that the arms and abdomen had been the commonly affected parts of the body. The study showed that most incidents happened within home premises and during cold dry season. Skin graft had been the leading procedure performed in the management of burn injuries to facilitate healing. Contrary to other similar studies conducted in other countries, children that were attended at QECH with burn injuries did not suffer major complications. Few children had sepsis as complication from burn injuries. The deaths were more in children who were referred from other health facilities and were mainly related to TBSA and depth of the wound.

CHAPTER SIX

6.0 Recommendations

The following are recommendations drawn from the results of this study.

6.1 National level

- Mass campaigns using posters, radios dramas, televisions to educate parents, guardians, and the entire public on the sources, dangers and prevention of burns in homes to minimize incidences of burn injuries in children.
- Improvement of public awareness on safety measures for children by designing, implementing, and evaluating injury prevention i.e. how to improve use of charcoal burners in families and communities without causing burn injuries in children.
- Improvement on resource allocation in all health facilities to meet the needs of the public.

6.2 Hospital level

- Design a burn assessment, management and referral form or primary treatment of burns at Public health care (PHC) clinics and prompt referral to tertiary care hospital.
- There is need to review and improve the process of referring children with burns from health centres to QECH Burns Unit to be quicker and more effective by minimising complications, avoid compromising and critical conditions of children.
- Ongoing Health Education on the sources, dangers and prevention of burn injuries in places like Out Patient clinics, under five clinics

6.3 Community level

- Health education to communities on how to effectively take care of children when mothers and guardians are preparing meals in the presence of children
- Mothers and care givers should be involved in the communities at all levels of prevention as most of the injuries are related to cooking and parental oversight in the homes.

6.4 Family level

- Parents should not leave the children unsupervised at the cooking places within home settings.
- Education to families to ensure that sources of heat are kept out of reach for children.

6.5 Suggested areas of further studies

- As retrospective study has used one source of data, it is advisable that future studies benefit more from not just the use of records as sources of data, but also from different types of methods used to collect data. Interviews conducted with guardians at the time of the incident may also add value to a descriptive study of this type.
- Explore the effect of improved nutrition in burn injuries of children. This is very important mindful that burns do not only affect appetite but also immunity levels.

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APPENDICES

APPENDIX A: Data Collection Tool

1. Demographic Data

Age	Sex				Weight	Address/Residential area
	M		F			

2. When did the incident occur?

Date	Month	Year	Time			
				Am		Pm

3. Date of admission

Day	Date	Month	Year	Time	Period between incident and admission					
					< 30 min		>30min		1hr and above	

4. Where did the incident occur?

5. Aetiological agent

Flame	Hot liquids	Chemicals	Electrical	others

6. Site of injury

Which parts of the body were affected by the burn injury?

Face	Neck	Trunk	Arms	Hands	Abdomen	Back	Buttocks	Thighs	Legs	feet	Perineum	Genitalia

7. Characteristics of the burn wound

What was the depth and total body surface area of the burn wound?

Superficial	Superficial partial	Deep partial	Full thickness	%

8. Complications of the burn wound

Was there any complication?

Yes	No

If yes what type of complications?

Sepsis	Contractures	Amputations	Skin graft	Ventilated	Transfusion	

9. Outcomes of the children with burn injuries

Admitted		Discharged		Died		Period of stay	
Date		Date		Date			Days/Months

10. Referals

Was the patient reffered case

Yes	No

APPENDIX B: HREC Clearance Certificate

M130651

R14/49 Ms Idah Mzama

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)

CLEARANCE CERTIFICATE NO. M130651

NAME: (Principal Investigator)	Ms Idah Mzama
DEPARTMENT:	Child Health Community Paediatrics Queen Elizabeth Central Hospital Blantyre.
PROJECT TITLE:	Describing Paediatric Burn Injuries at an Academic Hospital Queen Elizabeth Central Hospital
DATE CONSIDERED:	28/06/2013
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Dr Kuban Naidoo
APPROVED BY:	Professor PE Cleaton-Jones, Chairperson, HREC (Medical)

DATE OF APPROVAL: 19/07/2013

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Secretary in Room 10004, 10th floor, Senate House, University.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated from the research protocol as approved, I/we undertake to resubmit the application to the Committee. **I agree to submit a yearly progress report.**

Principal Investigator Signature Date 01/07/13

PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES

APPENDIX C: Malawi NHRC Clearance Certificate

Telephone: + 265 789 400
Facsimile: + 265 789 431
e-mail doccentre@malawi.net
All Communications should be addressed to:
The Secretary for Health



In reply please quote No. MED/4/36c

MINISTRY OF HEALTH
P.O. BOX 30377
LILONGWE 3
MALAWI

8th October, 2013

Idah Mzama
University of Witwatersrand

Dear Sir/Madam,

RE: Protocol # 1205: Description of paediatric burn injuries at an academic hospital, Blantyre, Malawi

Thank you for the above titled proposal that you submitted to the National Health Sciences Research Committee (NHSRC) for review. Please be advised that the NHSRC has **reviewed** and **approved** your application to conduct the above titled study.

- **APPROVAL NUMBER : NHSRC # 1205**
  The above details should be used on all correspondence, consent forms and documents as appropriate.
- **APPROVAL DATE : 08/10/2013**
- **EXPIRATION DATE** :This approval expires **on 07/10/2014**
  After this date, this project may only continue upon renewal. For purposes of renewal, a progress report on a standard form obtainable from the NHSRC secretariat should be submitted one month before the expiration date for continuing review.
- **SERIOUS ADVERSE EVENT REPORTING** :All serious problems having to do with subject safety must be reported to the National Health Sciences Research Committee within 10 working days using standard forms obtainable from the NHSRC Secretariat.
- **MODIFICATIONS**: Prior NHSRC approval using standard forms obtainable from the NHSRC Secretariat is required before implementing any changes in the Protocol (including changes in the consent documents). You may not use any other consent documents besides those approved by the NHSRC.
- **TERMINATION OF STUDY**: On termination of a study, a report has to be submitted to the NHSRC using standard forms obtainable from the NHSRC Secretariat.
- **QUESTIONS**: Please contact the NHSRC on Telephone No. (01) 724418, 0888344443 or by e-mail on mohdocentre@gmail.com
- **Other:**
  Please be reminded to send in copies of your final research results for our records as well as for the Health Research Database.

Kind regards from the NHSRC Secretariat.

.....
FOR CHAIRMAN, NATIONAL HEALTH SCIENCES RESEARCH COMMITTEE

PROMOTING THE ETHICAL CONDUCT OF RESEARCH
Executive Committee: *Dr.C.Mwansambo (Chairman), Prof. E. Molynuex (Vice Chairperson)*
Registered with the USA Office for Human Research Protections (OHRP) as an International IRB
(IRB Number IRB00003905 FWA00005976)

APPENDIX D : Letter of permision to conduct Research at QECH Burns Unit

Telephone: (265) 01 874 333 / 677 333

Facsimile: (265) 01 876928

Email: queenshosp@globemw.net

All communications should be addressed to:

The Hospital Director



In reply please quote **No.**

QUEEN ELIZABETH CENTRAL HOSPITAL

P.O. BOX 95

BLANTYRE

MALAWI

Ref No. QE/10 **6th June 2013**

Idah Mzama (Mrs)

University of Witwatersrand, Johannesburg

South Africa

Dear Madam

PERMISSION TO CONDUCT A RESEARCH STUDY AT QUEEN ELIZABETH CENTRAL HOSPITAL

This is to inform you that Management has no objection for you to do your entitled "**Describing Paediatric Burn Injuries at an Academic Hospital Queen Elizabeth Central Hospital, Malawi".** In partial fulfilment of your Masters Degree course in Child Health Community Paediatrics.

Please, remember to give us a copy of your findings.

All the best in your studies.

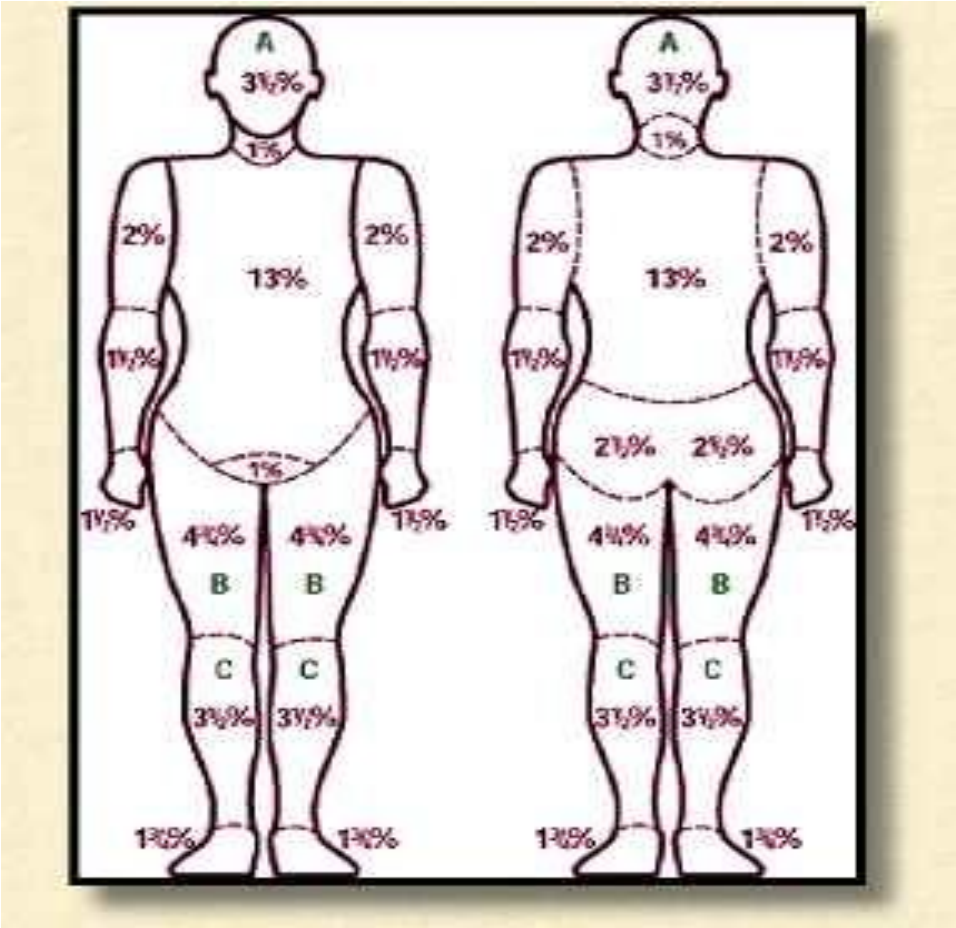
Yours faithfully,

T.N. Soko (Mrs)

DEPUTY HOSPITAL DIRECTOR-NURSING

For: HOSPITAL DIRECTOR

APPENDIX E: Lund Browder Chart



SOURCE: WHO 2015