CLINICAL PATTERNS AND EARLY OUTCOMES OF BURN INJURIES IN PATIENTS ADMITTED AT THE MOI TEACHING AND REFERRAL HOSPITAL, ELDORET.

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A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of Master of Medicine in General Surgery, Moi University, School of Medicine.

DECLARATION

Declaration by the Student

This thesis is my original work and has not been presented for a degree in any other University/institution.

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DEDICATION

I wish to dedicate this thesis to my husband Joram and my daughter Kristel, for always inspiring me to do my best.

ABSTRACT

Background: Burns are the fourth most common type of trauma worldwide and a major cause of mortality and disability in developing countries. Although burns are common in Kenya, there is still paucity of data on clinical patterns and early outcomes of burn injuries in western Kenya. Description of burn patterns, burn outcomes and associations of outcomes will inform clinical practitioners and improve care of patients with burns.

Objective: To describe clinical patterns, early outcomes and associations of burn outcomes among patients admitted at the Moi Teaching and Referral Hospital (MTRH) Eldoret.

Methods: A cross-sectional descriptive study was conducted at MTRH between January 2016 and June 2017. A total of 189 patients admitted to the hospital with burns were recruited into the study. An interviewer-administered questionnaire and chart review were used to collect data on sociodemographic variables, burn clinical characteristics and early burn outcomes. Data was presented in charts, graphs and frequency tables. Associations between patterns and early burn outcomes were assessed by binary logistic regression.

Results: Of the 182 burn patients whose data was analyzed, 149 (81.9%) were children below 18 years. Majority (75.6%) of burns were due to scalds. The commonest burn locations were the trunk and upper limbs. Only 40.1% of patients received prehospital intervention. The median Total Burn Surface Area (TBSA) was 14.5% and 74.2% of the patients had 2nd degree burns. The median length of hospital stay was 16 days (IQR=33) and commonest complication was wound infection (21.4%). Mortality rate was 9.3%. At multivariate analysis, a TBSA of 20%-30% ($p=0.01$) was associated with presence of burn complications while a TBSA of >10% ($p=0.03$) and time from burn to admission ($p=0.03$) were associated with the length of hospital stay.

Conclusions: Majority of burn patients were children and most burns were due to scalds. Although the median TBSA was low, wound infection rate was high and length of hospital stay was relatively long in comparison to other hospitals in the region. TBSA was significantly associated with presence of burn complications and length of hospital stay.

Recommendations: Health education of the public to improve on pre-hospital intervention and prompt health care for the burned patient. Further research on the causes of wound infection and factors that influence the development of wound infection in patients with burns.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

DALYS: Disability Adjusted Life Years

IQR: Interquartile range

IREC: Institutional Research and Ethics Committee

KNH: Kenyatta National Hospital

MTRH: Moi Teaching and Referral Hospital

SPSS: Statistical Package for the Social Sciences

TBSA: Total Burns Surface Area

WHO: World Health Organization

OPERATIONAL DEFINITION OF KEY TERMS

Burn: A traumatic injury to the skin or other organic tissue caused by thermal or other acute exposures leading to tissue destruction.

Clinical patterns: Complex of symptoms, clinical signs and other descriptions of burn injuries.

Early outcomes: Morbidity or mortality from the burn injury occurring from admission until discharge or death.

Length of hospital stay: Number of days from the time the patient is admitted to the time they are discharged by the clinician from in-patient management or death.

Moderate burn: Burn involving 5-10% of total body surface area in a child and 10-20% of the total body surface area in an adult (American Burn Association, 2013).

Severe burn: Burn involving more than 10% of total body surface area in a child and more than 20% of the total body surface area in an adult (American Burn Association, 2013).

Morbidity: Incidence of complications resulting directly or indirectly from the burn injury.

Mortality: Incidence of death resulting directly or indirectly from the burn injury.

Child: A study participant who is less than 18 years of age.

Sepsis in burn patients: Criteria by American Burn Association consists of; existence of an infection (documented by clinical response to antibiotics, pathological analysis of tissues from the wound or positive cultures) and at least three of the following criteria:

1. Fever > 39°C;
2. Hypothermia (< 36.5°C);
3. Progressive tachycardia (> 110 beats per min);
4. Progressive tachypnea (> 25 breaths per minute not ventilated or minute ventilation > 12 L/min ventilated);
5. Thrombocytopenia (< 100,000/μl);
6. Hyperglycemia, in the absence of preexisting diabetes mellitus (untreated plasma glucose > 200 mg/dl or > 7 units of insulin/h intravenous drip or significant resistance to insulin, > 25% increase in insulin requirement over 24 h);
7. Inability to continue enteral feedings > 24 h (abdominal distension or high gastric residuals, residuals two times feeding rate or uncontrollable diarrhea, >2500ml/day) (Greenhalgh et al 2007).

Severe anaemia: Anaemia requiring blood transfusion in a child or an adult.

Wound infection in a burn: Criteria by American Burn Association consists of;

1. Local signs; Increasing wound size, conversion of partial thickness to a full thickness burn, pocketing at the base of the wound, dark discoloured granulation tissue, worsening cellulitis of surrounding tissue, increasing friability, sero-purulent, hemo-purulent or pus discharge, eschar separation, tissue necrosis and abnormal smell
2. Systemic signs and symptoms; general malaise, pyrexia, tachycardia
3. Laboratory; elevated white blood cell count, elevated C reactive protein and demonstration of $>10^5$ bacteria per gram tissue or recovery of mold/yeast by culture (Greenhalgh et al 2007).

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CHAPTER ONE: INTRODUCTION

1.1 Background Information

A burn is defined as traumatic injury to the skin or other organic tissue primarily caused by thermal or other acute exposures and occurs when some or all cells of these tissues are destroyed (American Burn Association, 2013). Burn injuries are caused by hot solids, hot liquids, flame, cold, electricity, radiation, friction or caustic chemicals. Burns are classified on the basis of depth of tissue injury and total body surface area burned. According to depth, burns are classified into superficial burns involving only epidermis (first degree), partial thickness burns extending from epidermis to papillary and reticular dermis (second degree), full thickness burns extending through entire dermis (third degree) and fourth degree burns extending into subcutaneous tissue, fascia or bone (Sabiston & Townsend, 2002; Williams, Bailey, Bulstrode, Love, & O'Connell, 2008). Classification of burns is important in standardizing burn description as well in guiding management.

Burns are the fourth most common type of trauma worldwide following road traffic accidents, falls and interpersonal violence. About 90% of these worldwide burns occur in low to middle income countries and the incidence of fire-related injuries is estimated to be 1.1 per 100,000 population. Worldwide, approximately 180,000 deaths occur annually due to burns, with low and middle-income countries accounting for about 95% of these deaths (WHO, 2018). Non-fatal burns are a leading cause of morbidity, disfigurement, disability as well as prolonged hospitalization (Peck, 2011).

Most burns involving children (84%) and adult females occur in the domestic setting while burns involving adult males occur mostly in the outdoors or work setting. Majority of burns are unintentional (more than 95%) and the commonest causes of

burns in the western countries in both children and adults are flame injuries and scalds (American Burn Association, 2013).

In the developing countries, the groups most vulnerable to burn injuries are children aged below five years, the elderly and individuals with pre-existing illnesses such as uncontrolled epilepsy and diabetes. In the rural areas of lower income countries, unemployment, poverty, overcrowding, low education status and lack of electrification are major risk factors for burn injuries (Rybarczyk et al., 2017).

The Global Burden of Disease Project noted a 6% decline worldwide in fire and burn deaths, from 5.1 to 4.8 per 100,000 with 90% of these deaths occurring in lower middle income or low-income countries (WHO, 2008). Mortality among admitted patients with burns has also decreased from 60% to 4% and this has been attributed to incorporation of early excision and immediate skin grafting into routine patient care (Gravante, Delogu, Esposito, & Montone, 2007). Fortunately, majority of burn injuries in children are preventable and prevention programs need to be strengthened through education on home and personal safety (Sminkey, 2008).

The management of severe burn injuries often requires intensive and long-term multidisciplinary treatment approaches resulting in prolonged hospital stay (Bartosch, Bartosch, Egipto, & Silva, 2013). In many developing countries, late presentation to hospital after burn injuries is a common occurrence that affects burn morbidity and mortality. Some studies found that up to 50% of burn patients or more presented to hospital 24 hours post injury (Chalya et al.,2011; Forjuoh, 2006; Okoro, Igwe, & Ukachukwu, 2009). Though early burn wound excision and skin grafting has been recommended to improve outcomes in burn patients, it is yet to be adopted in many

centers due to economic, social, logistical and infrastructural reasons (Oladele & Olabanji, 2010).

Acute complications of burns include hypovolemic shock, electrolyte imbalances, infections, anaemia, renal failure and hypothermia (Williams, Bailey, Bulstrode, Love, & O'Connell, 2008). These commonly occur during the first week of the burn injury and coincide with the period that most deaths occur. Late complications are mainly due to inappropriate wound healing and include keloids, hypertrophic scars and contractures which contribute significantly to disability in burn patients. Rarely, thrombo-embolic complications may occur as well as Marjolin's ulcers (Billiar et al., 2004; Moonsamy, Nazarian, Schulz, & Goverman, 2016).

Management of burns at MTRH

Patient presenting with burns at MTRH are first seen in the emergency department by the medical officers, surgical residents and nurses. The TBSA is estimated by Wallace rule of nines for adults and Lund and Browder charts for children. Patients are then stabilized by fluid resuscitation using based on Parklands formula, given tetanus immunization, analgesia and prophylactic antibiotics. Patients with extensive TBSA and those with inhalation injury are taken to Intensive Care Unit for critical care when space is available. When space is not available in the Intensive Care Unit these patients are admitted in the general surgical wards. The burn wounds are dressed with antibiotic impregnated gauze ('Sofra tulle') for large wounds and silver sulphadiazine for smaller wounds or wounds on the face. Women and children below 14 years with burns of TBSA more than 20% are admitted to the Burns ward while all men, women and children with burns of TBSA less than 20% are admitted to the general wards. While in the wards, dressing changes are done regularly,

physiotherapy and nutritional supplementation if required are also done. Complete blood count and renal function tests are done on admission and checked regularly while in the ward and deficits corrected. Wound swabs for microscopy culture and sensitivity are also done whenever wound infection is suspected and antibiotics given as indicated. Patients whose wounds require grafting are then be prepared for theatre and delayed excision and split thickness grafting is done.

Challenges experienced in the management of burn patients in MTRH include;

1. Lack of a specialised burns unit to manage patients with severe burns.
2. Shortage of blood for transfusion.
3. Shortage of Intensive Care Unit space.
4. Inability to do early burn wound excision and grafting due to logistical and infrastructural reasons.

1.2 Problem statement

Although burns are common in Kenya, the mortality and morbidity patterns are yet to be well studied and documented (Nthumba & Oliech, 2005). This is compounded by the lack of a national burn repository that would provide vital information to aid research in the management and prevention of burns. Moreover, the World Health Organization has noted that a major hindrance to implementation of burn prevention strategies in low and middle-income countries is the scarcity of data on the characterization of burn injuries (WHO, 2008).

Besides causing mortality and morbidity, burns are also a major cause of both short term and long-term disability that lead to a negative economic impact (Dale et al., 2013).

At Moi Teaching and Referral Hospital (MTRH) burns constitute a significant problem. Unpublished hospital records show that the bed occupancy in the burns unit

was 151% while the average length of hospital stay was 48 days in 2014. Consequently, the management of burn patients is expectedly very resource intensive in terms of financial costs, human resource and time.

1.3 Justification of the study

Burns are a major cause of mortality and disability especially in the developing countries. Despite this, there is still a paucity of local data in the Western region of Kenya on the patterns and outcomes of these burn injuries. Patterns of burns vary from one setting to another, being influenced by many aspects of the population such as urbanization, socio-economic status and literacy levels, among others. This study relates the patterns of burns and the outcomes such as length of hospital stay and mortality. Knowledge of the causative factors and risk factors will also be a guide to the development and implementation of prevention strategies at the county and national levels especially for policy makers.

The outcomes that were evaluated included length of hospital stay, mortality and burn related complications. Traditionally mortality has been used as the proxy indicator of performance and outcomes in burn care but its usefulness is currently being questioned (Jaskille et al., 2009). The length of stay in hospitalized burn patients has been found to be a good indicator for; morbidity, incidence of complications, functional outcomes and the cost of caring for burn patients (Hussain & Dunn, 2013).

A previous retrospective study at MTRH recommended the creation of a burns unit to decrease burn mortality and morbidity but this was not done (Lelei, Chebor, & Mwangi, 2011). Furthermore, it has been a decade since this study with a few changes such as the employment of plastic surgeons and the introduction of a burn ward for

severe burns, a follow up study is necessary to assess the benefit of these interventions as well as look at the trends in patterns and outcomes.

A current study of burn patterns is also useful in identification of new potential risk factors as well as mapping out trends in burn injuries especially if done on a regular basis. Patterns of burns are expected to change over time due to factors such as modernization thus some causes of burns not previously seen may be identified. An example is the risk of occurrence of scalds due to increasing use of instant showers in urban areas.

Establishment of factors associated with mortality and length of stay allows comparisons with other regions leading to improvements in the management of burn injuries as well as evaluating the needs of these patients (Burton, Sharma, Harrop, & Lindsay, 2009).

This study aimed to undertake a comprehensive and updated evaluation of burn injuries in MTRH in order to inform county and other policy makers in terms of data informed decisions such as setting up a specialized burns unit to cater for the western region of Kenya.

1.4 Research question

What are the clinical patterns, early outcomes and their associations among patients admitted with burn injuries at MTRH?

1.5 Research objectives

1.5.1 Broad objective:

To describe the clinical patterns, early outcomes and their associations among patients admitted with burn injuries at MTRH.

1.5.2 Specific objectives:

1. To describe the clinical patterns of burn injuries in patients admitted at MTRH.
2. To determine the early outcomes of patients admitted with burns at MTRH.
3. To determine the association between the clinical patterns and early outcomes in patients admitted with burns at MTRH.

CHAPTER TWO: LITERATURE REVIEW

2.1 Patterns of Burn Injuries

Globally, the number of burns requiring medical attention in a year is about 11 million people and surpasses the combined incidence of tuberculosis and HIV infections (Peck, 2011). Worldwide, burns are ranked fourth among all injuries and are among the leading causes of disability-adjusted life years (DALYs) lost in low- and middle-income countries (WHO, 2014).

Several studies show that the incidence of burns is highest among toddlers due to their new-found mobility, increased curiosity in exploring their environment and unawareness of the danger from heat sources (Kemp, Jones, Lawson, & Maguire, 2014). However, a study done at Kenyatta National Hospital found a bimodal age distribution with peaks in the age groups 0-5 and 21-30 years (Ndiritu, Ngumi, & Nyaim, 2006). Other risk factors contributing to the incidence of burns include poverty, poor child supervision, overcrowding, low maternal education and presence of flammable substances in the home (Peck, 2011). This emphasizes the need for environmental modification and safety education for parents and caregivers. Several studies show a higher male to female ratio in occurrence of burn injuries (Agbenorku, Edusei, & Ankomah, 2011; Kemp et al., 2014; Ndiritu et al., 2006; Ortiz-Prado, Armijos, & Iturralde, 2015).

Burns occur as a result of a complex interaction between host characteristics, contact with an etiological agent through a certain mechanism, in a particular environment (Kemp et al., 2014). These factors greatly determine the pattern of burn injury that will be sustained.

Most burns (96 to 99%) are unintentional while a few are intentional as a result of assault, abuse or attempted suicide (Agbenorku et al., 2011; Ndiritu et al., 2006).

Most burns occur at home and are mainly scalds as compared to burns occurring at the workplace and outdoors where open fires, electrical or chemical burns particularly among adults occur. Common mechanisms of burn injury in children include pulling of hot liquids down on themselves, touching hot items, spill injuries and falling into or stepping into hot liquids, objects or flames (Kemp et al., 2014).

The frequency of scalds is the highest at 49-57% followed by open flame and electrical, chemical and finally friction burns which occur less frequently. However, Olaitan, Fadiora, and Agodirin, (2007) found that open flames caused more burns than scalds and this could have been due to differences in age composition of the sample. Scalds are more common in children, constituting about 90% (Mutiso, Khainga, Muoki, & Kimeu, 2015; Lelei et al., 2011). Scalds result from hot liquids such as hot soup, hot water or hot oil. Open flame burns are associated with more severe burns because of frequent involvement of accelerants, ignition of clothing, potential for inhalation injury and skin exposure to direct high temperatures results in higher morbidity and mortality (Ndiritu et al., 2006). They are more common in adults and are associated with a higher Total Burn Surface Area (TBSA) and burn depth.

Risk factors for burn injuries include low socioeconomic status, age, gender, cultural factors and presence of comorbidity (Peck, 2011). Increased rural to urban migration with resulting creation of slums, overcrowding with inadequate child supervision also increases the risk (Mutiso et al., 2015).

Level of education has also been found to have a significant association with incidence of burn injuries in that a higher level of education correlates with higher awareness of burn risk and prevention strategies (Ndiritu et al., 2006).

In a study at Kenyatta National Hospital in Kenya, the mean TBSA was found to be 22.3% (Ndiritu et al., 2006). Another study in the same hospital had reported a lower mean TBSA of 17% (Nthumba & Oliech, 2005). The mean TBSA in some developed countries ranges from about 12 to 20% (den Hollander, Albert, Strand, & Hardcastle, 2014). Another study done at a paediatric hospital in Kenya found that the majority of burns were minor burns (< 10% TBSA) and the most frequently burned areas were the arms and the chest (Mutiso et al., 2015). A previous study done in MTRH found the mean TBSA to be 16.4% (Lelei et al., 2011). Other studies in Africa also showed that in children the location of burns is mainly the extremities followed by the chest and face (Kemp et al., 2014). Burns of the extremities may result in contractures which are a major cause of disability while those of the face are frequently associated with disfigurement and low self-esteem.

Peck (2012) found a significant occurrence of intentional burns unevenly distributed worldwide with highest rates in young women in India and high rates in middle aged men in Europe. Contributory factors to the incidence of these burns include drug and alcohol abuse and unstable relationships.

2.2 Outcome of Burn Injuries

Mortality due to burns has generally been decreasing worldwide and this may be attributed to better surgical techniques, more trained medical personnel and better treatment protocols (Agbenorku, Akpaloo, Yalley, & Appiah, 2010; Peck, 2011). Adoption of early excision of burn wound has also led to better outcomes such as

decreased morbidity, decreased mortality and reduced hospital stay (Atiyeh, Masellis, & Conte, 2009). In Kenya, the management of burn patients is not optimal partly because of lack of resources and this may result in poorer outcomes in these patients (Nthumba & Oliech, 2005).

One of the major factors associated with mortality and hospital stay is TBSA (Olaitan & Jiburum, 2006). Other factors, especially in developing countries include the shortage of well specialized and motivated burn personnel, shortage of blood and inadequate health facilities (Agbenorku et al., 2011). Furthermore, lack of a fire rescue service and poor first aid practices in the community such as application of raw eggs or engine oil on burn wounds may lead to an increase in morbidity (Oladele & Olabanji, 2010).

The mortality rate in burns varies greatly in different regions. In a descriptive study done in Indonesia, the mortality rate in adult burns was 27.6 % associated with a mean TBSA of 45.85% (Martina & Wardhana, 2013). A prospective study in Pakistan reported a mortality rate of 36%, one of the highest reported so far (al Ibran, Mirza, Memon, Farooq, & Hassan, 2013). Globally, mortality due to burn injuries is about 5% and is much lower at about 1% in Canada (Burton et al., 2009). In KNH, the mortality of hospitalized patients was 14.4% with 68.9% of these patients dying within the first week of admission (Nthumba & Oliech, 2005). The average TBSA of these patients was 50.4% and mortality was higher in females. Mortality is associated with TBSA; mortality rates are about 80-90% in patients with more than 60% TBSA (al Ibran et al., 2013).

Studies indicate that the major causes of death include septicemia, multiple organ failure, systemic inflammatory response syndrome and acute respiratory distress

syndrome. On the contrary, Zanasi et al., (2015) reported that patients with sepsis had a higher survival. Although the incidence of burn related self-mutilation and suicide attempt worldwide is relatively low, these injuries carried a high overall mortality rate of 65% (Peck, 2012).

Prevention of burn related violence injuries requires multiple approaches such as legislation and enforcement, education and advocacy (Peck, 2012).

The rate and nature of complications varies in different centers and different regions. In Nigeria some of the major complications of burns include wound infection (20-34%), anxiety and depression (65%), post-burn contractures (8.6-20%) and extremity amputation (2.1%) and measles in children with major burns (Oladele & Olabanji, 2010). In Kenya, the rate of complications is 13.3% among survivors and include scarring, keloids, contractures, limb amputations and post-traumatic stress disorder in order of frequency of occurrence (Nthumba & Oliech, 2005).

Several studies have found that the strongest predictors of length of hospital stay are age and percentage of total body surface area burned (Hussain & Dunn, 2013; Yang, Wei, Yuan, & Schoung, 2010). Other factors associated with length of stay include female gender, inhalation injury, surgery and the depth of burn (Hussain & Dunn, 2013). The length of hospital stay in developed countries ranges from 8.22 days to 20.4 days. In Kenya, previous studies have found the length of stay in patients with burns to be 25.2 days/4% TBSA (Dale et al., 2013) and 25.7 ±33.5days (Lelei et al., 2011).

CHAPTER THREE: METHODOLOGY

3.1 Study setting

The study was conducted at the Moi Teaching and Referral Hospital (MTRH) burns ward and the surgical wards that admit patients with burn injuries.

MTRH is the second national referral hospital in Kenya and is located in Eldoret town in the North Rift region of Western Kenya. It has a catchment area of about 16.2 million people yet it lacks a specialised burns unit. It has a bed capacity of about 1000.

MTRH is also a teaching hospital for Moi University's Schools of Medicine and Nursing that offers degrees in both undergraduate and postgraduate disciplines. It is also a centre for training various diplomas for the Kenya Medical Training College and University of Baraton East Africa's School of Nursing.

3.2 Study population

The study population consisted of all patients (adults and children) with moderate and severe burns admitted at MTRH during the study period. The study period was from 1st January 2016 to 30th June 2017.

3.3 Study design

This was a cross sectional descriptive study. Patients were recruited upon admission, information about their demographic characteristics and the characteristics of the burn injury was obtained. At discharge or death, the length of hospital stay and complications experienced in the course of their treatment were noted. If death occurred during their stay in hospital it was also recorded as an outcome. Associations between demographics, patient characteristics, burn characteristics and the outcomes were then analyzed.

3.4 Sample size determination

The sample size required for the study was computed using Cochran's (1963:75) Equation 1 to yield a representative sample for proportions as follows;

$$N = \frac{z^2pq}{d^2}$$

Where

N = Sample size

Z^2 = Critical value associated with type 1 error of 5% at the desired confidence level at 95% (standard value of 1.96)

p = Estimated prevalence of burns

q = 1-p

d = Desired width of confidence interval (±5%)

From a previous study done in Kenyatta National Hospital, the value for p; which denotes mortality in admitted patients with burns, is 14.4 % (Nthumba & Oliech, 2005).

Thus

$$N = \frac{1.96^2 \times 0.144 \times 0.856}{0.05^2}$$

= **189 patients**

3.4 Sampling procedure

Consecutive sampling was used to recruit study participants. As patients with burns were admitted in the wards, those who were eligible for the study were recruited until the required sample size was achieved.

3.5 Eligibility criteria

3.5.1 Inclusion criterion

All patients with moderate and severe burns who were willing to participate in the study were included.

3.5.2 Exclusion criteria

1. Patients re-admitted for burn reconstructive surgery or other follow up procedures.
2. Patients who already had wound infection at admission.

3.6 Study variables

3.6.1 Independent variables

These included age, sex, marital status, level of education and occupation. However, if the patient was a child, the marital status, level of education and occupation variables of the parent, caregiver or guardian taking care of the child were recorded.

Burn clinical characteristics were also considered as independent variables and included burn location, total burn surface area, mechanism and cause of burn, depth of burn, pre-hospital assistance and presence of co-morbidities.

3.6.2 Dependent variables

These included presence of burn complications (dichotomized as either Yes or No) and length of hospital stay in days.

3.7 Data collection

Data was collected using a coded questionnaire (Appendix II) and included patient's characteristics, characteristics of the burn injury and burn outcomes. Before the commencement of data collection, the research assistant was briefed on the research process and given time to familiarize himself with the patient selection process and criteria. The research assistant helped in identification of potential research participants for recruitment into the study. The principal investigator administered the consent process, administered the questionnaire and conducted data entry and analysis.

A total of 189 patients met the eligibility criteria and were recruited into the study. Subsequently, 189 questionnaires were administered as there were no respondents who declined to participate in the study. Of the 189 patients, 3 absconded from treatment thus dropped out of the study before completion. At the time of conclusion of the study there were still 4 active respondents who had not been discharged from the hospital and were therefore not included the final sample of 182 patients (Figure 1). A total of 182 questionnaires were included in data analysis translating to about 96% of the initially calculated sample size.

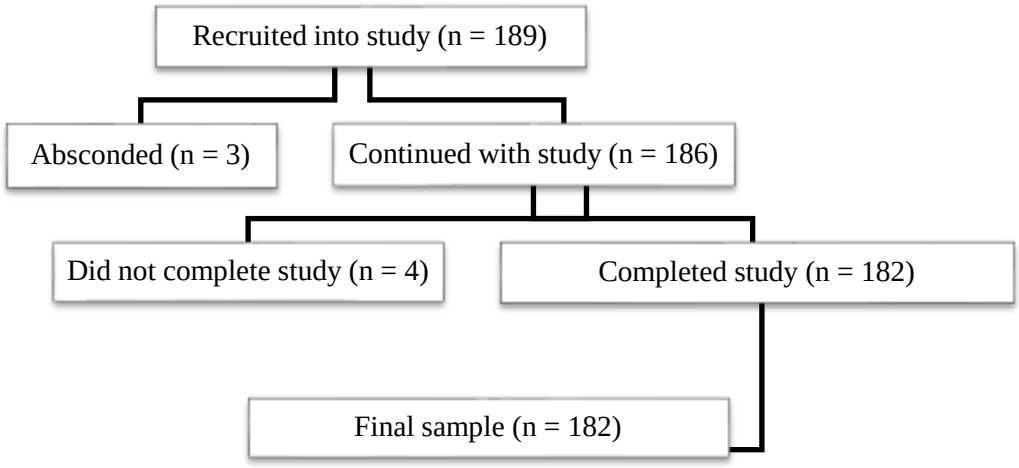


Figure 1: Study participants recruitment

Data on the Total Burn Surface Area was determined using the Wallace rule of sevens and nines in adults and the Lund and Browder chart in children (Appendix III). This was then recorded together with the depth of burn within 24 hours of admission. The occurrence of depression was assessed using Beck's depression inventory. Data was stored in a password protected computer folder to prevent access by unauthorized persons and to protect integrity of the data.

3.8 Data entry and analysis

Data entry was done using double entry method into Microsoft Excel data sheets to maintain integrity. Data was initially checked for consistency and extreme outliers through use of tables, histograms and box plots followed by analysis using both descriptive and inferential statistics. Continuous data was described using median and interquartile range while frequencies and proportions were used for categorical data. Statistical analysis was conducted using the software SPSS v20 for Windows, with an alpha value of 0.05 used to indicate significance. Bivariate logistic regression was used to assess associations between independent variables and burn outcomes: presence of burn complications and length of hospital stay. Multivariate logistic regression was used to assess independent associations of burn complications and length of hospital stay.

3.9 Ethical considerations

Ethical approval for the study was sought and obtained from IREC and permission to carry out the study obtained from MTRH. Informed consent was sought from study participants. Confidentiality of all information received from study participants was maintained. For study participants who were below 18years old, informed consent was sought from their parents or guardians. The consent procedure took place in a private room in the wards and the parent or guardian was given time to consider and

decide whether or not their child should participate in the study. Permission from one parent/guardian was sought but the consenting parent was given time to consult with the other parent/guardian. This research involved no more than minimal risk to the study participants because no interventions and procedures were carried out on participants. Verbal assent was obtained for children above seven years who were capable of understanding the information given on the purpose and nature of the study. The consent forms used in the study in both English and Kiswahili languages are attached in appendix I.

Possible identifiers for participants enrolled in the study such as names and in-patient numbers were dropped and instead, unique numbers were assigned. The participants were allowed to pull out of the study at any time if they no longer wished to continue.

Dissemination of research findings will be done through thesis defense, presentation in conferences or seminars and publication in a peer reviewed journal.

CHAPTER FOUR: RESULTS

4.1 Demographic characteristics of the study sample

The age of the participants (n=182) ranged from 0.25 to 72 years with a median age of 2.4, IQR 5.8. Of these, 109 (60%) were male. A total of 149 (82%) patients were children while 33 (18%) were adults. Among the adults, majority (64%) were married while the rest were either single (18%), divorced/separated (9%) or widowed (9%). Most of the adult participants (97%) had attended school (Figure 2) while a few (3%) had never attended school. The most common school level attained was primary (50.5%).

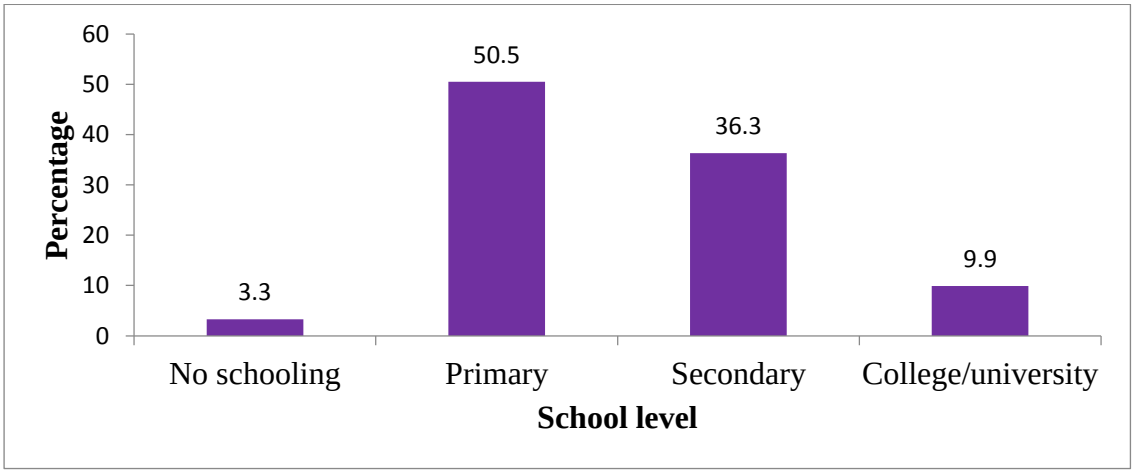


Figure 2: Highest school level attained by participants (n=33)

Regarding the nature of occupation, 42% of the adults were not employed, 52% were under informal employment while 6% were formally employed. Table 1 highlights the sociodemographic characteristics of the study participants.

Table 1: Sociodemographic characteristics of participants recruited into the study (n=182)

Characteristic*	**Children**		**Adults**		**Total**	
	n	%	n	%	n	%
Sex						
Male	91	61%	18	55%	109	60%
Female	58	39%	15	45%	73	40%
Marital status						
Married	-	-	21	64%	21	64%
Single	-	-	6	18%	6	18%
Divorced	-	-	3	9%	3	9%
Widowed	-	-	3	9%	3	9%
Highest school level						
No schooling	-	-	2	6%	2	6%
Primary	-	-	21	64%	21	64%
Secondary/Alevel	-	-	9	27%	9	27%
College	-	-	1	3%	1	3%
Nature of occupation						
Formal	-	-	2	6%	2	6%
Informal	-	-	17	52%	17	52%
None	-	-	14	42%	14	42%

Table 2 further illustrates the age distribution of study participants, most of whom were children aged below 5 years.

Table 2: Age and sex distribution of the study participants (n=182)

Variable	n	%
Age (years)		
<5	131	72.0
5-14.9	15	8.2
15-24.9	11	6.0
25-34.9	9	4.9
35-44.9	7	3.8
45+	9	4.9
Sex		
Male	109	59.9
Female	73	40.1

4.2 Burn clinical patterns

4.2.1 Time from burn to presentation

Most of the patients (58.8%) presentation to hospital within less than 3 hours of experiencing the burns as shown in figure 3.

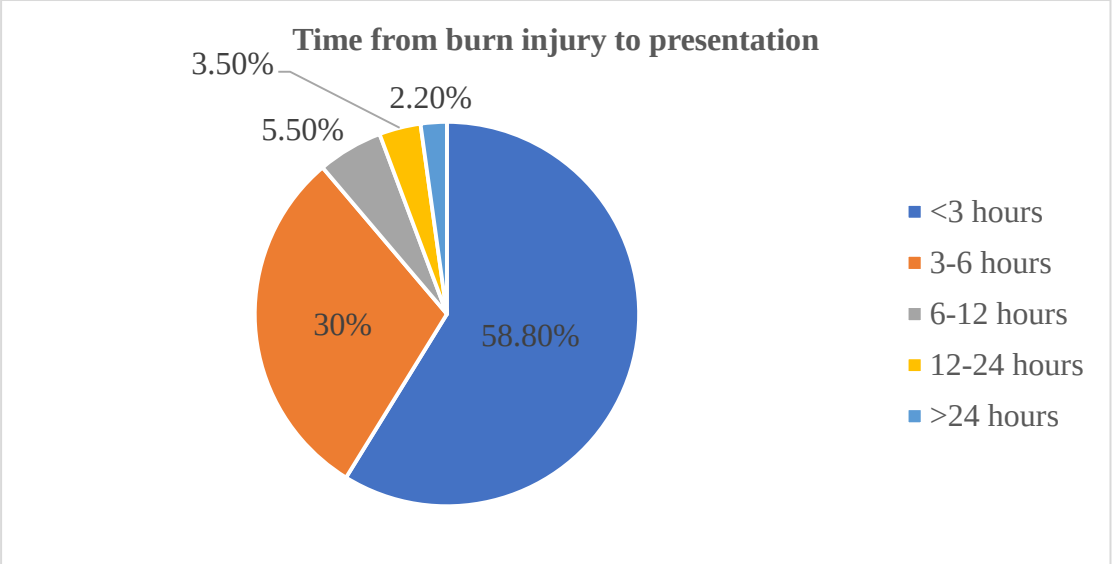


Figure 3: Time from burn injury to presentation to hospital (n=182)

4.2.2 Place of occurrence and cause of burn

Of the 182 patients that got admitted with burns, 176 (96.7%) got burnt at home, 2 (1.1%) got burnt at work while 4 (2.2%) got burnt at the roadside. Scald was the most common source of burn (75.8%) followed by flame (21.4%).

4.2.3 Burn location

Patients were admitted with the following burn locations: Head and neck, trunk, upper limbs, lower limbs and perineum. Notably, these occurred in combination with the most common being burns on the head, neck, trunk and upper limbs (14.3%). Isolated burns to the lower limbs (10.4%) and upper limbs (9.3%) were also seen.

In relation to anatomical regions, the trunk and upper limbs were the most affected as shown in table 3. Some patients presented with involvement of more than one anatomical region.

Table 3: Burn location based on body regions involved (n=182)

Region	Frequency of occurrence
Trunk	105
Upper limbs	91
Lower limbs	71
Head and neck	60
Perineum	27

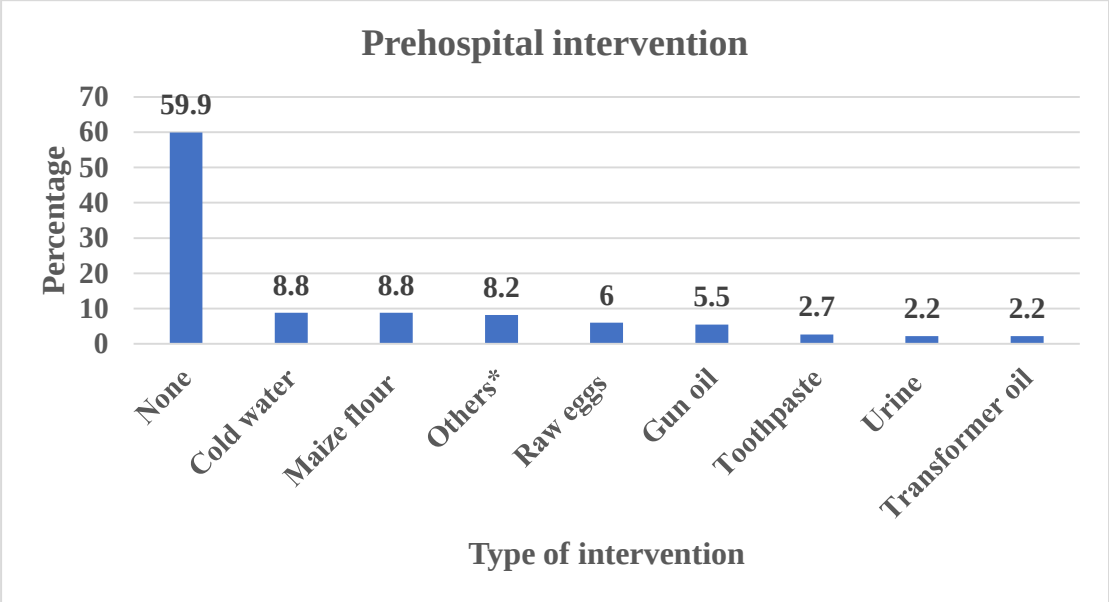
4.2.4 Nature and mechanism of injury

A total of 172 (94.0%) of the burn cases occurred by accident while 10 (6.0%) were intentional. Intentional burns were either self-inflicted or caused by assault and most of them were flame burns involving adults. The mechanisms of injury included fall

onto heat source (44.0%), spill (36.8%), clothes, bedside or house on fire (15.9%), contact with hot object (1.6%) and lightening (1.6%).

4.2.5 Prehospital intervention

Of the 182 patients, 40.1% received prehospital intervention. The most common was pouring of cold water on the wound. Figure 3 below highlights the types of prehospital intervention.



*Others included honey, coconut oil, sulphadiazine ointment, petroleum jelly, wheat flour, brake fluid and washing soap.

Figure 4: Prehospital intervention (n=182)

4.2.5 Total Burn Surface Area and burn depth

The median TBSA was 14.5%, (IQR=11.3%). The minimum TBSA was 6.0% while the maximum was 70.0%. The highest TBSA that was successfully managed and discharged home was 56%.

Regarding the burn depth, 135 patients (74.2%) had 2nd degree burns, 46 (25.3%) had 3rd degree burns while 1 (0.5%) had 4th degree burn.

4.2.6 Comorbidity

Of the 25 (13.7%) who presented with comorbidity, the distribution was as follows: systemic infection (28%), substance abuse (20%), epilepsy (16%), trauma (12%) and others like mental illness, hydrocephalus and developmental disorders (8%).

4.3 Burn Outcomes

4.3.1 Complications

A total of 66 patients (36.3%) developed complications while being treated for burns in the hospital. Wound infection was the commonest complication, occurring in 39 (21.4%) of patients (Table 4). Of those patients who developed complications, some had more than one complication occurring concurrently.

Table 5. Frequency of occurrence of burn related complications (n=182)

Complication	No of patients	% of patients
Wound infection	39	21.4
Severe anaemia	21	11.5
Death	17	9.3
Electrolyte abnormalities	13	7.1
Respiratory complications	12	6.6
Sepsis	11	6.0
Hypoalbuminemia	11	6.0
Acute renal failure	8	4.4
Others*	6	3.3

*Others included extremity amputation, depression and compartment syndrome.

Overall, death occurred in 17 patients (9.3%), most of whom had at least one or two other complications notably acute renal failure, respiratory complications, electrolyte abnormalities and sepsis.

4.3.2 Length of hospital stay

For the 165 patients that were discharged from hospital, their median length of hospital stay was 16 days (IQR=33) with a minimum stay of 2 days and a maximum stay of 203 days. Of the 17 patients that died, their median length of hospital stay was 7 days (IQR=17), their minimum length of stay 2 days and the maximum 53 days. The overall mean length of hospital stay for all the patients was 35.23 days which translates to 1.88 days/1% TBSA.

Table 6: Median length of hospital stay (days) of patients admitted with burns

Patient category	Median length of hospital stay	IQR	Min	Max
Patients who were discharged home	16	33	2	203
Patients who died	7	17	2	53
All the patients in the study	16	28	2	203

4.4 Association between patient sociodemographic and clinical characteristics and outcome variables

4.4.1 Association between patient sociodemographic and clinical characteristics and presence of burn complication

At bivariate analysis, factors associated with development of burn complications included age of the patient, time from burn to admission, cause of burn, burn depth, TBSA and presence of co-morbidity (Table 7). There was no association between sex of the patient and presence of burn complications.

Table 7: Bivariate analysis of association between patient characteristics and presence of burn complications

Characteristic	Unadjusted OR (95% CI)	p value
Age of the patient (years)		
– <18	1	
– 18+	3.2 (1.42-7.28)	0.01
Sex		
– Male	1	
– Female	0.99 (0.53-1.88)	0.99
Time from burn to presentation		
– <3 hours	1	
– 3+ hours	2.10 (1.10-4.0)	0.02
Pre-hospital intervention		
– Yes	1	
– None	2.56 (1.31-4.98)	0.01
Cause of burn		
– Scald	1	
– Flame	6.56 (3.0-14.32)	0.01
Mechanism of injury		
– Fall onto heat source	1	
– Spill	3.70 (1.49-9.18)	0.01
– Clothes, bedding or house on fire	10.18 (3.73-27.81)	0.01
TBSA (%)		
– <10	1	
– 10-<20	3.36 (0.99-11.37)	0.05
– 20-<30	7.43 (3.15-17.49)	0.01
– 30+	1.31 (0.45-3.83)	0.62
Burn depth		
– 2nd degree	1	
– 3rd degree and above	2.95 (1.45-6.02)	0.01
Presence of comorbidity		
– Yes	1	
– No	0.17 (0.07-0.45)	0.01

At multivariate analysis, only TBSA of 20 to less than 30% was significantly associated with the presence of burn complications (Table 8).

Table 8: Multivariate analysis of the association between patient characteristics and presence of burn complication

Characteristic	Adjusted OR (95% CI)	p value
Age of the patient (years)		
– <18	1	
– 18+	0.32 (0.08-1.41)	0.13
Sex		
– Male	1	
– Female	1.03 (0.47-2.25)	0.95
Time from burn to presentation		
– <3 hours	1	
– 3+ hours	1.20 (0.54-2.68)	0.66
Pre-hospital intervention		
– Yes	1	
– None	1.26 (0.54-2.96)	0.59
Cause of burn		
– Scald	1	
– Flame	2.98 (0.47-18.71)	0.24
Mechanism of injury		
– Fall onto heat source	1	
– Spill	1.08 (0.17-6.86)	0.94
– Clothes, bedding or house on fire	1.99 (0.25-16.09)	0.52
TBSA (%)		
– <10	1	
– 10-<20	3.28 (0.49-22.05)	0.22
– 20-<30	4.96 (1.59-15-49)	0.01
– 30+	0.94 (0.27-3.34)	0.93
Burn depth		
– 2nd degree		
– 3rd degree and above	1.85 (0.51-6.67)	0.35
Presence of comorbidity		
– Yes	1	
– No	0.31 (0.09-1.10)	0.07

4.4.2: Association between patient characteristics and length of hospital stay

At bivariate level, the following patient characteristics were associated with length of hospital stay: Age of the patient, time from burn to admission, prehospital intervention, cause of burn, mechanism of injury and TBSA (Table 9). Sex of the patient, burn depth and presence of comorbidity were not associated with the length of hospital stay.

Table 9: Bivariate analysis of the association between patient characteristics and length of hospital stay

Characteristic	Unadjusted OR (95% CI)	p value
Age of the patient (years)		
– <18	1	
– 18+	4.08 (1.44-11.53)	0.01
Sex		
– Male	1	
– Female	1.52 (0.81-2.84)	0.19
Time from burn to presentation		
– <3 hours	1	
– 3+ hours	2.69 (1.37-5.25)	0.01
Pre-hospital intervention		
– Yes	1	
– None	2.46 (1.31-4.63)	0.01
Cause of burn		
– Scald	1	
– Flame	9.25 (3.08-27.80)	0.01
Mechanism of injury		
– Fall onto heat source	1	
– Spill	9.46 (2.62-34.18)	0.01
– Clothes, bedding or house on fire	12.07 (3.32-48.85)	0.01
TBSA (%)		
– <10	1	
– 10-<20	7.24 (2.22-23.6)	0.01
– 20+	5.73 (2.50-13.12)	0.01
Burn depth		
– Mostly 2nd degree		
– Mostly 3rd degree and above	1.60 (0.77-3.33)	0.21
Presence of comorbidity		
– Yes	1	
– No	0.64 (0.22-1.86)	0.41

At multivariate analysis, a TBSA of over 10% and time from burn to admission of over 3 hours were significantly associated with prolonged hospital stay (Table 10).

Table 10: Multivariate analysis of the association between patient characteristics and the length of hospital stay*

Characteristic	Adjusted OR (95% CI)	p value
Age of the patient (years)		
– <18	1	
– 18+	0.59 (0.12-2.88)	0.50
Sex		
– Male	1	
– Female	1.74 (0.82-3.71)	0.15
Time from burn to admission		
– <3 hours	1	
– 3+ hours	2.35 (1.08-5.11)	0.03
Pre-hospital intervention		
– Yes	1	
– None	1.72 (0.81-3.68)	0.16
Cause of burn		
– Scald	1	
– Flame	1.98 (0.22-17.75)	0.54
Mechanism of injury		
– Fall onto heat source	1	
– Spill	3.36 (0.32-34.81)	0.31
– Clothes, bedding or house on fire	3.36 (0.30-37.76)	0.33
TBSA (%)		
– <10	1	
– 10-<20	11.27 (1.33-9.53)	0.03
– 20+	3.37 (1.19-9.49)	0.02
Burn depth		
– Mostly 2nd degree	1	
– Mostly 3rd degree and above	2.03 (0.40-10.28)	0.39
Presence of comorbidity		
– Yes	1	
– No	2.44 (0.57-10.55)	0.23

*17 patients that died were excluded in this analysis

CHAPTER FIVE: DISCUSSION

5.1. Burn clinical patterns

Majority of the patients in the study were children below five years which is consistent with several studies that show that incidence of burns is higher among toddlers because of their curious nature, physical instability and unawareness of the dangers around them (Albertyn, Numanoglu, & Rode, 2014; Kemp et al.,2014). However, these results differ with those found at Kenyatta National hospital in Kenya where a bimodal peak of 0-5 and 21-30 years was observed (Ndiritu et al., 2006).

In this study, majority of the patients got admitted to hospital within less than three hours of experiencing the burns. Since most of the patients in this study were children, the occurrence of burns was most likely perceived to be an emergency by the caregivers. This probably prompted the need to take the children to the hospital within the shortest time possible. Despite majority being admitted within a short period after experiencing burns, 41.2% got admitted after three hours. In Kenya, due to suboptimal emergency fire rescue services, most patients have to find their own means to hospital which usually contributes to delays due to lack of resources and poor road networks. Establishment of this service would ensure patients receive appropriate first aid and timely resuscitation and therefore lead to an improvement in burn outcomes. Studies in other low- and middle-income countries have shown late presentation to hospital is common and affects burn morbidity and mortality (Chalya et al.,2011; Ringo & Chilonga, 2014).

Most of the patients got burnt at home. This could be explained by the fact that the majority of the patients who were admitted with burns were children aged below five years. These children spend most of their time within the home environment and especially in the kitchen where most of the accidental burns occur. This is similar to

what is seen in several other studies (Lelei et al., 2011; Mutiso et al., 2014). Burns involving mostly children and in the home environment could also point to inadequate child care as children are expected to be with a guardian at all times. There is need for burn prevention strategies to target the home environment and the care givers to these children. Burns are less likely to occur at the place of work due to two main reasons. Firstly, there is minimal exposure to flame, hot liquid or gas and hot objects in most places of work. Secondly, most places of work have adopted occupational safety measure to minimize burn injuries such as availability of safety standard operating procedures, fire drills, presence of fire extinguishers and fire assembly points, among others. The finding that burns occur mostly at home has also been described in other studies for both children and adults (Agbenorku et al., 2011; Fadeyibi et al., 2015; Rybarczyk et al., 2017).

Similar to what has been reported in Kenya (Dale et al., 2013; Mutiso et al., 2014) and elsewhere (Agbenorku et al., 2011; Rybarczyk et al., 2017; Samuel et al., 2011), scalds were the most common cause of burn in all ages. These scalds resulted mostly from hot water and hot tea and are common during meal preparation times. When stratified by age, the most common cause of burns in patients aged below five years was scald while older patients experienced a higher proportion of flame as the cause of burns. Other studies have reported flame burns as a common occurrence within the overall patient population (Dokter, Vloemans, et al., 2014; Fazeli et al., 2014; Nnabuko et al., 2009). In this study, flame burns occurred more in adults and were associated with higher total burn surface area and higher morbidity when compared to scalds. The discrepancies in study findings regarding causes of burns can be attributed to variations in sociodemographic characteristics of the populations studied including age, nature of work, living standards and cultural beliefs and practices.

The commonest mechanism of injury was falls directly on the heat source. Such falls may expose the tissues to a higher heat intensity and is likely to result in increased depth of burn, leading to a prolonged length of hospital stay.

Patients were admitted with burns affecting several parts of the body. The most common combination of burn locations was burns to the head, neck, trunk and upper limbs. This may reflect on the mechanism of injury which included falling on heat sources, spill injuries and children pulling on hot liquids upon themselves from a higher surface (Kemp et al., 2014). These mechanisms of injury lead to multiple body parts being exposed to the cause of burn at the same time. Burns on the head and neck are likely to be associated with disfigurement and psychological issues while those on the upper limbs are likely to lead to disability and a decrease in productivity if not well managed. The commonest region involved was the trunk followed by the upper limbs which is similar to a study in Nigeria which showed that the trunk was the commonest region involved (56.4%) followed by the upper limbs at 51.3% (Oladele & Olabanji, 2010). Several studies have also shown the upper limbs and trunk to be the common anatomic location in the majority of burn patients (Forjuoh, 2006; Rybarczyk et al., 2017; Samuel et al., 2011).

Almost all of the burns in this study were unintentional, with the few that were intentional mostly occurring in adults. Intentional burns were either self-inflicted as a suicide attempt or they involved assault. Assaults resulted from domestic violence against family members, civil disputes, arson and mob justice to purported criminals. They were almost all flame burns and most of them were due to the use of accelerants such as petroleum products. In this study unintentional burns (94%) were similar to other studies in Kenya and the rest of Africa where unintentional burns were about 96-99% (Agbenorku et al., 2011; Ndiritu et al., 2006). Some studies in Iran have

reported very high rates of suicide burns of about 30% which commonly involve young females and result in extensive burns and a high mortality (Fazeli et al., 2014; Hosseini, Askarian, & Assadian, 2007). This was however not seen in this study.

In a well-organized primary health care setting, prehospital management of burns has been shown to improve burn outcomes. The use of cold water is beneficial in reducing wound depth, conferring analgesia, improving wound healing and ultimately decreasing the length of hospital stay in burn patients (Cuttle & Kimble, 2010).

In this study, majority of the patients (59.9%) did not receive any form of prehospital intervention after experiencing burns. For those that did, the substances used ranged from cold water, maize flour, raw eggs, gun oil and urine among others. The use of an array of substances indicate that burn patients or their caregivers are aware that some form of first aid is necessary for burn patients prior to hospital admission. However, they may not have adequate knowledge on the necessary first aid interventions and the rationale of their use. Similar unsuitable substances have been used on burn wounds both in the developed as well as in developing countries and the use is not associated with the level of education (Fadeyibi et al., 2015). Oladele and Olabanji (2010) found that application of substances such as raw eggs could result in an increase in morbidity in burn patients but this was not seen in this study. Application of raw eggs and similar substances could result in erroneous assessment of the burn wound and subsequent improper management thus leading to complications.

Health education should be done to the public on the importance of cooling the burn using cold running water for 20 minutes. They should also be taught to avoid the use of creams, oils, lotions and other substances that might make burn assessment difficult besides being potentially harmful (Shrivastava & Goel, 2010). Furthermore, in this

study the use of cold water was in only 8.8% of patients which is way below that seen in other lower middle-income countries of about 30% (Atiyeh, Masellis, & Conte, 2009).

Characterization of burn severity, based on TBSA and burn depth is important as it informs choice of intervention and ultimately determines burn outcomes. Most of the patients had a fairly low TBSA and mostly superficial burns. Several studies in developing countries have shown similar results of mean TBSA less than 20% and most burns seen being 2nd degree (Forjuoh, 2006; Rybarczyk et al., 2017).

The low TBSA and presence of mostly superficial burns might probably explain why less adverse outcomes were noted within the patients. Burn depth has been found to be an independent predictor of burn complications in some studies (Klein et al., 2014; Kraft, Herndon, Finnerty, Shahrokhi, & Jeschke, 2014). Deeper burns are associated with more complications and higher mortality because of profound hypermetabolic, catabolic and inflammatory responses to injury (Kraft et al., 2014).

Most of the patients did not present with any comorbidity. For those that had comorbidities, it was noted that epilepsy and substance abuse contributed to causing the burns. Most burns in these patients occurred when they fell into heat sources especially when they had uncontrolled epilepsy or were inebriated. Notably, these were mostly adults with probably no home care therefore it would take longer for them to be rescued hence presenting with more severe burns. Ndiritu et al. (2006) also found that alcohol intoxication and epilepsy were two important risk factors for burns and should be the subject of public health burn prevention campaigns. Presence of comorbidities such as systemic infection increases the stress on the already compromised immune system, predisposing patients to development of complications.

Systemic infections can lead to complications such as wound infection due to poor healing of the burn wounds. These findings are similar to what has been found in other studies (Dokter, Meijs, et al., 2014; Dokter, Vloemans, et al., 2014; Mahar et al., 2010).

Some studies in Africa have shown that incidence of burns is high in epileptic patients but due to some cultural beliefs family members or onlookers are unlikely to rescue a convulsing patient from a fire (Boschini et al., 2014; Sabiston & Townsend, 2002). Prevention of burn injuries in these patients would involve health education on identification and treatment of patients with convulsive disorders and to reduce stigma associated with this condition in order to improve the outcomes of these patients. Similarly, patients with substance abuse were likely to have more severe injuries and at the same time may present with adjustment issues during the recovery period.

5.2. Early outcomes of patients admitted with burns

5.2.1 Burn complications

In this study, less than half of the patients experienced burn complications while admitted in the hospital. For those that experienced complications, the most common included wound infection, anemia, electrolyte abnormalities, respiratory complications and death. Most of these complications can be alluded to the break in the integrity of the skin leading to loss of fluids, poor temperature control and reduced immune function. While occurrence of burn complications was noted within the study, the proportion of patients experiencing these complications was generally lower than that described elsewhere in Kenya (Nthumba & Oliech, 2005) and other countries (Samuel et al., 2011). Being a teaching and referral hospital, the facility where the patients were admitted offers quality care within an isolated burn unit reducing the likelihood of burn complications occurring on a larger scale. Wound

infection was the commonest complication at a similar rate to that reported in Malawi (Samuel et al., 2011). A recent study in India in both children and adults found a much higher mortality of 57.7 (Kumar, 2018). In Nigeria, the wound infection rate ranged from 15% to 34% and this varied in different geographical regions (Oladele & Olabanji, 2010). They further described different organisms responsible for burn wound infection in each region but this was not done in this study and can be considered for future studies. Factors that contribute to wound infections in burns include immunosuppressive effect of the burns, loss of the skin barrier against infection and the prolonged hospital stay coupled with an array of procedures performed in the hospital (Vinitha et al., 2011).

Mortality is a critical complication which can occur even in moderate burns if patients do not undergo rigorous resuscitation and surgical management during admission in the hospital. Due to advances in surgical intervention and critical care, mortality due to severe burns is on the decline (Klein et al 2015). On the contrary, there was a rise in mortality in this study when compared to the previous mortality of 5% in the same hospital about a decade ago. This is despite an increase in health workforce dedicated to burns patients and creation of a dedicated burns ward. This means that efforts to improve burn morbidity and mortality need to be intensified. Although mortality occurred in fewer patients in this study as compared to other studies in Africa, it was still at a higher rate than most developed countries. In Netherlands, despite the increase in the incidence of burns over time the mortality rate has steadily decreased up to 4% which could be an indication of major improvement in their burn care, better infrastructure and the employment of multidisciplinary approach in caring for these patients (Dokter, Vloemans, et al., 2014). In Canada, the mortality rate was much lower at 1% despite them managing some high TBSA burns (Burton et al., 2009).

The proportion of patients who died in this study due to burns and burn complications was much lower than what has been reported in other studies (Fazeli et al., 2014; Nthumba & Oliech, 2005; Oladele & Olabanji, 2010). Common causes of death in burn patients include sepsis, respiratory failure, and renal failure (Agbenorku, Agbenorku, & Fiifi-Yankson, 2013). Studies have shown that independent predictors of mortality in burn patients include TBSA and burn depth (Klein et al., 2014). In this study, the low median percentage TBSA and occurrence of mostly 2rd degree burns could be the factors that contributed to less mortality. Other factors include timely referral of burn patients to hospital within less than three hours and good surgical care for admitted patients. Early arrival of the patients in the hospital after burn injuries allows effective resuscitation and control of infection while mitigating for any other physiologic and metabolic derangements that could result in serious complications.

5.2.2 Length of hospital stay

The length of hospital stay is a good measure of the cost effectiveness of burn care in various dimensions such as financial costs, lost work hours, lost opportunities as well as psychological and social disruption in the life of the burn patient and their family (Maan et al., 2014). Length of hospital stay was evaluated in this study as an early outcome of admitted patients. The median length of hospital stay in this study is slightly longer to what other researchers have found in Kenya (Dale et al., 2013; Lelei et al., 2011) and Africa (Samuel et al., 2011). In the developed countries, the length of hospital stay is much shorter. The standard length of hospital stay is generally estimated to be one day per percent burn (Johnson et al., 2011). However, in our study, the reported length of hospital stay was relatively longer when the mean TBSA is considered. This implies that in our study patients generally have a longer hospital stay. Furthermore, this being a referral hospital, some patients were admitted with

inhalation injury and extensive TBSA. These two factors have been shown to increase length of hospital stay (Taylor et al., 2015).

5.3. Associations between clinical patterns and burn outcomes

5.3.1. Burn complications

On multivariate analysis, TBSA was the only factor associated with the occurrence of burn complications. In this study, TBSA of 20 to less than 30% was significantly associated with increased likelihood of burn complications. Several studies have demonstrated that lower TBSA is associated with fewer complications (Agbenorku et al., 2013). Consequently, patients with a high TBSA should be prioritized for immediate intervention following triage including advanced care in Intensive Care Unit or High Dependence Unit. In our study setting, female and paediatric patients with TBSA of more than 30% were admitted to the burns ward and received more specialised services compared to those with lower TBSA who were admitted to the general wards. This ensured that such patients received timely supportive and surgical interventions, resulting in fewer burn complications. Higher TBSA is generally associated with higher occurrence of acute complications such as hypovolemic shock and organ failure due to the higher magnitude of physiological response mounted in these patients (Nielson et al., 2017). The higher surface area burned also predisposes them to infection and hypothermia which leads to further complications.

Other factors associated with the development of burn complications in other studies such as burn depth, presence of comorbidities and pre- hospital intervention were not statistically significant in this study on multivariate analysis.

5.3.2 Length of hospital stay

In this study, TBSA and time to admission were significantly associated with the length of hospital stay. Each increase in TBSA by 10% was associated with higher odds of a longer hospital stay. This is similar to what has been reported in other studies (Khaliq et al., 2012 & Taylor et al., 2015).

Patients with higher TBSA were more likely to require more specialized care and therefore contributing to a longer hospital stay. At the same time, patients with higher TBSA were likely to develop complications and this would increase their length of stay. Patients with much higher TBSA require Intensive Care to support their physiological functions in the acute phase to hasten their recovery. This has an implication in the allocation of resources for these patients because they require multi-disciplinary resource intensive care.

In this study, patients who presented more than three hours after the burn had a longer hospital stay compared to those who presented to the hospital earlier. Early presentation to the hospital would enable early resuscitation and control of anticipated complications. Some studies found that in developing countries late presentation is common and up to 50% or more burn patients presented to hospital 24 hours post injury (Chalya et al., 2011; Forjuoh, 2006; Okoro et al., 2009). This was shown to increase the morbidity and mortality in burn patients. In Kenya the introduction of a fire rescue service or community ambulances would reduce the time from burn to admission that may be prolonged due to poverty and other difficulties accessing health care.

Other factors previously reported to be associated with prolonged hospital stay in burns patients such as age, female gender, presence of co-morbidities, cause of burn

and depth of burn (Hussain & Dunn, 2013; Yang, Wei, Yuan, & Schoung, 2010) were not significant in this study at multivariate analysis. Different study settings, location and sample sizes could probably explain this difference in findings.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

6.1: Conclusions

The majority of burn patients were children below 5 years and most burns were due to scalds. The median TBSA was 14.5% and there was a low pre- hospital intervention rate for burn injuries.

Some of the burn patients experienced burn complications and the commonest complications were wound infection, severe anemia and death.

TBSA was significantly associated with both the occurrence of burn complications and the length of hospital stay.

6.2: Recommendations

There is need for continued health education of the public on the importance of pre-hospital intervention with cool water and prompt health care for the burned patient.

Further research on the causes of wound infection and factors that influence the development of wound infection in patients with burns in MTRH is necessary.

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APPENDICES

Appendix I: Consent Forms

PART A: INRODUCTION

My name is Dr. Ruth Negesa Odondi, a medical doctor registered by the Kenya Medical Practitioners' and Dentists Board (A6961). I am currently pursuing a Master of Medicine degree in General Surgery at Moi University School of Medicine.

I am conducting a study on clinical patterns and outcomes of burn injuries in patients admitted at the Moi Teaching and Referral Hospital, Eldoret. The aim of this study is to describe the patterns and outcome of burn injuries at MTRH which will be useful in guiding management, highlighting areas for improvement in management of burns and ultimately for development of burn prevention strategies.

Data that will be collected include: demographic data, characteristics of the burn injury and outcome of treatment. You will receive the standard care in line with the hospital protocols and your choice to withhold consent or to withdraw from the study will not affect your treatment. The information that you give for the purposes of this study will be treated with utmost confidentiality.

There are no direct benefits such as payment or incentives for participating in this study and neither are there any risks to the participants.

If you have any questions about your rights as a research subject, you can contact;

The Chairman,

Institutional Research and Ethics Committee,

Moi University/Moi Teaching and Referral Hospital

P.O. Box 3-30100

Eldoret.

Telephone number: 053-2033471/2/3 Extension 3008.

PART B: CONSENT BY RESEARCH PARTICIPANT

I, the undersigned, do voluntarily accept to participate in this research study. The nature and the purpose of the study have been fully explained to me by the principal investigator, Dr. Ruth Negesa Odondi.

I understand that I may choose to withdraw at any time should I change my mind and that any information that I will give will be treated with utmost confidentiality and will only be used for the purposes of this study.

Name----------

Signature ---------- Date----------

I confirm that I have given the information regarding this research to the above participant and they are free to contact me should they have any questions or concerns.

Dr. Ruth Negesa Odondi (0722 536937)

Signature----------Date----------

PART C: CONSENT BY PARENT/GUARDIAN ON BEHALF OF MINOR

I, the undersigned as the parent/legal guardian, do voluntarily accept to let my son/daughter participate in this research study. The nature and the purpose of the study have been fully explained to me by the principal investigator, Dr. Ruth Negesa Odondi.

I understand that I may choose to withdraw at any time should I change my mind and that any information that I will give will be treated with utmost confidentiality and will only be used for the purposes of this study.

Name----------

Signature ---------- Date----------

I confirm that I have given the information regarding this research to the above participant and they are free to contact me should they have any questions or concerns.

Dr. Ruth Negesa Odondi (0722 536937)

Signature----------Date----------

PART D: ASSENT BY A CHILD OVER 7 YEARS

I accept to voluntarily accept to participate in this research study. The nature and the purpose of the study have been fully explained to me by the principal investigator, Dr. Ruth Negesa Odondi.

I understand that I may choose to withdraw at any time should I change my mind and that any information that I will give will be treated with utmost confidentiality and will only be used for the purposes of this study.

I confirm that I have given the information regarding this research to the above participant and they are free to contact me should they have any questions or concerns.

Dr. Ruth Negesa Odondi (0722 536937)

Signature----------Date----------

CONSENT FORM: KISWAHILI VERSION

SEHEMU A: UTANGULIZI

Majina yangu ni Ruth Negesa Odondi. Mimi ni daktari aliyehitimu na kusajiliwa na bodi ya madaktari ya Kenya nambari A6961.Kwa wakati huu ninasomea shahada ya juu ya upasuaji katika chuo kikuu cha Moi.

Ninafanya utafiti unaohusu magonjwa yanayosababishwa na kuchomeka kati ya wagonjwa waliolazwa katika hosipitali ya Rufaa ya MTRH. Kiini cha utafiti huu ni kuchunguza jinsi haya magonjwa hufanyika na matokeo baada ya matibabu. Maelezo haya yanaweza kutumiwa kuimarisha matibabu na kuangazia jinsi ya kuzuia magonjwa haya kwa kupitia mikakati itakayotekelezwa kwa kaunti na nchi kwa jumla.

Ujumbe utakaojumuishwa ni kama: maelezo kuhusu waathiriwa,athari za majeraha ya kuchomeka na matokeo baada ya kutibiwa.Utapata matibabu ya ugonjwa wako kama inavyohitajika katika hosipitali ya MTRH na ukiamua kutojijumuisha au kujiondoa katika utafiti huu matibabu yako hayataathirika. Maelezo utakayotoa yatahifadhiwa vyema.

Hakuna manufaa ya kibinafsi kama malipo kwa kujumuishwa katika utafiti huu wala hakuna madhara kwa wale watakaohusishwa.

Iwapo utakuwa na maswali kuhusu utafiti huu,unaweza kuwasiliana na ,

Mwenyekiti

Institutional Research and Ethics Committee,

Moi University/Moi Teaching and Referral Hospital

P.O. Box 3-30100

Eldoret.

Telephone number: 053-2033471/2/3 Extension 3008.

SEHEMU B: KIBALI CHA UTAFITI NA MHUSIKA

Mimi niliyetia sahihi hapo chini,nimekubali kwa hiari yangu kujumuishwa katika utafiti huu. Nimeelezwa kuhusu huu utafiti na mtafiti, Dr. Ruth Negesa Odondi.

Ninaelewakuwa ninaweza kujiondoa kutoka utafiti huu wakati wowote nikibadili nia yangu na kuwa ujumbe nikaotoa utahifadhiwa vyema na kutumiwa katika utafiti huu peke yake.

Jina----------

Sahihi ---------- Tarehe----------

Ninahakikisha kuwa nimetoa maelezo yanayohitajika kwa mhusika huyu na anaweza kuwasiliana nami kwa nambari ya simu iwapo an swali au tashwishi.

Dr. Ruth Negesa Odondi (0722 536937)

Sahihi----------Tarehe----------

SEHEMU C: KIBALI CHA UTAFITI NA MZAZI/MLEZI KWA NIABA YA MWANAWE

Mimi niliyetia sahihi hapo chini kama mzazi/mlezi,nimekubali kwa hiari yangu mwanangu ajumuishwe katika utafiti huu. Nimeelezwa kuhusu huu utafiti na mtafiti, Dr. Ruth Negesa Odondi.

Ninaelewa kuwa ninaweza kumuondoa mwanangu kutoka utafiti huu wakati wowote nikibadili nia yangu na kuwa ujumbe nikaotoa utahifadhiwa vyema na kutumiwa katika utafiti huu peke yake.

Jina----------

Sahihi ---------- Tarehe----------

Ninahakikisha kuwa nimetoa maelezo yanayohitajika kwa mhusika huyu na anaweza kuwasiliana nami kwa nambari ya simu iwapo an swali au tashwishi.

Dr. Ruth Negesa Odondi (0722 536937)

Sahihi----------Tarehe----------

SEHEMU D: KIBALI CHA UTAFITI KWA WATOTO

Mimi nimekubali kwa hiari yangu nijumuishwe katika utafiti huu. Nimeelezwa kuhusu huu utafiti na mtafiti, Dr. Ruth Negesa Odondi.

Ninaelewa kuwa ninaweza kumuondoka kutoka utafiti huu wakati wowote nikibadili nia yangu na kuwa ujumbe nikaotoa utahifadhiwa vyema na kutumiwa katika utafiti huu peke yake.

Ninahakikisha kuwa nimetoa maelezo yanayohitajika kwa mhusika huyu na anaweza kuwasiliana nami kwa nambari ya simu iwapo an swali au tashwishi.

Dr. Ruth Negesa Odondi (0722 536937)

Sahihi----------Tarehe----------

Appendix II: Questionnaire

CLINICAL PATTERNS AND OUTCOMES OF BURN INJURIES IN PATIENTS ADMITTED AT THE MOI TEACHING AND REFERRAL HOSPITAL, ELDORET.

SECTION 1: DEMOGRAPHIC DATA

UNIQUE ID _____

DATE OF ADMISSION _____

TIME FROM BURN TO HEALTH FACILITY (HOURS)_____

SEX……

NO.	QUESTION	CODING CATEGORY	SKIP
101	Age of the respondent	YEARS..... ☐	
102	Marital status	MARRIED..... 1 SINGLE..... 2 DIVORCED..... 3 WIDOWED..... 4	
103	School attendance	YES..... 1 NO..... 2	→ 105
104	Highest level of school attended IF THE PATIENT IS A CHILD, RECORD THE HIGHEST EDUCATION LEVEL OF THE MOTHER	PRIMARY..... 1 SECONDARY/A LEVEL..... 2 COLLEGE/UNIVERSITY…... 3	
105	Nature of occupation FORMAL: EMPLOYED	FORMAL..... 1 INFORMAL..... 2	

	INFORMAL: SELF EMPLOYED	NONE……..... 3	

SECTION 2: CHARACTERISTICS OF THE BURN INJURY

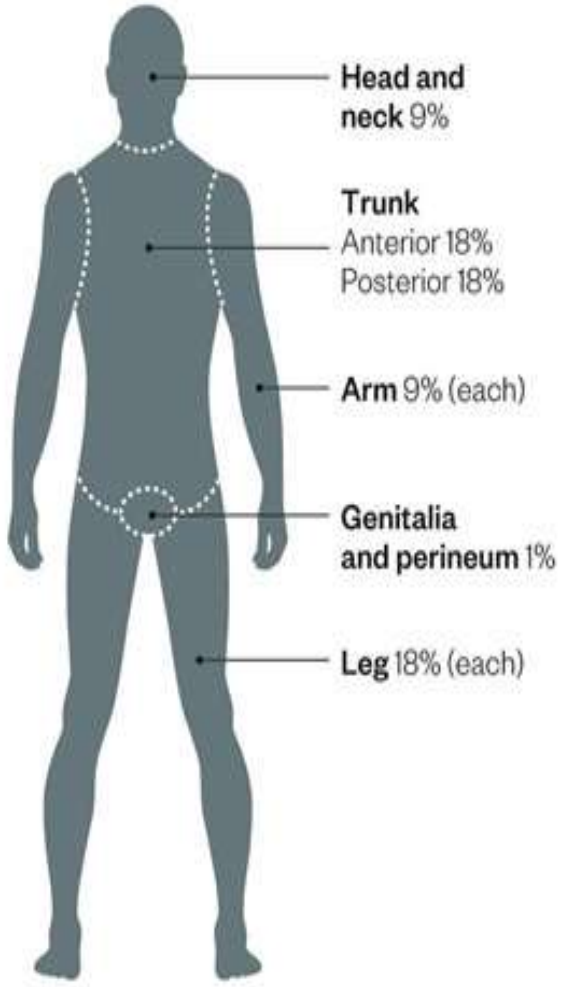
NO.	QUESTION	CODING CATEGORY	SKIP
201	Location of the burn as seen during physical examination	HEAD AND NECK..... 1 TRUNK……..... 2 UPPER LIMBS..... 3 LOWER LIMBS.....4 PERINIUM..... 5 OTHER (specify)..... 6	
202	Place of occurrence of the burn	HOME..... 1 WORK PLACE..... 2 ROADSIDE…… 3 OTHER (specify)..... 4	
203	What was the cause of the burn?	SCALD..... 1 FLAME..... 2 CHEMICAL…….. 3 ELECTRICAL……... 4 OTHER (specify)…….. 5	
204	What was the nature of the injury?	ACCIDENTAL..... 1 INTENTIONAL..... 2	
205	What was the mechanism of injury?	FALL ONTO HEAT SOURCE 1 SPILL……..... 2 TOUCH ON HOT OBJECT..... 3 CLOTHES, BEDDING OR	

		HOUSE CAUGHT FIRE……4 OTHER (specify)…….. 5	
206	Was first aid given?	YES (specify)..... 1 NO..... 2	
207	Assess the total burn surface area (TBSA) % (Using Wallace rule of sevens and nines for >15 years and Lund and Browder chart for children <15years)	……..... ☐	
208	Assess the depth of the burn	2ND DEGREE..... 1 3RD DEGREE..... 2 4TH DEGREE..... 3	
209	Is there presence of comorbidities?	YES..... 1 NO..... 2	→ 301
210	Specify the comorbidity	EPILEPSY……..….....1 MENTAL ILLNESS……..….. 2 SUBSTANCE ABUSE…….… 3 TRAUMA…….…..… 4 SYSTEMIC INFECTION……...5 OTHERS (specify)……. 6	
SECTION 3: BURN OUTCOMES			
401	Did any complications arise from the burn injury?	YES…… 1	→ 402

→

		NO…….. 2 403	
402	Specify type of burn complication	WOUND INFECTION…… 1 SEPSIS.....2 RESPIRATORY COMPLICATIONS……. 3 ACUTE RENAL FAILURE……...…….. 4 ELECTROLYTE ABNOMALITIES….……..5 ANAEMIA……...6 DEPRESSION……..……7 DEATH…….8 HYPOALBUMINEMIA……...9 OTHERS (specify)……10	
403	Treatment outcome	DISCHARGE.....1 DEATH.....2	
404	What was the length of hospital stay (days)?	…….	

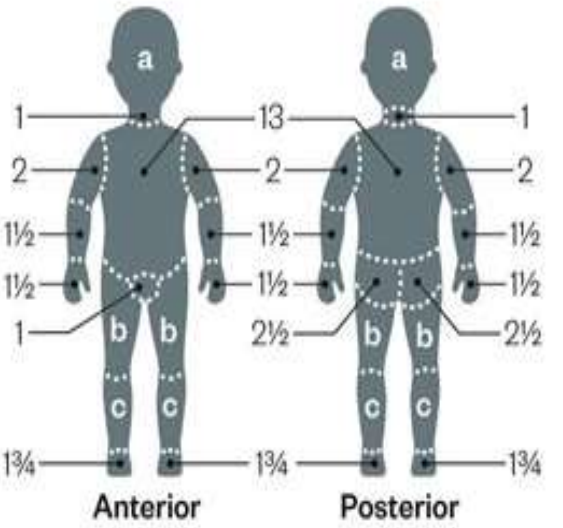
Appendix III: Wallace Rule of Nines and Lund and Browder Charts



Lund and Browder chart

Relative percentage of body surface area (% BSA) affected by growth

	half of head (a)	half of one thigh (b)	half of one lower leg (c)
0 yr	9½	2¾	2½
1 yr	8½	3¼	2½
5 yr	6½	4	2¾
10 yr	5½	4¼	3
15 yr	4½	4¼	3¼



Appendix IV: Beck's Depression Inventory

NAME:_____ **DATE:**_____

On this questionnaire are groups of statements. Please read each group of statements carefully. Then pick out the one statement in each group which best describes the way you been feeling this **PAST WEEK, INCLUDING TODAY**. Circle the number beside the statement you picked. If several statements in the group seem to apply equally well, circle each one.
Be sure to read all the statements in each group before making your choice.

1. **0** I do not feel sad
   1 I feel sad
   2 I am sad all the time and I can't snap out of it
   3 I am so sad or unhappy that I can't stand it

2. **0** I am not particularly discouraged about the future
   1 I feel discouraged about the future
   2 I feel I have nothing to look forward to
   3 I feel that the future is hopeless and much that things cannot improve

3. **0** I do not feel like a failure
   1 I feel I have failed more than the average person
   2 As I look back on my life, all I can see are a lot of failures
   3 I feel I am a complete failure as a person

4. **0** I get as much satisfaction out of things as I used to
   1 I don't enjoy things the way I used to
   2 I don't get real satisfaction out of anything anymore
   3 I am dissatisfied or bored with everything

5. **0** I don't feel particularly guilty
   1 I feel guilty a good part of the time
   2 I feel guilty most of the time
   3 I feel guilty all of the time

6. **0** I don't feel I am being punished
   1I feel I may be punished
   2 I expect to be punished
   3 I feel I am being punished

7. **0** I don't feel disappointed in myself
   1 I am disappointed in myself
   2 I am disgusted in myself
   3 I hate myself

8. **0** I don't feel I am any worse than anybody else
   1 I am critical of myself for my weaknesses or mistakes
   2 I blame myself all of the time for my faults
   3 I blame myself for everything bad that happens

9. **0** I don't have any thoughts of killing myself
   1 I have thoughts of killing myself, but I would not carry them out
   2 I would like to kill myself
   3 I would kill myself if I had the chance

10. **0** I don't cry any more than usual
    1 I cry more now than usual
    2 I cry all the time now
    3 I feel irritated all the time now

11. **0** I am no more irritated by things than I ever am
    1 I am slightly more irritated by things now more than usual
    2 I am quite annoyed or irritated a good deal of the time
    3 I feel irritated all of the time now

12. **0** I have not lost interest in other people
    1 I am less interested in other people than I used to be
    2 I have lost most of my interest in other people
    3 I have lost all of my interest in other people

13. **0** I make decisions about as well as I ever could
    1 I put off making decisions more than I used to
    2 I have greater difficulty in making decisions than before
    3 I would kill myself if I had the chance.

14. **0** I don't feel that I look any worse than I used to
    1 I am worried that I am looking old or unattractive
    2 I feel that there are permanent changes in my appearance that make me look unattractive
    3 I believe that I look ugly

15. **0** I can work about as well as before
    1 It takes an extra effort to get started at doing something
    2 I have to push myself very hard to do anything
    3 I can't do any work at all

16. **0** I can sleep as well as usual
    1 I don't sleep as well as I used to
    2 I wake up 1-2 hours earlier than usual and find it hard to get back to sleep
    3 I wake p several hours earlier than I usually do and cannot get back to sleep

17. **0** I don't get more tired than usual
    1 I get tired more easily than I used to
    2 I get tired from doing almost anything
    3 I am too tired to do anything

18. **0** My appetite is no worse than usual
    1 My appetite is not as good as it used to be
    2 My appetite is much worse now
    3 I have no appetite at all anymore

19. **0** I haven't lost much weight, if any, lately
    1 I have lost more than five pounds
    2 I have lost more than ten pounds
    3 I have lost more than fifteen pounds

20. **0** I am no more worried about my health than usual
    1 I am worried about my physical problems such as aches and pains, or upset stomach or constipation
    2 I am very worried about physical problems and it's hard to think of much else
    3 I am so worried about my physical problems that I cannot think about anything else

21. **0** I have not noticed any recent changes in my interest in sex
    1 I am less interested in sex than I used to be
    2 I am much less interested in sex now
    3 I have lost interest in sex completely

Suggested interpretation of the scale (Beck 1978)

0-9 Normal Range
10-15 Mild Depression
16-19 Mild-Moderate Depression
20-29 Moderate-Severe Depression
30-63 Severe Depression

Appendix V: IREC Formal Approval

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET

Reference: IREC/2015/154
Approval Number: 0001498

11th September, 2015

Dr. Ruth Negesa Odondi,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
11 SEP 2015
APPROVED
P.O. Box 4606-30100 ELDORET

Dear Dr. Odondi,

RE: FORMAL APPROVAL

The Institutional Research and Ethics Committee has reviewed your research proposal titled:-

"Clinical Patterns and Early Outcomes of Burn Injuries in Patients Admitted at the Moi Teaching and Referral Hospital, Eldoret."

Your proposal has been granted a Formal Approval Number: ***FAN: IREC 1498*** on 11th September, 2015. You are therefore permitted to begin your investigations.

Note that this approval is for 1 year; it will thus expire on 10th September, 2016. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

For

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc	Director	-	MTRH	Dean	-	SOP	Dean	-	SOM
	Principal	-	CHS	Dean	-	SON	Dean	-	SOD

Appendix VI: IREC Continuing Approval

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471/2/3

MOI UNIVERSITY
SCHOOL OF MEDICINE
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/2015/154
Approval Number: 0001498

5th April, 2017

Dr. Ruth Negesa Odondi,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
05 APR 2017
APPROVED
P.O. Box 4606-30100 ELDORET

Dear Dr. Odondi,

RE: CONTINUING APPROVAL

The Institutional Research and Ethics Committee has reviewed your request for continuing approval for your study titled:-

"Clinical Patterns and Early Outcomes of Burn Injuries in Patients Admitted at the Moi Teaching and Referral Hospital, Eldoret".

Your request has been granted Approval with effect from 5th April, 2017. You are therefore permitted to continue with your study.

Note that this approval is for 1 year; it will thus expire on 4th April, 2018. If it is necessary to continue with this research beyond the expiry date, a request for continuation should be made in writing to IREC Secretariat two months prior to the expiry date.

You are required to submit progress report(s) regularly as dictated by your proposal. Furthermore, you must notify the Committee of any proposal change (s) or amendment (s), serious or unexpected outcomes related to the conduct of the study, or study termination for any reason. The Committee expects to receive a final report at the end of the study.

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc:	CEO	-	MTRH
	Principal	-	CHS
	Dean	-	SOM
	Dean	-	SPH
	Dean	-	SOD
	Dean	-	SON

Appendix VII: MTRH Approval

MOI TEACHING AND REFERRAL HOSPITAL

Telephone: 2033471/2/3/4
Fax: 61749
Email: director@mtrh.or.ke
P. O. Box 3
ELDORET

Ref: ELD/MTRH/R.6/VOL.II/2008

11th September, 2015

Dr. Ruth Negesa Odondi,
Moi University,
School of Medicine,
P.O. Box 4606-30100,
ELDORET-KENYA.

RE: APPROVAL TO CONDUCT RESEARCH AT MTRH

Upon obtaining approval from the Institutional Research and Ethics Committee (IREC) to conduct your research proposal titled:-

"Clinical Patterns and Early Outcomes of Burn Injuries in Patients Admitted at Moi Teaching and Referral Hospital, Eldoret".

You are hereby permitted to commence your investigation at Moi Teaching and Referral Hospital.

DR. JOHN KIBOSIA
DIRECTOR
MOI TEACHING AND REFERRAL HOSPITAL

CC - Deputy Director (CS)
- Chief Nurse
- HOD, HRISM

Appendix VIII: Budget

ITEM	AMOUNT (Kshs)
Stationery	5,000
Research assistants	30,000
Transport	40,000
Internet bundles	10,000
Airtime	5,000
Ethical approval	3,000
Data analysis	30,000
Typing, printing and binding	30,000
Miscellaneous	15,000
Total	**168,000**

Appendix IX: Time frame

ACTIVITY	COMMENCEMENT	COMPLETION
Proposal development	October 2014	March 2015
Proposal writing	March 2015	May 2015
Proposal submission	June 2015	July 2015
Data collection	January 2016	June 2017
Data analysis	July 2017	September 2017
Thesis writing	October 2017	March 2018
Thesis submission and defence	April 2018	September 2019