

**RISK FACTORS FOR BURN INJURIES AMONG PATIENTS HOSPITALIZED AT
KENYATTA NATIONAL AND REFERRAL HOSPITAL IN NAIROBI, KENYA: A
CASE CONTROL STUDY**

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**A Thesis Submitted in Partial Fulfilment of the Requirements for the Degree of Master of
Public Health in the School of Public Health of the University of Nairobi.**

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Student's declaration

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DEDICATION

I dedicate this work to my wife Beatrice, daughter Gertrude and son Neil.

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ABSTRACT

Burn injuries are some of the most physically and psychologically devastating forms of trauma and most common injuries affecting children especially in the home environment. They are a major cause of morbidity and mortality all over the world for both children and adults more so in developing countries like Kenya because of inadequate and high cost of medical treatment. Implementation of preventive measures is therefore extremely important in these countries where the risk for burn injuries is high due to poverty. Effective prevention programmes must be informed by well-designed studies aimed at investigating risk factors for burns.

The main objective of this study was to establish the risk factors for burn injuries among patients hospitalized at the Kenyatta National Hospital (KNH). It was a case-control study with cases being 202 patients admitted with burns and the controls were 202 non-surgical patients admitted into the paediatric and medical wards of KNH. The data was collected using a structured questionnaire administered in English or Swahili by the principle researcher or the research assistants.

Data analysis was done using SPSS version 17. Descriptive statistics was used for demographic data whereas Pearson Chi Square test and Odds Ratio were used to analyze the relationship between the risk factors and burn injuries. Logistic regression was used to determine the strength of association for risk factors identified by Pearson Chi Square and Odds Ratios.

Burn injuries were found to be commonest in children within the 0-4 years age bracket (42.6%) with the second commonest age bracket being the active adults of 20-40 years (38.6%). The

male:female ratio was found to be 1:1 and the risk factors found to be significant for burn injuries were; low level of education (OR=2.32, 95% CI: 1.28-4.22, p=0.003), use of kerosene for cooking (OR=1.935; 95% CI:1.303–2.874, p=0.001) and lack of knowledge of burn injury prevention and fire safety (OR=1.885, 95% CI:1.559-2.279, p=0.000). The strength of association was confirmed by multivariate logistic regression analysis (p=0.000).

Low level of education, use of kerosene for cooking and lack of knowledge of burn injury prevention and fire safety were identified as risk factors for burn injury among patients admitted at the Kenyatta National Hospital. The recommendation from this research is that these risk factors be addressed through implementation of burn injury prevention programs and that they should be the basis for policy change or advocacy for fire and burn injury prevention programs.

LIST OF ABBREVIATIONS AND ACRONYMS

| | |
|--------------------|---|
| ANOVA | Analysis Of Variance |
| CCU | Critical Care Unit |
| CDC | Centers for Disease Control |
| CHS | College of Health Sciences |
| CO | Carbon Monoxide |
| ISBI | International Society for Burn Injuries |
| KMTC | Kenya Medical Training College |
| KNH | Kenyatta National Hospital |
| KNH/UoN-ERC | Kenyatta National Hospital/University of Nairobi Ethics and Research Committee |
| LMIC | Low and Middle Income Countries |
| SES | Social Economic Status |
| SPH | School of Public Health |
| TBSA | Total Body Surface Area |
| UN | United Nations |
| UoN | University of Nairobi |
| WHO | World Health Organization |

CHAPTER ONE: INTRODUCTION

1.1 Background

1.1.1 Definition of Burns

Burns are tissue injuries resulting from direct contact with flames, hot liquids, gases, or surfaces; caustic chemicals; electricity; or radiation. Internal burn injuries can also result from smoke inhalation. Burn injuries are characterized by coagulative necrosis of the skin or other affected body tissues. The skin is the tissue most commonly injured with resultant compromise of its function as a barrier to injury and infection and as a regulator of body temperature, fluid loss, and sensation (Asuquo et al, 2009; Klingensmith et al, 2000).

1.1.2 Causes of Burns

Burns are caused by flames, contact with hot surfaces or ashes, hot fluids or steam, gas, electricity, radiation and extreme cold (frost bite). Flame burns occur when the body gets into contact with flames causing direct injury to tissues. The flames might ignite clothing and if synthetic, they melt adding a contact burn component to the injury. If the burn occurs in an enclosed area, the patient is at risk of carbon monoxide (CO) and cyanide poisoning.

Flash burns are a subset of flame burns and they are a result of rapid ignition of a flammable gas or liquid. The body parts involved are those exposed to the agent when it ignites and the areas covered by clothing are usually spared. A classic example of this type of injury occurs when a person pours gasoline on a trash or leaf fire to increase the flame and is burned by the subsequent fireball.

Contact burns result from direct contact with hot objects (e.g. soldering irons, cooking appliances, irons etc) or ashes and the injury is confined to the point of contact.

Scalds result from contact with all manner of hot fluids and in general, the more viscous the liquid and the longer the contact with the skin, the greater the damage. Steam burns often occur in industrial accidents or result from automobile radiator accidents. These burns produce extensive injury from the high heat-carrying capacity of steam and the dispersion of pressurized steam and liquid. Furthermore, steam inhalation can cause thermal injury to the distal airways of the lung. Inhalation of hot gas causes thermal injury to the upper airway and subsequent occlusion due to edema. The distal airways are usually not injured as the heat-exchange capacity of the upper airway is excellent. Injury to the distal airway is more likely to be due to the direct effects of the products of combustion on the mucosa and alveoli.

Electrical burns including lightning occur when heat is released following the passage of an electric current through tissue. Most problems from these burns present in patients exposed to high voltage (>1000 volts) current but children can have significant burns after exposure to 200 – 1000 volts. Concomitant ignition of clothing may produce flame burn and cardiac injury, long bone and spine fractures may occur.

Chemical burns are caused by alkaline or acidic substances coming into contact with the skin. If the agent is ingested, circum-oral, oro-pharyngeal and gastro-intestinal burns may occur (Herndon, 2007).

Burns are caused by extremes of temperature and are classified by cause as follows; Thermal (caused by hot fluids, objects/surfaces or flames), chemical, electrical, radiation and frost-bite (D'Souza et al, 2009). Thermal burns caused by fire (flame burns), hot liquids (scald) or contact with hot surfaces (contact burns) have been recognized as significant hazards for centuries and many fire disasters have resulted in catastrophes and loss of life (WHO, 2008b). Burn injuries to the skin can also be caused by ultraviolet radiation and radioactivity and to the respiratory tree by smoke inhalation (WHO, 2008b).

Thermal burns can be further classified according to percentage of total body area burned or by skin depth in the following manner; first-degree burns are limited to the epidermis, second-degree burns are limited to the dermal layers of the skin, third-degree burns are characterized by damage to all layers of the skin including some subcutaneous tissues and fourth-degree burns involve all layers of the skin as well as the underlying fascia, muscle, or bone.

Depending on the extent of Total Body Surface Area (TBSA) burnt and the depth, burns may further be categorized as minor, moderate or major and in the initial evaluation of burned patients in the emergency department this estimation determines whether or not to transfer to a specialized burn unit (Klingensmith, 2000).

Most burns are caused by wet (hot fluids and steam) or dry heat (e.g. hot surfaces/objects, ashes) and flames but may also occur following contact with chemicals or electricity. Burns caused by hot fluids (scalds) are most frequent in children whereas flame burns occur more frequently in adults (Kalayi, 1994; Liao and Rossignol, 2000, Justin-Temu, 2008).

1.1.3 Incidence, Impact and Prevention of Burns

Fire related mortality rates in the developing world are estimated to be 6.1 deaths per 100 000 population compared to 1.0 deaths per 100 000 population in the developed world (WHO, 2011). Morbidity patterns and mortality rates for burns in Kenya are not known but these injuries are believed to contribute heavily to the public health burden (Nthumba and Oliech, 2005). Poverty and poor housing are known to be risk factors worldwide but every country has unique risk factors due to varied cultures and circumstances (Asuquo et al, 2009).

In Kenya, we have had burn injuries as a result of fire disasters on the roads, in supermarkets, industries and schools as a result of accidents and in some occasions, following arson attacks or riots. Villagers have died or sustained serious burn injuries while scooping fuel after fire broke out at accident sites involving overturned fuel tankers on Kenyan roads. Housing construction in close proximity to electric power lines and stealing of oil from electric power transformers have also resulted in serious electrical injuries. The most common cause of accidental burn injuries is however hot fluid and the home environment is the commonest site (Nderitu et al, 2006).

Treating burns is costly as it entails frequent change of dressing, multiple drugs and prolonged hospitalization in some cases. In the case of burns affecting children, parents and particularly the mother have to miss work to take care of injured children at home or in hospital. The average daily cost of hospitalization of a burn patient at KNH is 50 US\$ which many poor burn injury patients are unable to pay forcing the hospital to waive the fees.

An average of 2 patients is admitted with burns at the Kenyatta National Hospital every day and approximately 600 patients every year (KNH Medical Records, 2011). At KNH, burnt patients are managed in the plastic surgery unit and the plastic surgeons are most of the times pre-occupied with burns management at the expense of the other patients requiring reconstructive surgery. The average mortality of the hospitalized burns patients is 20% and many are suspected to succumb at the burn injury scene or before reaching the hospital (Table 1).

Table 1: Number of Burn Patients Admitted at KNH in 2008-2012 Dis-aggregated by outcome

| Year | Discharged Alive | Died while undergoing treatment | Total |
|-------------|-------------------------|--|--------------|
| 2008 | 464 | 120 (20.6%) | 584 |
| 2009 | 450 | 137 (23.3%) | 587 |
| 2010 | 484 | 120 (19.9%) | 604 |
| 2011 | 783 | 170 (17.8%) | 953 |
| 2012 | 517 | 148 (22.3%) | 665 |

Source - KNH Medical Records, April, 2013.

In the United States burn injuries are the fourth leading cause of unintentional injury death accounting for 3% of all injury deaths (Liao and Rossignol, 2000) and in developing countries burns are a major cause of injury morbidities, disabilities and deaths. Childhood burns are a major public health issue in Africa and many of the South Asian countries (Mashreky et al, 2008; Torabian & Saba, 2009).

Burn injuries are recognized by the World Health Organization (WHO) as a serious public health problem worldwide with more than 300,000 people dying from flame burns every year and many more dying as a result of scalds, electrical and chemical burns (WHO, 2011). Over 90% of burns are avoidable and 95% of burn deaths occur in low and middle income countries and are preventable. Many survivors of burns are permanently disabled or disfigured, have adverse psychological effects and are often times stigmatized or discriminated upon (Asuquo et al, 2009; Lau, 2004; Liao et al, 2000; Mock, 2011; WHO, 2011a; WHO, 2011b).

In the developed world, the incidence of burn injuries has been reduced through prevention strategies including development of surveillance systems, legislation, social marketing and advocacy. Mortality of the burn injured victims has been lowered and disfigurement diminished by improved burn care, and burn survivor support groups have provided emotional support, assisting survivors to lead full and meaningful lives. These support groups have also been useful in advocacy for improvements in burn prevention and treatment (Mock, 2011; WHO, 2011b).

Sadly, these strategies are largely not being applied in the developing world and the WHO and the International Society for Burn Injuries (ISBI) have developed a partnership to increase international action with the first consultation on prevention and care of burns being held at the WHO headquarters in Geneva in April 2007 (Mock, 2011; WHO, 2011b).

Studies have shown that prevention programs such as public education and improved fire safety practices in homes, offices, institutions, industries etc, can result in prevention of many injuries including burns. Fewer burn cases translate into less morbidity and mortality as well as huge savings in health expenditure by government hospitals (Warda, 1999).

A comprehensive surveillance system for burns and other injuries is required for planning and evaluation of prevention programmes and to raise awareness but few developing countries have such a system. The WHO in collaboration with Centres for Disease Control and Prevention (CDC) has published guidelines for injury surveillance. As a result of this, some countries such as China, Jamaica, Nicaragua, South Africa, Thailand and Uganda have started the development of injury-surveillance systems (Krug, 2004).

Delgado et al (2002) conducted a case control study to investigate burn injuries in a pediatric population in Lima, Peru in an effort to develop an effective preventive program and they concluded that prevention efforts are essential to reduce these injuries. They recommended the development of programs at a local level, tailored to the prevalent risk factors.

According to Nderitu et al (2006) in their descriptive cross-sectional study, there is low public awareness on the risk and prevention of burn injuries. They identified alcohol intoxication and epilepsy as two important risk factors and recommended public health campaign on the risk of burns and prevention tailored to different recipient communities.

In the review of literature, no other research specifically addressing local burn injury risk factors in Kenya was found and therefore a need for a powerful study such as this case control study dedicated to and specifically addressing the local risk factors for burns in order to implement a sound national burn injury prevention program. Prevention of occurrence of burn injuries will result in fewer admissions and more importantly less morbidity and mortality from burns.

1.2 Research Problem

Kenyatta National Hospital (KNH) is the only hospital with a Burns Unit in Kenya and an average 679 burn injury patients are admitted every year (Table 1). The demand for the specialized burn services offered at KNH has gradually increased creating a need for more patient beds and plans to construct a National Burns Centre within the hospital are underway.

When completed, the new facility will ease the burden on the existing burn unit and ward.

Burn injury patients who survive are psychologically traumatized and many become permanently disfigured or maimed.

Many burn injuries are preventable especially if the risk factors can be identified. The main objective of this study therefore was to identify the risk factors for the study population so that they may be targeted by prevention programs.

1.3 Aims and Objectives

The aim of this study was to determine the risk factors for burn injuries of patients admitted at the Kenyatta National Hospital in Nairobi, Kenya.

Specifically, the study sought to:

1. Determine the socio-demographic characteristics of the study participants admitted at the Kenyatta National Hospital burn wards;
2. Determine the types of burns admitted at KNH;
3. To determine if occupation, level of education, fire safety knowledge, area of residence and mode of cooking and lighting houses are risk factors for burn injuries;
4. Establish knowledge and attitude of burns patients or caretakers on fire safety and burn injury prevention;

5. To correlate previous family history of burns, post-burn injury scarring and burn injury hospitalization with occurrence of burn injury.

1.4 Research Questions

- i. What are the socio-demographic characteristics of burns patients in KNH?
- ii. What are the types of burns among patients admitted at KNH?
- iii. What are the common risk factors for burn injuries treated at KNH?
- iv. What are the practices predisposing individuals to burns injuries?
- v. What are some of the beliefs concerning the causes of burn injuries?
- vi. Are the burn injuries of patients hospitalized at the KNH preventable?

1.5 Research Hypothesis

1.5.1 Null Hypothesis (H_0)

There is no difference in the risk of sustaining a burn injury between burn injury patients and non-trauma patients hospitalized at KNH.

1.5.2 Alternative Hypothesis (H_a)

There is a difference in the risk of sustaining a burn injury between burn injury patients and non-trauma patients hospitalized at KNH.

1.6 Rationale

Burn injury is one of the commonest injuries in both children and adults treated in hospitals in Kenya and worldwide. In the year 2012, 188,985 children under the age of 5 years were treated

for injuries in out-patient departments of hospitals in Kenya. Burn injuries constituted 75,363 (39.9%) of these injuries whereas 113,622 (60.1%) children were treated for all other injuries combined. Burns therefore are a significant cause of injury in the under 5 age group compared to the other causes of injuries (Kenya National Bureau of Statistics, 2012). Some of the burns occur as a result of carelessness, ignorance or lack of preventive measures in homes (Nderitu et al, 2006). The relatively high cost, the attendant pain, misery and suffering of burn patients can be minimized or prevented all together if preventive measures are instituted. Only one other local study has looked into the risk factors for burn injury. In their cross-sectional study of Risk factors for Kerosene stove explosion burns seen at KNH in Kenya, Ombati et al (2013) found that the source of kerosene and refuelling a stove without first extinguishing it were risk factors for these injuries.

1.7 Limitations of the Study

Limitations might have arisen due to use of a hospital based control group. The accuracy of the data could have been improved by having a community-based control group but this idea was shelved for this study because of the logistic and financial difficulties that this would have entailed. Biases may have arisen due to use of surrogate (Parents and Caregivers): some respondents for cases might not have been entirely truthful as a result of guilty feeling. In other words, the parent, guardian or caretaker could have felt that he/she would be viewed as having been responsible for the injury if he/she told it as it actually happened. Recall and information biases were also likely especially within the control arm of the study.

1.8 Definition of Operational Terms

Burn Injury/Burn(s) – Injury sustained by body tissues as a result of being subjected to extremes of temperature. In this study burn injury refers to injuries sustained by the human body from high temperatures/heat. Burn injury was the outcome or dependent variable in this study.

Risk of Burn Injury – The possibility or likelihood of sustaining a burn injury as a result of being in an environment within which are known causes of burns.

Risk factors – Factors predisposing individuals to harm or injury. These were the predictor or independent variables in this study.

Child – Study participant whose age was below 18 years. Children are not able to make serious decisions as a result of which they require special care and protection. They must therefore be under the care of a responsible adult (Parent/Guardian/Caregiver) according to the United Nations Convention on the Rights of the child (UN General Assembly, 1989).

Burn disasters– An event resulting in mass burn casualties and severe loss of human lives and material from a known thermal agent (Ahuja & Battacharya, 2004). Slum, school fires or petrol tanker explosions causing many people to sustain burn injuries are examples of burn disasters considered in this study.

Guardian/Caregiver – Person taking care of the child other than the parent.

Kupi Bati – Traditional kerosene lamp used in Bangladesh (Mashreky et al, 2010).

Formal settlement – Settlements with well constructed residential houses and having access roads and amenities such as water, electricity and sewers. This was one of the predictor or independent variables in this study.

Informal settlement – Slum areas or unplanned/illegal residential areas lacking amenities such as roads and water. This was one of the predictor or independent variables in this study.

Formal education – Education or learning within institutions (e.g. schools, colleges or universities) and with a curriculum for learning. In this study education was with regard to fire safety and burn injury prevention knowledge which was a predictor/independent variable.

Informal education – Education acquired outside institutions (e.g. mosques, churches or work places) and without a curriculum for study. This was a predictor or independent variable in this study. In this study informal education on fire safety and burn injury prevention was that acquired through mass media, at home or from friends and relatives.

CHAPTER TWO: LITERATURE REVIEW

2.1 Risk Factors for Burn Injuries

People of all ages are susceptible to minor burn injury with the highest incidence occurring during the first few years of life and in those aged 20-29 years (Delgado et al, 2001). The mechanism of minor burn injury is influenced by socio-economic factors and also varies considerably with the age of the victim. Minor burns in children younger than 4 years are caused primarily by contact with hot surfaces and liquids (scalds). After this age, a large number of heat sources (e.g., hot surface, liquid scald, grease scald, radiation, chemical) cause burn injury (Albertyn et al, 2006).

Many of the burns seen in Africa are as a result of poverty, illiteracy and migration to urban areas. Children are at greatest risk and sustain burns in preventable home accidents (Albertyn et al, 2006). Children are the most vulnerable and are at greatest risk because they have less perception about dangerous situations and limited ability to react appropriately (Mashreky et al, 2008).

Self-inflicted burns account for 4% of burn admissions worldwide and the majority (60-91%) of these patients have an underlying psychiatric condition as a risk factor. These can be prevented by restricting or prohibiting smoking in institutions (hospitals, prisons, schools etc) and identifying those at risk (Horner, 2005).

Risk factors for burn injuries vary from country to country but generally include alcohol and smoking, use of ground level stoves, long loose-fitting clothing, very hot bath water and faulty electrical wiring (WHO, 2008). In her review article of 34 studies, Edelman (2007) reported

several Social Economic Status (SES) factors related to risk of burns and which may be considered when studying burn populations. These factors are; ethnicity (non-white), low income, large families, single parents, illiteracy, low maternal education, unemployment, job loss, substandard living conditions, not owning a home, not having a telephone and overcrowding.

In a local study conducted at KNH, Nderitu et al (2006) found the paraffin stove and epilepsy to be risk factors and 20% of the patients had relatives who had sustained burns previously. There was a positive correlation between level of education and risk awareness.

Delgado et al (2001) found that the factors associated with a high risk of sustaining burns were: lack of water supply, low income and crowding. Protective factors were: presence of a living room and better maternal education. They recommended that burn intervention measures should target low socioeconomic groups and designed according to local risk factors.

Mashreky et al (2010) in their case-control study conducted in Bangladesh found that family size, cooking area and use of the traditional kerosene lamp were determinants for childhood burns. They recommended isolation of the cooking area, replacement of the *kupibati* with hurricane lamps and introduction of parent's education programs as measures to curb burn injuries.

In their study of 284 burn admissions, Tse et al (2006) found no correlation between level of education of parents and burns incidence. They recommended use of printed material, internet, media and school curriculum to educate all about safety issues in the home.

In a Peruvian case control study Delgado et al (2010) found that poverty, crowding and lack of education were significant risk factors. Other studies done in Brazil, England and Greece had also determined a positive relationship of burn injuries with overcrowding, maternal socioeconomic status and ethnicity.

In their case-control study of 239 burn injury children at a children's hospital in Athens, Petridou et al (1998) found the kitchen to be a high risk area and there was a powerful inverse association of the burn avoidance index with burn injury risk. Supervision lapses and barefoot walking were also found to increase the risk of burn injuries.

In a review of 117 studies aimed at assessing the status of burn preventive efforts Forjuoh (1996) found the same descriptive epidemiological characteristics but slightly different risk factors for burns in developing countries. These included pre-existing impairment in children, lapses in supervision, storage of flammable substances at home, low maternal education and overcrowding as well as several treatment modalities and preventive efforts including immediate application of cool water to a burned area.

2.2 Epidemiology's of Burn Injuries

In the developed world, serious burn injuries occur most commonly in males (67%) with the highest incidence of serious burn injury occurring in young adults (20-29 yrs) followed by children younger than 9 years. Individuals older than 50 years sustain the fewest number of serious burn injuries (2.3%). Major causes of severe burn injury are flame burns (37%) and liquid scalds (24%). For children younger than 2 years, liquid scalds and hot surface burns

account for nearly all serious burn injuries (Ytterstad and Sjøgaard, 1995). After age 2, flame burn is the most common cause of serious burn injuries, accounting for nearly one-third of all serious burns. In much older persons (80 yrs and older), hot surface exposure is a major cause (22%) of serious burns (WHO, 2008b). With regard to hospitalized burn patients, 5% die as a result of their burn injuries and most of these deaths are from flame burns. Liquid scald burns account for the second largest number of deaths. In structural fires, approximately one-half of all burn victims, many with only moderate burns of less than 40% body surface area, die of asphyxiation or carbon monoxide poisoning before reaching the hospital (WHO, 2008b).

Okonjo (1989), in his unpublished study on burns at the Kenyatta National Hospital (KNH), found that scalds and flame burns in children were 74.4% and 20.3% respectively. In adults, 63.8% of the burns were attributable to flame or dry heat and 8.5% to wet heat (scalds). In another local study, Nthumba (2002) reported 63.2% burns as caused by scalds and 36.7% by open flames. This latter pattern has been observed by many researchers all over the world with the majority of the children sustaining burns accidentally at home and the adults being injured at place of work or following assault (Asuquo et al, 2009; Boukind et al, 1995; Forjuoh et al, 1995; Muguti et al, 1994).

In their study of 109 consecutive burn patients admitted at KNH, Nderitu et al (2006) reported that 48.6% of them were children under 5 years of age, a majority of them with scald injuries. Most of the burns occurred at home (80.7%), with the rest occurring at work (11.0%) and elsewhere (8.3%). The causes of the burns were: scalds (51.3%), open flame (45.9%) and electricity (2.7%). The majority of the burns were accidental and involved children whereas adults mostly sustained flame burns. In retrospective study of 4481 burns patients treated at a in

South Korea burn centre between January 2003 and December 2012, Seo et al, 2015 found that the main causes of burns were; Fire (n=3017, 67.3%), Hot fluids, (n=986, 22.0%), Electricity (n=338, 7.5%) and Chemicals (n=72, 1.6%). Hot fluids (57.4%), fire (38.2%), Chemicals (2.6%) and Electricity (1.9%) were the commonest cause of burns in another retrospective epidemiological study from by Agbenorku et al of Ghana. The different aetiology of burns among countries is dictated by the different living standards and lifestyles (Agbenorku, 2011).

2.3 Impact of Burn Injuries

In the United States, the medical cost of primary care for one burns patient ranges from USD 3,000 – USD 5,000 per day (equivalent to Kenya shillings 300,000 – 500,000 per day). The economic impact of burns also includes loss of wages and the costs relating to post-burn deformities in terms of emotional trauma and loss of skills (WHO, 2011b). The medical cost of burns in developing countries is unknown. However, there is little doubt that the social and medical costs are enormous for families and societies.

Many burn victims require prolonged hospitalization for both the physical and the emotional trauma (Nderitu et al, 2006; Tse et al, 2006). The financial implications are enormous and most developing countries cannot afford the high cost of setting up modern burns care facilities (Asuquo et al, 2009).

In low-income countries, burn patients experience long hospital stays, post-burn complications such as wound infection, malnutrition and post-burn contractures. They have high mortality rates and are a major source of economic burden to families and society (Edwards et al, 2011).

2.4 Preventive Strategies for Burn Injuries

Researchers agree that the best treatment approach for burns is prevention and many communities around the world have introduced house fire prevention strategies that include education and training of children. Burd and Tse divided prevention of burn injuries into active and passive preventions: passive being modifications of equipment and materials, and active being education and provision of information for the target population (Burd, 2003; Tse et al, 2006). Active participation by children in learning fire responses was found to be more effective than the use of passive methods (Warda et al, 1999). In an Australian study, King et al (1999) demonstrated the value of community-based injury prevention campaign specifically targeting linguistically diverse communities.

The role of public health in burn injuries is to describe the magnitude of the problem by collecting data on mortality and morbidity from burn injuries and to study the risk and protective factors. Further, public health demonstrates the economic impact of burns on the community in order to provide a basis for cost-benefit analysis for burn injury preventive mechanisms (WHO, 2011).

Prevention of burn injuries requires knowledge of the epidemiological characteristics and associated risk factors for burns. This is acquired through sustained research on the descriptive epidemiology and risk factors for burn injuries. Great strides have been made in this regard in the developed world but the developing world still lags behind.

In a study of 421 New Zealand primary school children aged 7 – 13 years, Niki Harre et al (1998) concluded that investigation of children's involvement in household activities that carry an injury risk may help in the design of prevention strategies, including school-based education. Using four-way Analysis of Variance (ANOVA) they found significant main effect on burn risk for sex, age, ethnicity and sibling status. In New Zealand, the fire service teaches fire safety and prevention strategies to school children. Knowledge of this was also studied and the level found to be high.

Delgado et al (2010), in their study on risk factors for burn injuries in children, concluded that the implementation of intervention programmes should not wait for the socio-economic status of communities to improve. To reduce this common cause of injury, especially in children, they proposed that prevention efforts be urgently developed on a local level in response to risk factors identified in individual areas.

Examples of developing countries where prevention programs have been undertaken include Sri Lanka where an award-winning safe kerosene (paraffin) lamp has been developed and promoted by the Safe Bottle Lamp Foundation (SBLF) (WHO, 2011b; Mock, 2011; Lau, 2006). In South Africa, a program has been promoting education on burn prevention and a safer paraffin cooking stove is also being developed (WHO, 2011b; Mock, 2011). Other developing countries are making efforts to improve burn care through adaptation of surgical techniques to the local circumstances (Mock, 2011). In Kenya unlike in these countries, burns are not considered a public health problem and there are no focused injury prevention policies or programs.

The WHO Plan for Burn Prevention and Care will address the spectrum of injury control as applied to burns including improving data services, surveillance, promotion of burn prevention strategies and encouraging innovative pilot programs to address burn-prevention priorities in areas where the risk factors have not been well addressed, such as in rural areas (WHO, 2011b). The WHO approach for addressing the world burden of burn injuries is illustrated in the theoretical framework shown in Figure 1 and which appears in the WHO Plan for Burn Prevention and Care. This model has generally been used to good effect by the WHO Department of Violence and Injury Prevention and Disability and is the basis of the WHO Burn Prevention Programme (WHO, 2011b). The principles of this model will be applied in planning and implementing burn injury prevention strategies for Kenya after this study is concluded.

The co-operation between WHO and ISBI is anticipated to result in diminished frequency of burn injuries and fire disasters around the world. The results of this research will hopefully aid the achievement of these goals locally. Similar WHO activities aimed at violence prevention and traffic safety have significantly drawn attention to these problems globally (WHO, 2011b).

In conclusion, suffice it to say that burn injury prevention programs save costs of burn care and more importantly result in improved health for the community. Such programs are based on the evidence provided by research on risk factors, some of which may be specific to a particular community due to socio-economic and other circumstances. Several descriptive studies on burns have been done in sub-Saharan Africa but literature review did not reveal any case control study on burn injuries (Albertyn et al, 2006; Kalayi, 1994; Nderitu et al, 2006).

2.5 Conceptual Framework

Accidental injuries or deaths are attributed to bad luck or witchcraft by many people in the third world. For this reason the only prevention that some might consider would be prayers and/or a visit to the witchdoctor. Prevention has been proven in the developed world to reduce the morbidity and mortality resulting from injuries. Many burn injuries in Kenya can be prevented after identification of the local risk factors and targeting them in national injury prevention programs.

The WHO has recorded success with a model for prevention of violence, road traffic accidents, child injuries and emergency and trauma care provision (WHO, 2008). This model is also the basis for WHO's 10 year strategy (2008 – 2017) for burn prevention and care in developing countries. This research will be a good local platform for this global strategy in Kenya using the conceptual framework adapted from the one of WHO (Figure 2).

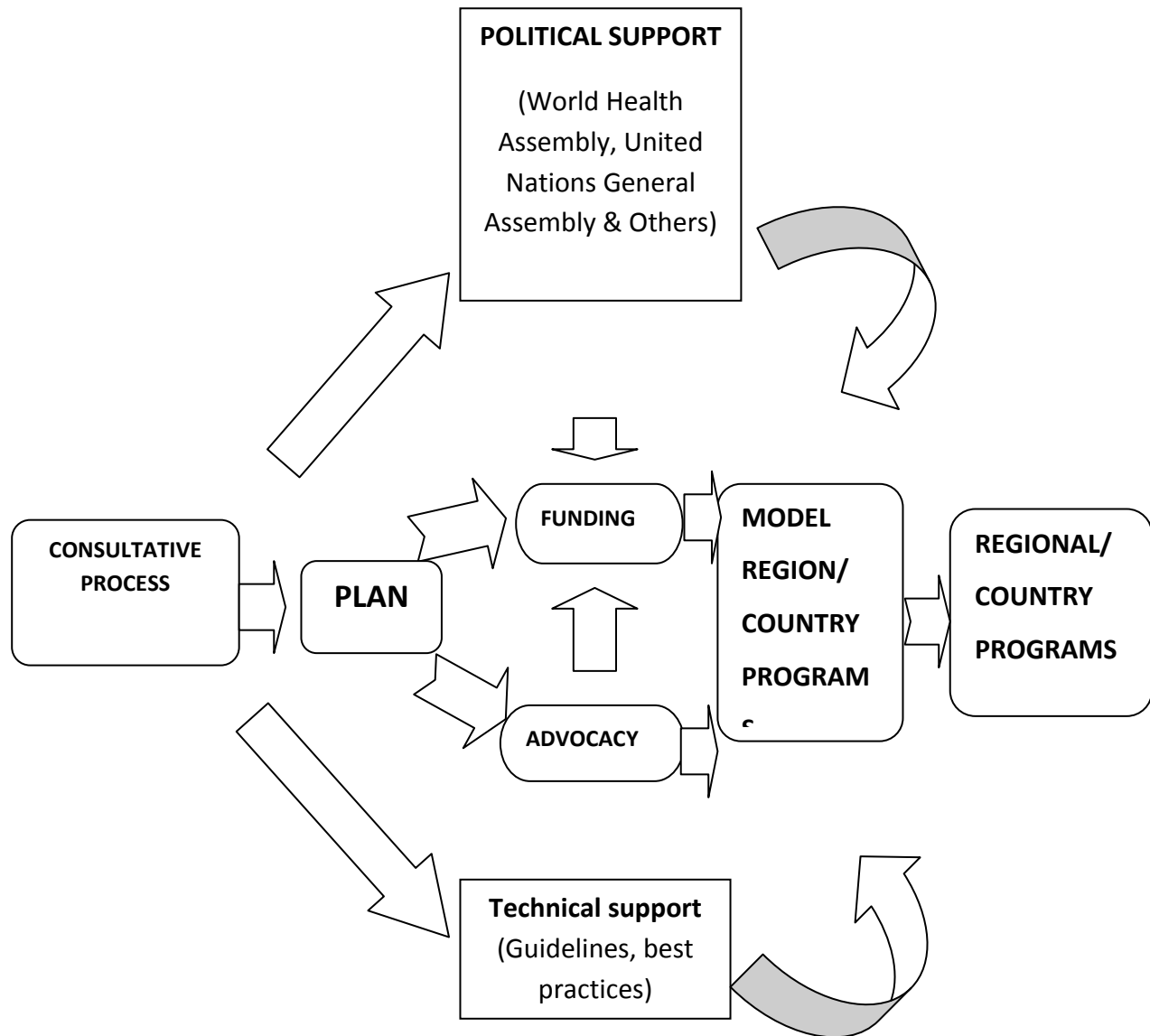


Figure 1: WHO Conceptual Framework for Burden of Injury in Developing World
 (Source: WHO Plan for Prevention and Care of Burn Injuries - Geneva, WHO, 2008)

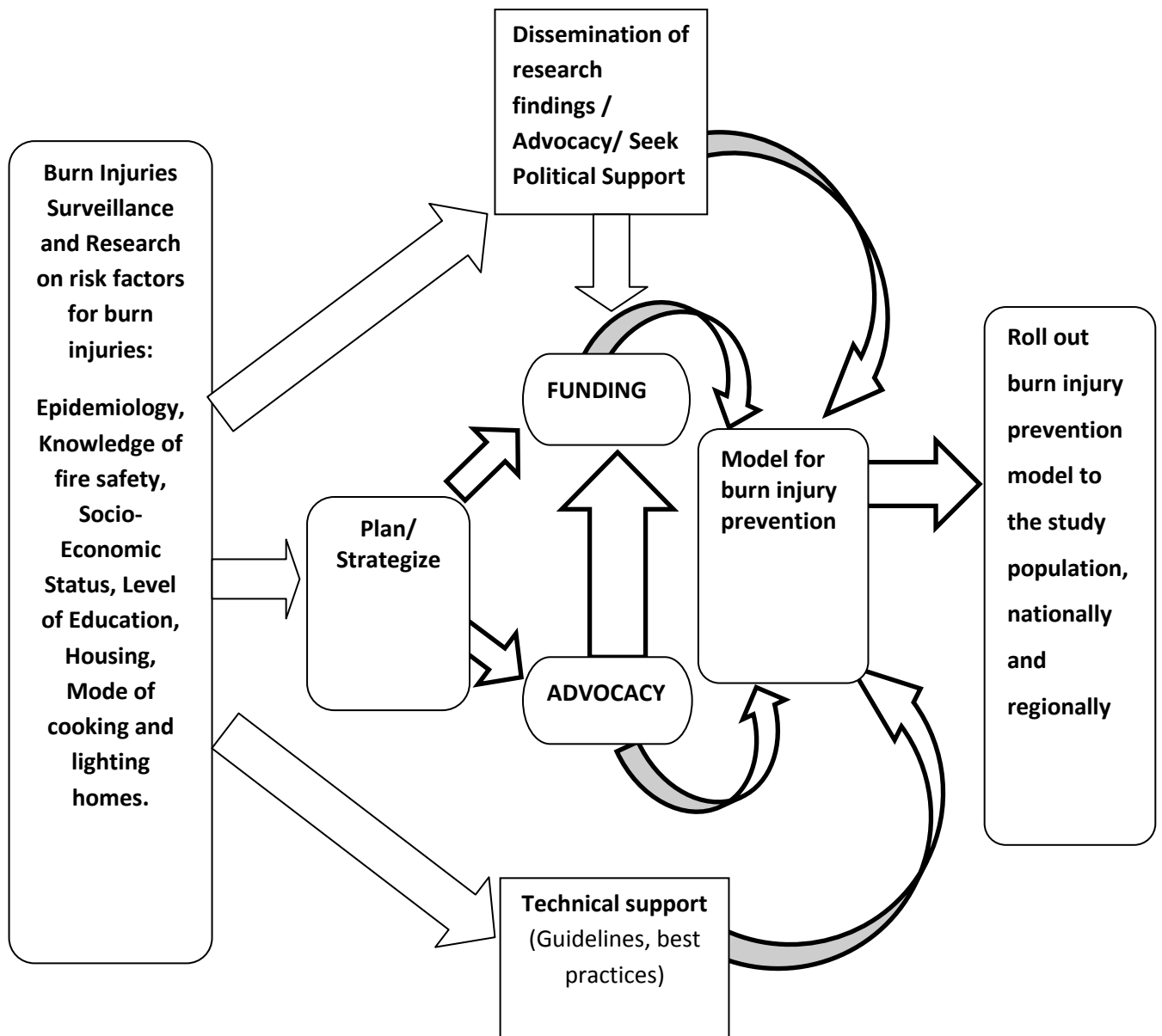


Figure 2: Study's Conceptual Framework

CHAPTER THREE: STUDY DESIGN AND METHODOLOGY

3.1 Study Design

This was a case-control study. Cases were defined as burn injury patients admitted in Kenyatta National Hospital (KNH) burn wards and the controls were defined as age-and-sex-matched patients without any injury (including burn) admitted into paediatric and medical wards of KNH.

The setting was therefore clinical with a view to establishing the mechanism of causation of burn injuries seen at KNH. Age and sex matching was done to make the case and control groups as similar as possible except for disease status.

A case control study is an efficient way to determine the cause-effect relationship. Furthermore, it is cheap and is known to be suitable for rare outcomes. Burns may be considered relatively rare in comparison to other injuries. The previous descriptive studies done by other researchers set the stage for this study.

3.2 Variables

The dependent (outcome) variable was the presence of burns, and the independent (predictor variables) were: occupation, level of education, knowledge of burn injury prevention and fire safety, residence (formal or informal), mode of lighting the house and cooking, history of a family member having sustained a burn and whether or not they healed with a scar and whether or not they were hospitalized.

3.3 Study Site

This study was conducted at the KNH in Nairobi, Kenya, which is a 2000-bed government hospital with a staff establishment of 4,700 which includes 260 doctors and 2000 nurses. It is the

largest national referral hospital in Kenya and also serves as the teaching hospital for the University of Nairobi (UoN) and the Kenya Medical Training College (KMTC). It is the largest referral hospital in East and Central Africa. KNH was chosen as a study site because it admits relatively many burn patients due to its location in a large city and by virtue of it being a national referral hospital. The study proposal was reviewed and approved by the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH/UoN-ERC).

An average of two burn injury patients are admitted every day into the hospital's Ward 4D, Burns Unit (BU) or Critical Care Unit (CCU). All patients are first seen at the busy Casualty Department/Accident and Emergency Department where they are triaged and either treated and discharged or admitted into one of the 3 wards. Severely injured burn patients including those with suspected inhalational injury are initially admitted to the hospital's Critical Care Unit (CCU) before being transferred to BU, Ward 4D or discharged.

3.4 Source Population

The study population consisted of patients utilizing the KNH, the majority of whom are low and middle income residents of Nairobi City and its environs. It also includes patients referred from health facilities elsewhere in Kenya. The population of cases included burn patients admitted in the Burns Unit or Ward 4D of KNH while the population of controls comprised non-injury patients admitted in the non-surgical paediatric or medical wards of KNH.

3.5 Sampling

3.5.1 Sampling Frame

The sampling frame was patients admitted in BU, Ward 4D, Paediatric non-surgical and Medical Wards.

3.5.2 Formulae used to Calculate Sample Size

The following formulae and considerations for determination of sample size in each group (*cases & controls*) was used (Kirkwood et al, 1988; Mashreky et al, 2010);

$$\frac{\{u\sqrt{[\pi_0(1-\pi_0)+\pi_1(1-\pi_1)]} + \sqrt{[2\pi(1-\pi)]^2}}{(\pi_1-\pi_0)^2}$$

Where:

π_0 = Proportion of controls exposed

Assumed to be 0.5 in this research

OR = Odds Ratio taken as 1.5 for this study

π_1 = Proportion of cases exposed, calculated from

$$\pi_1 = \frac{\pi_0 \text{OR}}{1 + \pi_0(\text{OR} - 1)}$$

u = One-sided percentage point of the normal distribution corresponding to 100% - the power e.g. if power = 80%, $u = 0.67$

v = Percentage point of the normal distribution corresponding to the (two-sided) significance level e.g. if significance level = 5%, $v = 1.96$

The required sample sizes for each of the two groups using this formulae is 199.

The sample size was calculated using the following considerations used in a similar community-based Bangladeshi case control study (Mashreky et al, 2010);

- Ratio of exposed and non-exposed; 1:1
- Incidence of exposures (socio-demographic, environmental and caring) among control: 50%
- Power: 80%
- Relative risk worth detecting: 1.5

The choice of formulae was determined by the study type (case control involving binary exposure/predictor variables) and also by its having been used in a similar study by Mashreky (2010).

3.5.3 Sampling Procedure

The burn cases were sampled first before sampling of the controls was done with gender and age profile matching. Sampling of the controls with respect to age was done within 2 years for all the cases and all study participants were grouped within 5 year groups.

3.5.4 Selection of Study Cases

Consecutive random sampling method was used to select 202 cases for the study from among patients admitted with burn injuries in the 2 wards (Burns Unit and Ward 4D) which admit burn injury patients at KNH. At the commencement of the study, the whole population of admitted burn patients who met the inclusion criteria was recruited. After that, any burn patient was

admitted until the sample size was reached. All were required to give written informed consent before they could be admitted to participate in the study.

3.5.5 Selection of Controls

Consecutive random sampling was also used to select 202 age and sex individually matched controls from among patients admitted into any of the 8 KNH medical and 4 non-surgical paediatric wards.

Age-matching for controls was done within a range of +/-2 years of the age of the case.

3.5.6 Inclusion Criteria

Patients with burn injuries (cases) and those admitted with diseases other than trauma (controls) and who gave informed consent either directly or through proxy, were included. All study participants had to be able to talk or in the case of children, have a person (parent or caretaker) present to answer questions on their behalf.

3.5.7 Exclusion Criteria

Selected patients from whom written informed consent was not obtained were excluded.

3.5.8 Biases

- Problems of recall among both the cases and the controls.
 - The cases might have remembered their exposure (cause of burn injury) with a higher accuracy than the controls.

- Information bias due to use of surrogates in situations where parents and guardians responded on behalf of the patient.

3.6 Data Collection Instrument

3.6.1 Questionnaire

Data for both the cases and the controls was collected using a questionnaire which had been pre-tested and found acceptable and easy to understand (Appendix II). Pre-testing was done at Kiambu Level 4 hospital which was chosen for logistical reasons (Appendix VII). The only other national referral hospital in Kenya is the Moi Teaching and Referral Hospital (MTRH) situated 300 kilometres away in Eldoret.

The principal investigator and his assistants selected study participants for cases and controls within respective KNH wards through consecutive random sampling. The study was explained to participants so selected and questions invited from them before they were requested to give consent with a signature or thumb print (Appendix III). In case of minors (children aged ≤ 18 years), the parent, guardian or accompanying person responded on their behalf. The research assistant circled the appropriate response and/or, in case of the structured sections of the questionnaire, wrote the response given by the participant.

The research assistants who aided in data collection were recruited, trained and supervised by the principal investigator.

3.6.2 Pre-testing of the Questionnaire

To determine the practicability, reliability and validity of the questionnaire, pre-testing was done.

This was undertaken at Kiambu Level 4 Hospital and entailed administration of the questionnaire

to 10 cases and 10 sex-and-age matched controls with non-trauma ailments. Following the analysis of the 20 questionnaires, a small adjustment was made regarding the order of questions to facilitate data analysis. The question concerning presence of fire prevention or fire safety appliances was moved to just before the question concerning awareness of fire safety or burn injury prevention. This adjustment was necessitated by the fact that the two questions were related.

3.7 Data Management and Analysis

SPSS version 17 statistical software was used for data analysis with tables, graphs and charts used to present the data. The exposure distribution among the cases was compared with the exposure distribution among the control subjects. Pearson chi-square test was used to compare the demographic characteristics between the two groups and to determine the relationship between the risk factors (the exposure) and burn injuries (the outcome). The ratios from the chi-square were compared using Odds Ratios (OR) which was the main measure of association. Logistic regression analysis was used to determine the strength of association between the risk factors and burn injuries. The confidence limit was 95% and level of significance 0.05 in all the analysis.

3.8 Minimization of Errors and Biases

Susceptibility to sampling bias is a problem in case control studies and the following strategies were utilized in the methodology and study design to minimize it:

1. Matching of cases and controls for age and sex.
2. Use of a structured pre-tested data collection instrument with no leading questions.

3. Pre-testing and revision of the data collection tool.
4. Proper training of research assistants.
5. Stratification of the demographic profiles (age, level of education, etc).

3.9 Assumptions of the Study

This being a hospital-based study, it was assumed that the conclusions made from it could be extrapolated to the larger population to which the participants belonged. Furthermore, KNH being a national referral hospital, the conclusions can therefore be generalized for the whole country.

It was also assumed that the potential of recall bias was the same in the cases and controls.

3.10 Ethical Considerations

The study was authorized through ethical clearance certificate number P327/08/2011 of 14th October, 2011 (Appendix VI) and the following were the ethical considerations;

3.10.1 Approval

The study commenced soon after approval by the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH/UoN-ERC) to which this research proposal was submitted in August 2011 (Appendix VI).

3.10.2 Confidentiality

All information collected for this research has been treated with utmost confidentiality and study participants were at all times treated with respect during data collection. The information

gathered has been used solely for this study and will be divulged only if it is in the interest of the patient and with his/her approval.

3.10.3 Plagiarism

Extensive literature review has been done, references used have been cited using the Harvard System as recommended by the university supervisors and the work of other authors appropriately acknowledged.

All persons who contributed to this study in any way have been duly acknowledged and/or credited.

3.10.4 Consent

Written informed consent was mandatory before participants were recruited into the study. The researcher or his research assistants first explained to the prospective participant what the study was all about before inviting them to ask questions and requesting them to participate in the study. English and Swahili versions of the written explanation of the study were provided to those who were literate and the same was read out to those not able to read (Appendix IIIa & IIIb). They were clearly informed that refusal to participate or withdrawal from the study would not jeopardize any treatment that they were entitled to. The prospective participants were given a chance to ask questions or seek clarification on any aspect of the study before giving written consent. Recruitment into the study was done once the informed consent was duly signed.

CHAPTER FOUR: RESULTS

4.1: Introduction

A total of 404 study participants were interviewed: half of them (202) were burn cases and the other half (202) controls.

4.2: Social-Demographic Characteristics

The age distribution for cases and controls was similar due to age-matching. The age range was 0.1 to 58 years, the mean age was 15 years, standard deviation was 15 years, the median age was 11 years (10-14 years age group) and the modal age category was the 0-4 years. The age group most affected by burn injuries therefore was 0-4 years (42.6%) followed by 25-29 years (11.4%), 20-24 years (10.9%) and 30-34 (10.4%) (Figure 3).

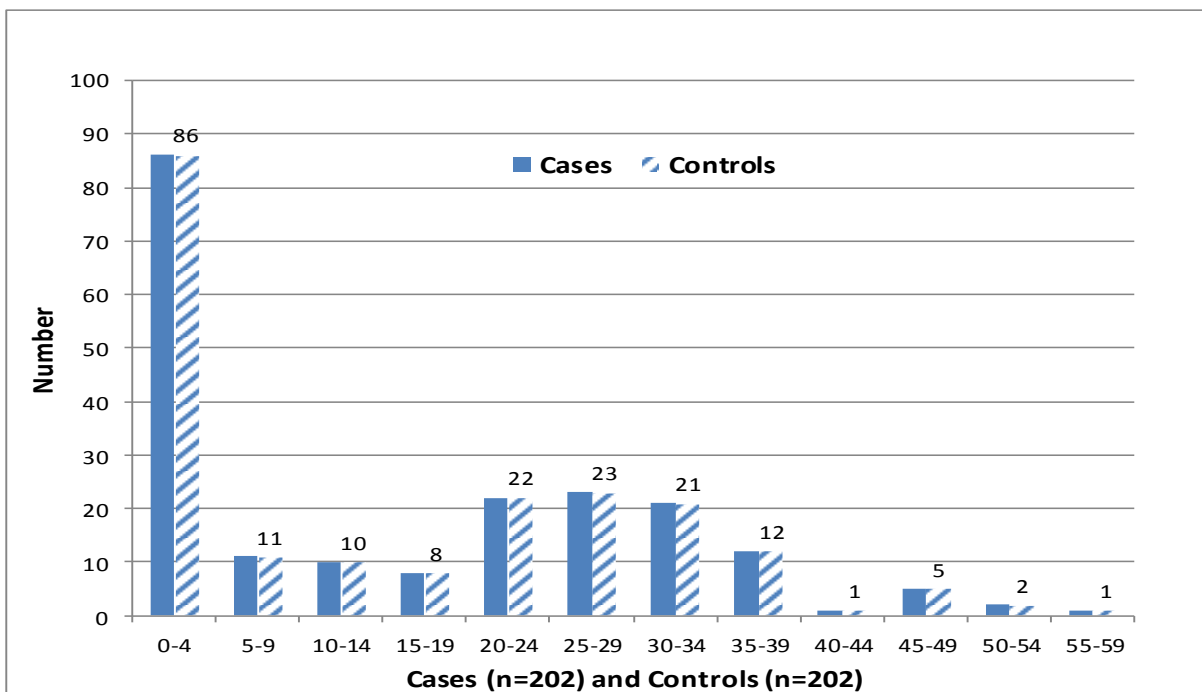


Figure 3: Frequencies for the Different Age Categories for Both Cases and Controls

The number of males and females was 106 and 96 respectively for both cases and controls, giving a male to female ratio of 1.1:1 (Figure 4). More males than females sustained burn injuries up to the age of 4 years. However, thereafter up to the age of 24, there were more females than males (Table 2).

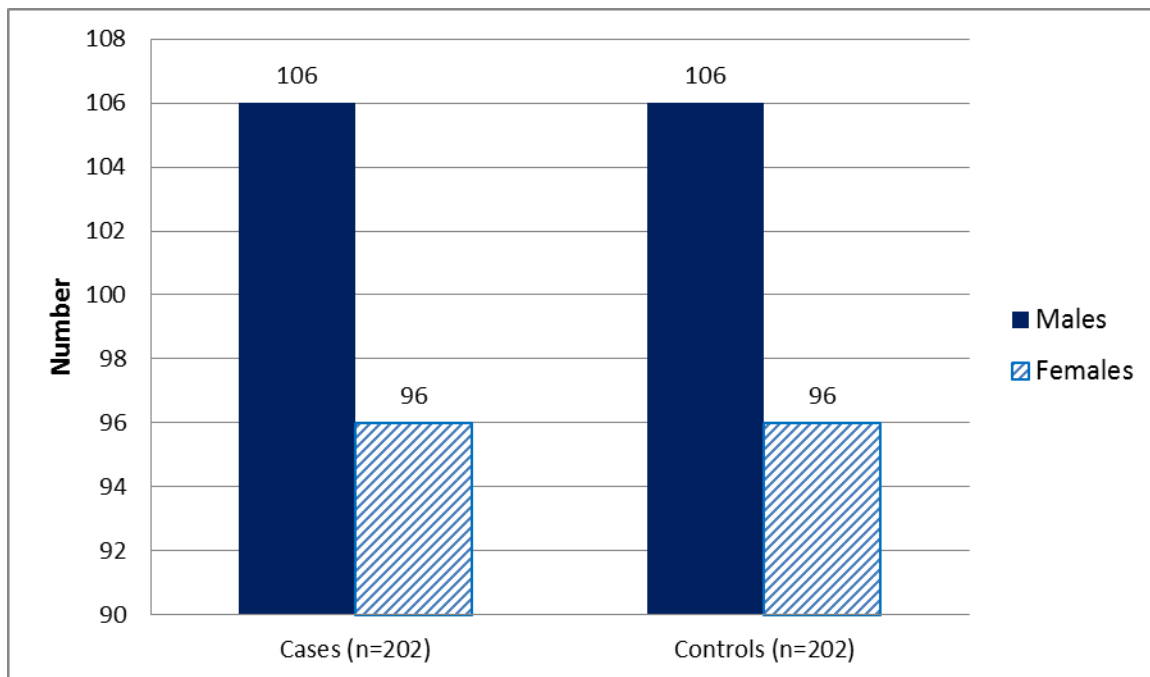


Figure 4: Sex Distribution of study Subjects/Participants

Table 2: Age and Sex Distribution of all Study Subjects

| Age category (Years) | Case male (n=106) | Case female (n=96) | Control male (n=106) | Control female (n=96) | Total |
|----------------------|-------------------|--------------------|----------------------|-----------------------|-------------|
| 0-4 | 49 (46.2%) | 37 (38.5%) | 49 (46.2%) | 37 (38.5%) | 172 (42.6%) |
| 5-9 | 4 (3.8%) | 7 (7.3%) | 4 (3.8%) | 7 (7.3%) | 22 (5.4%) |
| 10-14 | 5 (4.7%) | 5 (5.2%) | 5 (4.7%) | 5 (5.2%) | 20 (5.0%) |
| 15-19 | 2 (1.9%) | 6 (6.3%) | 2 (1.9%) | 6 (6.3%) | 16 (4.0%) |
| 20-24 | 5 (4.7%) | 17 (17.7%) | 5 (4.7%) | 17 (17.7%) | 44 (10.9%) |
| 25-29 | 14 (13.2%) | 9 (9.4%) | 14 (13.2%) | 9 (9.4%) | 46 (11.4%) |
| 30-34 | 14 (13.2%) | 7 (7.3%) | 14 (13.2%) | 7 (7.3%) | 42 (10.4%) |
| 35-39 | 8 (7.5%) | 4 (4.2%) | 8 (7.5%) | 4 (4.2%) | 24 (5.9%) |
| 40-44 | 1 (0.9%) | 0 (0%) | 1 (0.9%) | 0 (0.0%) | 2 (0.5%) |
| 45-49 | 3 (2.8%) | 2 (2.1%) | 3 (2.8%) | 2 (2.1%) | 10 (2.5%) |
| 50-54 | 1 (0.9%) | 1 (1.0%) | 1 (0.9%) | 1 (1.0%) | 4 (1.0%) |
| 55-59 | 0 (0.0%) | 1 (1.0%) | 0 (0.0%) | 1 (1.0%) | 2 (0.5%) |

With regard to occupation, formal occupation made up 12.4% (n=24, 12.4%) and 12.9% (n=26, 12.9%) of the cases and controls respectively. Employment within the informal sector was 20.1% (n=39, 20.1%) and 18.9% (n=38, 18.9%) for the cases and controls respectively. The unemployed were 11.9% (n=23, 11.9%) of the cases and 12.4% (n=25, 12.4%) of the controls.

Table 3: Occupation of Participants

| Occupation of participants | Cases (n=194) | Controls (n=201) |
|-----------------------------|---------------|------------------|
| Children | 108 (55.7%) | 98 (48.8%) |
| Pupil/student | 0 (0%) | 14 (7.0%) |
| Employed in Formal sector | 24 (12.4%) | 26 (12.9%) |
| Employed in Informal sector | 39 (20.1%) | 38 (18.9%) |
| Unemployed/Housewife | 23 (11.9%) | 25 (12.4%) |
| TOTAL (Percentage) | 100% | 100% |

There were 85 (n=85, 42.7%) and 92 (n=92, 47.9%) of the cases and controls respectively who were non-school going children respectively. When this category was excluded and Chi Square analysis performed, the difference in level of education between the two groups was found to be statistically significant ($X^2=9.849$, 95% CI, $n=0.043$). There were more primary school educated among the cases (n=68, 34%) than the controls (n=42, 22%). In the case of secondary and tertiary level education, the controls were more (n=54, 28%) than the cases (n=39, 20%) (Table 4). When those with a lower level of education (pre-school, nursery or primary school) were compared with those with higher education (secondary or a higher level) the difference was found to be statistically significant using the Chi Square test. The odds of sustaining a burn injury was 2.32 times higher where the level of education was low (Table 5), (OR=2.32, 95% CI: 1.28-4.22, $p= 0.003$).

Table 4: Participants' Level of Education (n=199)

| Education level reached by study participant | Cases (n=199) | Controls (n=192) |
|---|-------------------------|----------------------------|
| Never attended school | 3 (1.5%) | 3 (1.6%) |
| Pre-school/Nursery | 4 (2.0%) | 1 (.5%) |
| Primary school | 68 (34.2%) | 42 (21.9%) |
| Secondary school & Tertiary level of education | 39 (20%) | 54 (28%) |
| Children (Level of education Not-Applicable) | 85 (42.7%) | 92 (47.9%) |
| TOTAL (Percentage) | 100% | 100% |

Table 5: Education Level of Patient

(Aggregated - Primary vs combined Secondary and Tertiary)

| Education level reached | Cases (n=111) | Controls (n=97) | Odds Ratio (OR) | 95% Confidence Interval (CI) | p-value |
|--|----------------------|------------------------|------------------------|-------------------------------------|----------------|
| Pre-school/Nursery & Primary school | 72 | 43 | 2.32 | 1.28-4.22 | 0.003 |
| Secondary school & Tertiary level of education | 39 | 54 | | | |

In both arms of the study, the majority of the respondents were mothers. They made up 88.5% (n=92, 88.5%) in both the cases and the controls. For the cases, 11.5% (n=12, 11.5%) relatives other than the mother were the respondents or caregivers compared to 12.4% (n=13, 12.4%) for the controls. The numbers in the two study groups were therefore almost the same (Table 6). The difference was not statistically significant ($X^2=12.45$, 95% CI, $p=0.087$).

Table 6: Relationship of Respondent (Caregiver) to Participant

| Relationship of respondent to patient | Cases (n=104) | Controls (n=105) |
|--|--------------------------|-----------------------------|
| Mother | 92 | 92 |
| Auntie | 5 | 1 |
| Grandmother | 2 | 1 |
| Sister-In-Law | 1 | 0 |
| Spouse | 1 | 0 |
| Father | 2 | 9 |
| Uncle | 1 | 0 |
| Sister/brother | 0 | 2 |

With regard to the occupation of the parent or caregiver, there were 59 (n=59, 55.1%) unemployed among the cases whereas the controls had 61 (n=61, 58.1%). In the case of formal employment it was 30 (n=30, 28%) and 26 (n=26, 24.8%) for the cases and controls respectively. For informal employment it was 18 (n=18, 16.8%) of the cases and 18 (n=18, 17.1%) of the controls (Table 7). When Pearson’s Chi-Square statistical analysis was done, there was no significant difference between the cases and the controls with regard to the occupation of the respondent ($X^2=0.3$, 95% CI, $p=0.861$). Considering the hypothesis that there is no difference between the two groups with regard to whether or not the parent or caregiver was in formal or informal employment, the null hypothesis is not rejected. This means that the occupation of the caregiver was not a risk factor for burn injury.

Table 7: Occupation of Respondent (Parent or Caregiver)

| Occupation of the parent or caregiver | Cases (n=107) | Controls (n=105) | p-value |
|--|-------------------------|----------------------------|----------------|
| Unemployed | 59 (55.1%) | 61 (58.1%) | 0.861 |
| Employed (Formal sector) | 30 (28%) | 26 (24.8%) | |
| Employed (Informal sector) | 18 (16.8%) | 18 (17.1%) | |

4.3: Cause of Burn and Site/Place where the burn Injury Occurred for Burn Cases

The home environment was where majority (n=161, 80.9%) sustained burn injuries followed by the work place (n=15, 7.5%). Only one person (n=1, 0.5%) sustained a burn in a motor vehicle and the remainder (n=22, 11.1%) sustained burn injuries in other places such as neighbour's/friend's house or the roadside (Table 8).

Table 8: Site where the Affected Individual Sustained the Burn Injury

| Place of Injury | (n=199) | Percent (%) |
|---|----------------|--------------------|
| Home | 161 | 80.9 |
| Place of work | | |
| • Construction site | 3 | 1.5 |
| • Workshop | 2 | 1.0 |
| • Roadside | 2 | 1.0 |
| • Hotel | 2 | 1.0 |
| • Industry | 1 | 0.5 |
| • Filling station | 1 | 0.5 |
| • Garage | 1 | 0.5 |
| • Butchery | 1 | 0.5 |
| Total | 15 | 7.5 |
| In a vehicle (Water from radiator) | 1 | 0.5 |
| Other places | | |
| • Roadside | 8 | 4.0 |
| • Neighbour's/friend's house | 6 | 3.0 |
| • House compound | 3 | 1.5 |
| • Open space | 2 | 1.0 |
| • Transformer | 1 | 0.5 |
| • Mob justice | 1 | 0.5 |
| • In a bar | 1 | 0.5 |
| Total | 22 | 11.1 |
| TOTAL | | 100 |

The major causes of burns were hot fluids (n=93, 46.3%) and fire/flame (n=81, 40.3%). Electricity, other substances and chemicals were responsible for 6.5% (n=13, 6.5%), 5.5% (n=11, 5.5%) and 1.5% (n=3, 1.5%) respectively. Twenty-five (n=25, 30%) of the flame/fire burns were associated with exploding cooking stoves and 8 (n=8, 9.9%) were caused by exploding wick lamps. In the hot fluids category, tea and water were the commonest causes of burn injuries whilst in the electrical burns category, exposed electrical wires were responsible for 46.2% (n=6, 46.2%) of the electrical injuries (Table 9).

Table 9: Causes of the Burn Injuries

| Cause of injury | (n=201) | Percent (%) |
|---|-----------|-------------|
| Hot fluids | | |
| • Tea | 20 | 21.5 |
| • Water | 54 | 58.1 |
| • Porridge | 5 | 5.4 |
| • Oil/Kerosene/Paraffin | 7 | 7.5 |
| • Milk | 1 | 1.2 |
| • Cooking oil | 4 | 4.3 |
| • Soup | 2 | 2.2 |
| Total | 93 | 46.3 |
| Fire | | |
| • Stove explosion | 25 | 30.0 |
| • House caught fire | 12 | 14.8 |
| • Fell into fire/epileptic | 10 | 12.3 |
| • Explosion of lamp/koloboi/burner | 8 | 9.9 |
| • Gas explosion/leakage | 8 | 9.9 |
| • Open flamePetrol tanker explosion | 7 44 | 8.6 |
| • Clothes caught fire | 3 | 4.9 |
| • Mob justice | 81 | 4.9 |
| Total | | 40.3 |
| Electrical | | |
| • Touched exposed wire/illegal connection | 6 | 46.2 |
| • Electrocuted – high voltage/low voltage | 5 | 38.5 |
| Electrocuted while welding | 1 | 7.7 |
| Total | 13 | 6.5 |

| | | |
|-------------------------|-----------|------------|
| Chemical | | |
| • Sulphuric acid | 2 | 1.0 |
| • Methylated spirit | 1 | 0.5 |
| Total | 3 | 1.5 |
| Other | | |
| • Hot food | 4 | 2.0 |
| • Molten metal | 1 | 0.5 |
| • Hot charcoal/firewood | 4 | 2.0 |
| • Pressure cooler | 1 | 0.5 |
| Total | 11 | 5.5 |
| TOTAL | | 100 |

4.4: Awareness of Burn Injury Prevention and Fire Safety Practises among the Cases

Seventy eight (n=78, 38.6%) and one hundred and twenty four (n=124, 61.4%) of the cases thought that the burn injury in question could have been prevented or could not have been prevented respectively (Figure 5). Many participants among the cases therefore felt that the burn injury was unavoidable despite the fact that burns are known to be very preventable.

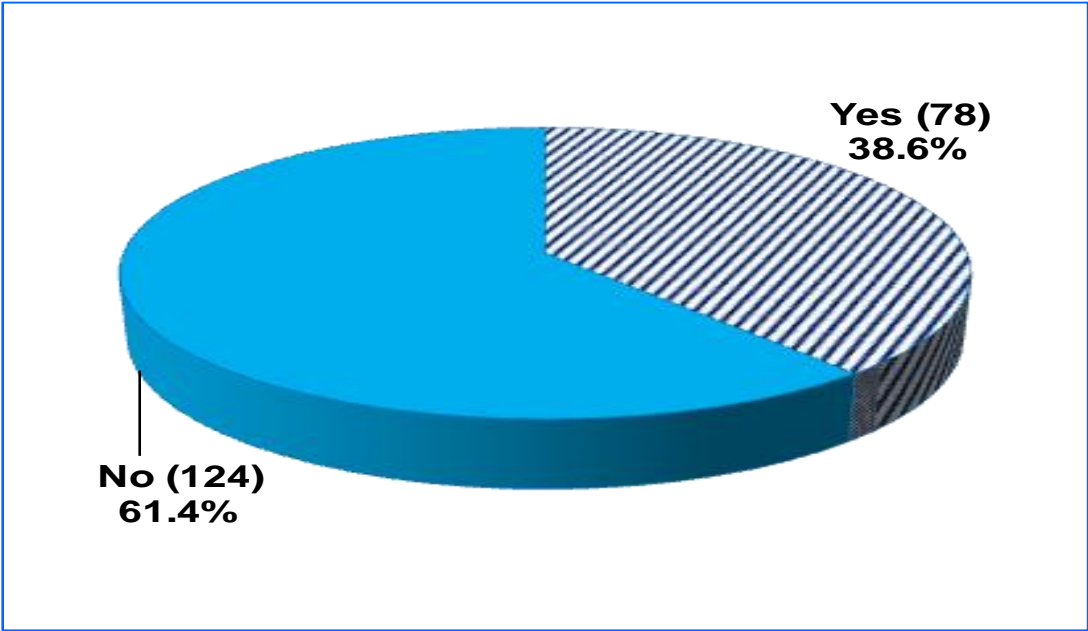


Figure 5: Opinion on Whether or not the Burn Injury could have been Prevented among the Cases (n=202)

Ninety-six per cent (n=194, 96%) of the cases said that there were no fire prevention or fire safety appliances at the site of the burn injury whereas 4% (n=8, 4%) said such appliances were present (Figure 6). Many premises where the burn injuries occurred did not therefore have equipment to fight fire or measures to prevent burn injuries.

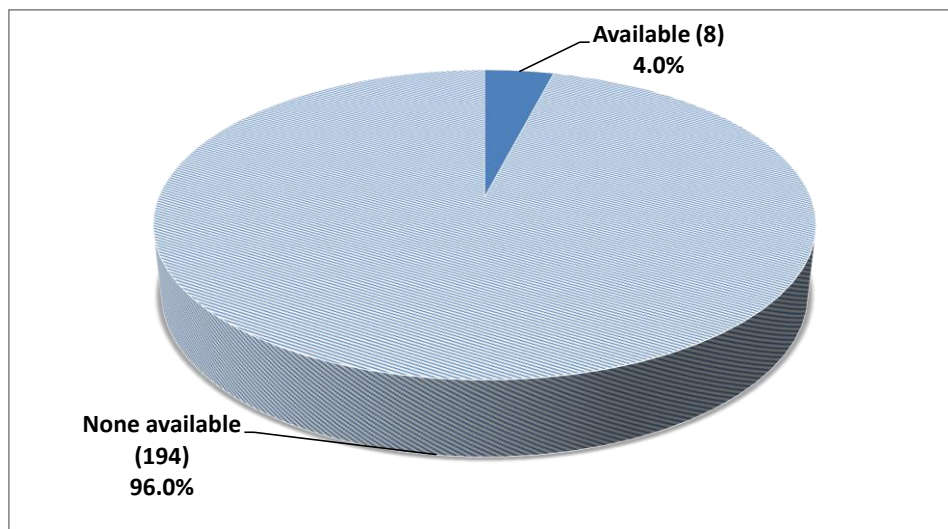


Figure 6: Availability of Fire Prevention or Fire Safety Appliances at the Place where Patient (case) Sustained the Burn (n=202)

Forty-five (n=45, 22.3%) of the cases and 108 (n=108, 53.5%) of the controls had previously been taught about fire safety and burn injury prevention. One hundred and fifty seven (n=157, 77.7%) of the cases and 94 (n=94, 46.5%) of the controls had no knowledge of fire safety or burn injury prevention (Figure 7).

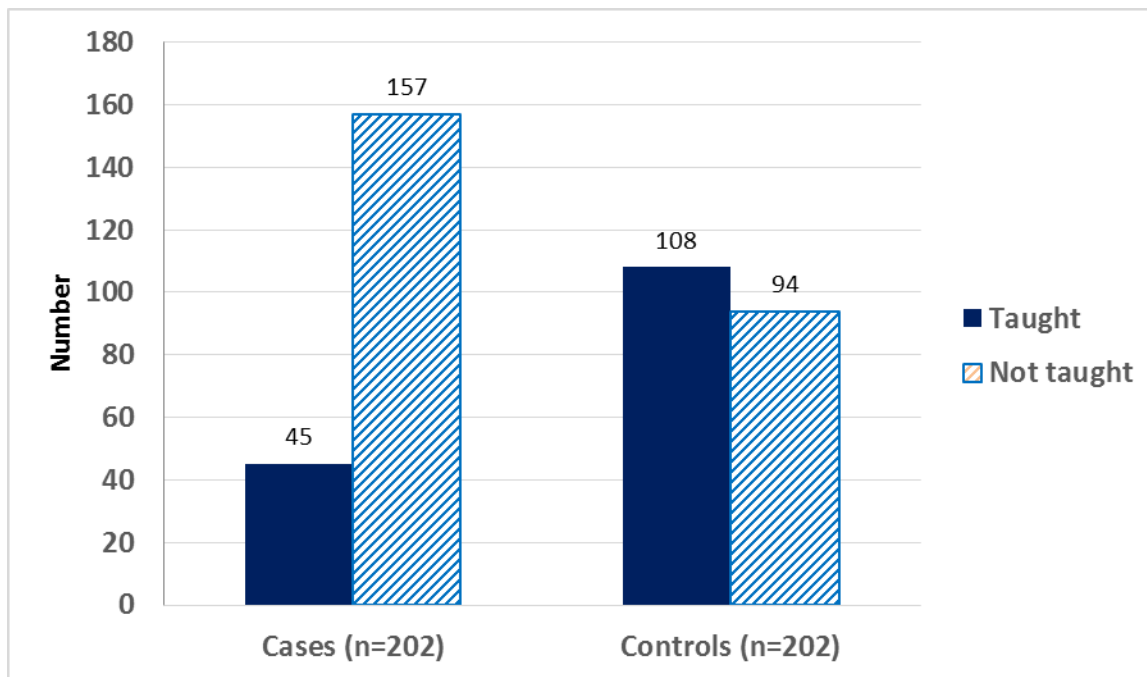


Figure 7: Formal or Informal Fire Safety Knowledge

The level of awareness of fire safety and burn injury prevention was four times more among the controls compared to the cases (OR=4.009, 95% CI: 2.603-6.172, p=0.000). The result was significant (p=0.000) and therefore the null hypothesis (H_0) is rejected. There is evidence of a strong association between knowledge of fire safety and burn injury prevention on the one hand, and the outcome variable (burn injury) on the other. Lack of fire safety and burn injury prevention knowledge is therefore a statistically significant risk factor for burn injury (Table 10).

Table 10: Knowledge of Fire Safety and Burn Injury Prevention

| Whether or not fire safety or burn injury prevention strategies had been taught | Cases (n=202) | Controls (n=202) | Odds Ratio (OR) | 95% Confidence Interval (CI) | p- value |
|--|--------------------------|-----------------------------|--------------------------------|---|---------------------|
| Taught | 45 (22.3%) | 108 (53.5%) | 4.009 | 2.603 – 6.172 | 0.000 |
| Not taught | 157 (77.7%) | 94 (46.5%) | | | |
| TOTAL (percentage) | 100% | 100% | | | |

A total of 152 study participants from among both the cases and the controls said that they had been taught fire safety and burn injury prevention (Table 11). The majority from both groups (n=109, 71.7%) had been taught at home or in school. The control group had a larger number (n=107, 52.9%) who were knowledgeable in fire safety and burn injury prevention. Only 22.3% (n=45, 22.3%) of the cases group had received information on fire safety and burn injury prevention. The difference between the two groups with regard to place where the knowledge was acquired was analysed with Chi Square test and was found to be statistically significant ($X^2=39.096, 95\% \text{ CI}, p=0.000$).

Table 11: Source of Information on Fire Safety and Burn Injury Prevention Strategies

| Place where fire safety and burn injury prevention strategies were taught | Cases (n=45) | Controls (n=107) | Total (n=152) | P - value |
|--|-------------------------|-----------------------------|--------------------------|----------------------|
| Home | 6 | 46 | 52 (34.2%) | 0.000 |
| School | 12 | 45 | 57 (37.5%) | |
| Church | 2 | 3 | 5 (3.3%) | |
| Radio/Television (TV) | 5 | 0 | 5 (3.3%) | |
| School & Radio | 1 | 0 | 1 (0.7%) | |
| Home & Radio | 1 | 0 | 1 (0.7%) | |
| Elsewhere | 18 | 13 | 31 (20.4%) | |
| TOTAL (Percentage) | | | 100 | |

Those who had been taught fire safety and/or burn injury prevention methods mentioned use of fire blanket (n=45, 11.1%), use of sand or soil (n=45, 11.1%) or use of a fire extinguisher (n=35, 8.7%) to put out the fire (Table12).

Table 12: Burn Injury Prevention Methods Taught

| Safety/injury prevention measures | Frequency (n=187) | Percent |
|---|--------------------------|----------------|
| Use of blanket | 45 | 11.1 |
| Use of sand/soil to put off electrical fire | 45 | 11.1 |
| Use of fire extinguisher | 35 | 8.7 |
| Use of fire exit | 10 | 2.5 |
| Careful handling of fire | 10 | 2.5 |
| Cook away from child/children | 8 | 2.0 |
| Escape from burning house | 7 | 1.7 |
| Switch off main switch in electrical fault | 7 | 1.7 |
| Safe storage of flammable | 5 | 1.2 |
| Use of fire alarm | 3 | 0.7 |
| Not leaving flames unattended | 3 | 0.7 |
| Use water as First Aid for burns | 2 | 0.5 |
| Proper handling of electrical appliances | 2 | 0.5 |
| Avoid cooking alone | 1 | 0.2 |
| Roll yourself on ground when on fire | 1 | 0.2 |
| Use wood to cut off electric current | 1 | 0.2 |
| Pour own urine on burn wound | 1 | 0.2 |
| Demolish unaffected wall and use as exit | 1 | 0.2 |

The majority had been taught about fire and burn injury prevention at school (37.5%) or home (34.2%) with the remainder learning it from radio, television, work place or other sources and places (Table 13).

Table 13: Source of Information of Fire Safety and Burn Injury Prevention (n=152)

| Place where knowledge was obtained | Frequency (n=153) | Percentage |
|---|--------------------------|-------------------|
| 1. School | 57 | 37.5 |
| 2. Home | 52 | 34.2 |
| 3. Church | 5 | 3.3 |
| 4. Radio/TV | 5 | 3.3 |
| 5. School and Radio | 1 | 0.7 |
| 6. Home and Radio | 1 | 0.7 |
| 7. Elsewhere | 31 | 20.4 |
| • Workplace | 16 | 10.5 |
| • Health worker | 7 | 4.6 |
| • Experience | 4 | 2.6 |
| • NGO/Organisation | 2 | 1.3 |
| • Hotel | 2 | 1.3 |
| • Show ground | 1 | 0.7 |
| • Newspaper | 1 | 0.7 |
| • Magazines, print media | 1 | 0.7 |

4.5: Area of Residence

Considering the two groups with regard to area of residence, 45% (n=90, 45%) and 55% (n=110, 55%) of the cases lived in slums and planned settlements respectively whereas 44.2% (n=88, 44.2%) and 55.8% (n=111, 55.8%) of the control group lived in slums and planned settlements respectively (Figure 8). No statistically significant difference between the 2 groups was found when Chi Square analysis was done ($X^2=0.024$, 95% CI, $p=0.876$).

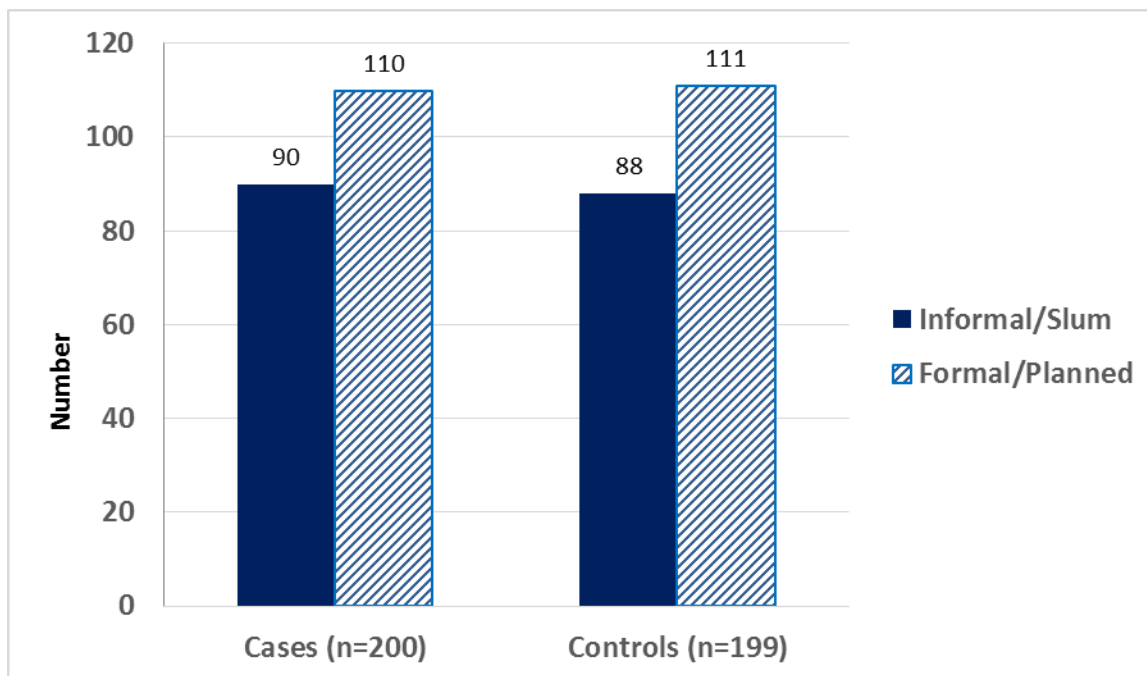


Figure 8: Formal Versus Informal Residential Areas

There was also no significant difference between the two groups found after univariate logistic regression analysis was performed on the data for place of residence (Formal vs Informal). The Odds Ratio was 1.032, which means that the likelihood of a burn injury having been sustained in a slum other than a formal settlement was only 1.032 times more (OR = 1.032, 95% CI: 0.695-1.532, p=0.920). The null hypothesis is therefore not rejected and the inference is that the area of residence is not a risk factor for burn injury (Table 14).

Table 14: Area of residence for burn cases and control groups

| Area of residence | Cases (n=200) | Controls (n=199) | Odds Ratio (OR) | 95% Confidence Interval (CI) | p- value |
|---------------------------------------|--------------------------|-----------------------------|--------------------------------|---|---------------------|
| Formal/Planned settlement/Non-slum | 110 (55.0%) | 111 (55.8%) | 1.032 | 0.695 – 1.532 | 0.920 |
| Informal/Slum | 90 (45.0%) | 88 (44.2%) | | | |
| TOTAL (Percentage) | 100% | 100% | | | |

In both groups, the majority lived in houses made of stone walls which presumably were permanent buildings (Table 15). These were 57.9% (n=117, 57.9%) and 49.5% (n=100, 49.5%) of the control and the cases groups respectively. Those living in iron sheet walled houses comprised 30.7% (n=62, 30.7%) and 17.3% (n=35, 17.3%) of the cases and controls respectively. There was however no statistically significant difference between the two groups after Chi-Square analysis (p=0.863). The type of residential building was therefore not a risk factor for burn injuries sustained.

Table 15: Materials used to Construct Walls of the House

| Material used to construct walls of house | Cases (n=202) | Controls (n=202) | p-value |
|--|--------------------------|-----------------------------|----------------|
| Stone | 100 (49.5%) | 117 (57.9%) | 0.63 |
| Iron sheets | 62 (30.7%) | 35 (17.3%) | |
| Mud | 19 (9.4%) | 19 (9.4%) | |
| Timber | 10 (5.0%) | 16 (7.9%) | |
| Iron and Timber | 3 (1.55) | 11 (5.4%) | |
| Iron and mud | 2 (1.0%) | 1 (0.5%) | |
| Iron and stone | 4 (2.0%) | 0 (0%) | |
| Iron and cardboard | 0 (0%) | 1 (0.5%) | |
| Timber and cardboard | 1 (0.5%) | 0 (0%) | |
| Other materials | 1 (0.5%) | 2 (1%) | |
| TOTAL (Percentage) | 100% | 100% | |

4.6: Mode of Lighting the House and Cooking

Electricity was used exclusively for lighting the house by 60.4% (n=122, 60.4%) of the cases and 61.4% (n=124, 61.4%) of the controls. Kerosene on the other hand was used exclusively for lighting the house by 31.7% (n=64, 31.7%) of the cases and 37.6% (n=76, 37.6%) of the controls. Electricity and Kerosene were both used for lighting the house by 4.5% of the cases (n=9, 4.5%) but none of the control group used these two methods for lighting the house. The difference between the two groups with regard to the mode of lighting the house was statistically significant after Chi-Square analysis ($X^2=13.178$, 95% CI, $p=0.022$). The Odds Ratio for this variable was not computed because this table could not be converted into a 2x2 contingency table.

Table 16: Mode of Lighting the House

| Mode of lighting the house | Cases (n=202) | Controls (n=202) | p-value |
|-----------------------------------|-------------------------|----------------------------|----------------|
| Electricity | 122 (60.4%) | 124 (61.4%) | 0.022 |
| Generator | 2 (1.0%) | 1 (0.5%) | |
| Kerosene | 64 (31.7%) | 76 (37.6%) | |
| Solar | 1 (0.5%) | 0 (0%) | |
| Electricity and Kerosene | 9 (4.5%) | 0 (0%) | |
| Other fuel types | 4 (2.0%) | 1 (0.5%) | |
| TOTAL (Percentage) | 100% | 100% | |

Most of the cases (n=107, 53%) exclusively used kerosene for cooking compared to only 36.6% (n=74, 36.6%) from the control group. Gas was used exclusively by 24.3% (n=49, 24.3%) of the control group compared to 10.4% (n=21, 10.4%) of the cases group. The difference between the two groups was statistically significant when Chi-Square analysis was done ($X^2=26.843$, 95% CI, p=0.001), (Table 17).

Table17: Type of Fuel used for Cooking (n=202)

| Household's cooking mode | Cases and Controls | | P value |
|--------------------------|--------------------|-----------------|---------|
| | Case (n=202) | Control (n=202) | |
| Kerosene | 107 (53.0%) | 74 (36.6%) | 0.001 |
| Gas | 21 (10.4%) | 49 (24.3%) | |
| Electricity | 1 (0.5%) | 2 (1.0%) | |
| Firewood | 30 (14.9%) | 37 (18.3%) | |
| Other fuel types | 22 (10.9%) | 20 (9.9%) | |
| Gas & Electricity | 6 (3.0%) | 2 (1.0%) | |
| Kerosene & Gas | 14 (6.9%) | 10 (5.0%) | |
| Gas & Firewood | 1 (0.5%) | 4 (2.0%) | |
| Kerosene & Firewood | 0 (0.0%) | 4 (2.0%) | |

A significant difference was also found when use of kerosene as fuel for cooking was analysed against all other cooking modes using Chi-Square and logistic regression analysis (Table 18). The likelihood of sustaining a burn injury was found to be 2.027 times higher when kerosene was used exclusively as the fuel for cooking compared to other modes of cooking (OR=2.027, 95% CI: 1.361-3.019, p=0.000). This result is statistically significant and therefore, exclusive use of kerosene for cooking is a risk factor for burn injury ($p < 0.05$).

Table 18: Type of Fuel used for Cooking (Kerosene Versus other Fuels)

| Source of fuel for cooking (Kerosene compared with other fuels) | Cases (n=202) | Controls (n=202) | Odds Ratio (OR) | 95% Confidence Interval (CI) | p- value |
|--|--------------------------|-----------------------------|--------------------------------|---|---------------------|
| Kerosene used for cooking | 121 (59.9%) | 84 (42.4%) | 2.027 | 1.361 – 3.019 | 0.000 |
| Other fuel types used for cooking | 81 (40.1%) | 114 (57.6%) | | | |
| TOTAL (Percentage) | 100% | 100% | | | |

4.7: Regression Analysis of Risk Factors for Burn Injuries Identified using Pearson Chi Square test or Odds Ratios

Multiple regression analysis was done for the following 3 independent variables identified as risk factors by their Odds Ratios: a) Prior knowledge of fire safety & burn injury prevention, b) Area of residence (formal or informal settlement) and c) Fuel type used for cooking (Table 19). Knowledge and fuel variables had positive unstandardized and standardized coefficients of 0.340 and 0.154 respectively whereas area of residence had a negative unstandardized and standardized coefficient of -0.086. Area of residence had a protective value of -0.086 whereas knowledge of fire safety and burn injury as well as exclusive use of kerosene for cooking had predictive values of 0.340 and 0.154 respectively (Table 19).

The risk of burn injury was 4.009 higher among the cases due to lack of fire safety and burn injury prevention knowledge (OR = 4.009, 95% CI: 0.243-0.438, p=0.000). In the case of the type of fuel used for cooking, the risk of sustaining a burn injury was 2.027 times higher as a result of more of them using kerosene exclusively for cooking in comparison with the controls (OR = 2.027, CI: 0.060-0.248, p=0.001). The risk of burn injury was however only 1.032 times more among the cases as a result of living in slums/informal settlements (OR = 1.032, 95% CI: 0.182-0.010, p=0.080). Living in a slum or informal settlement was therefore not a risk factor for burn injury.

The two variables confirmed to be risk factors for burn injury by Multivariate Logistic Regression analysis therefore are: 1. Lack of knowledge of fire safety and burn injury prevention and 2. Exclusive use of kerosene as fuel for cooking.

Table 19: Results of Multivariate Logistic Regression Model analysis

| | B | Z | p-value | ODDS RATIO | 95% CI |
|---|--|----------|----------------|-------------------|---------------|
| Intercept | 1.338 | .042 | .000 | | |
| Knowledge of fire safety & Burn Injury prevention | 0.340 | 0.050 | 0.000 | 4.009 | 0.243-0.438 |
| Area of residence (Formal vs Informal settlement) | -0.086 | 0.049 | 0.080 | 1.032 | -0.182-0.010 |
| Fuel used for cooking | 0.154 | 0.048 | 0.001 | 2.027 | 0.060-0.248 |
| Model | Burn injury = 1.338 + 0.340Knowledge of fire safety & Burn injury prevention - 0.086Area of residence + 0.154Use of kerosene as fuel for cooking | | | | |

4.8: History of Burn Injuries within Families

More of the cases (n=62, 30.7%) had either sustained a previous burn themselves or recalled a relative having sustained a burn previously as compared to the controls (n=47, 23.4%). This was an indication that there could be more risk factors for burn injury in the environment in which the cases resided (Table 20). The difference was however found not to be statistically significant after Chi-Square analysis (OR=0.689, 95% CI: 0.443-1.073, p=0.062).

Table 20: Previous History of Burn Injuries in the family

| Whether or not the study participant or any family member had sustained a burn injury previously | Cases (n=202) | Controls (n=201) | Odds Ratio (OR) | 95% Confidence Interval (CI) | p-value |
|---|--------------------------|-----------------------------|----------------------------|---|----------------|
| Family history of burn injury present | 62 (30.7%) | 47 (23.4%) | 0.689 | 0.443 – 1.073 | 0.062 |
| No family history of burn injury | 140 (69.3%) | 154 (76.6%) | | | |
| TOTAL (Percentage) | 100% | 100% | | | |

Forty-one of the cases (n=41, 68.3%) had a family history of burn injury hospitalization whereas only 19 (n=19, 31.7%) said there was no history of hospitalization of family members as a result of burns. The numbers for family history of hospitalization and non-hospitalization for the controls were 22 (47.8%, n=22) and 24 (n=24, 52.2%) respectively (Figure 9).

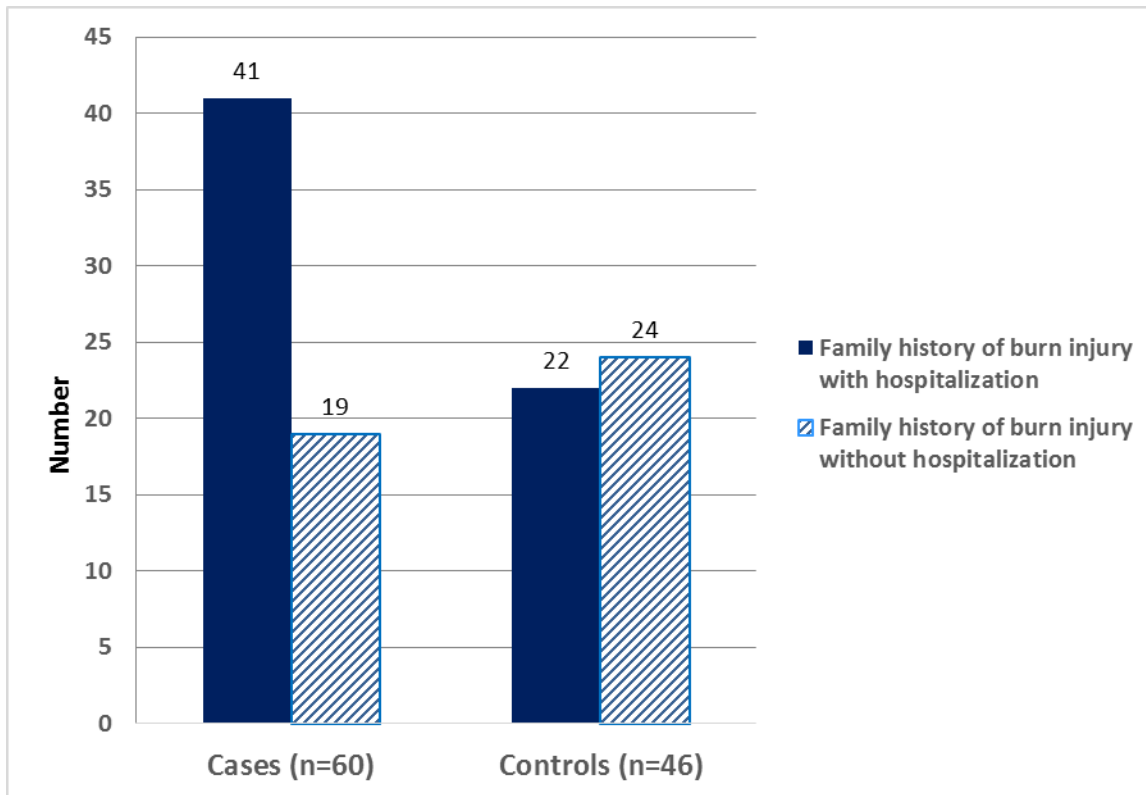


Figure 9: Family History of Burn Injury Hospitalization

With regard to history of hospitalization, the Odds Ratio of 2.354 means that the likelihood of having a family history of hospitalization from a burn injury was about 2.4 times more among cases compared to the controls. Assuming that hospitalization is an indication of the burn injury having been severe, the cases therefore were at a higher risk of sustaining severe burn injuries (OR=2.354, 95% CI: 1.064-5.208, p=0.033). This result was statistically significant and therefore the null hypothesis (Ho) is rejected. There is therefore a greater risk of sustaining a burn injury if someone in the family had previously been hospitalized with a burn (Table 21). History of hospitalization for burns within the family is a predictor for occurrence of burn injury.

Table 21: History of Hospitalization of Burn Injury Subjects among both the cases and the Controls

| Whether or not the family member who had sustained a burn injury was hospitalized/admitted in hospital | Cases (n=60) | Controls (n=46) | Odds Ratio (OR) | Confidence Interval (CI) | p-value |
|---|------------------------|---------------------------|---------------------------|------------------------------------|----------------|
| Hospitalised | 41 (68.3%) | 22 (47.8%) | 2.354 | 1.064 – 5.208 | 0.033 |
| Not hospitalised | 19 (31.7%) | 24 (52.2%) | | | |
| TOTAL (Percentage) | 100% | 100% | | | |

The presence of a scar in previously burnt family members was used to determine whether or not there was a difference between the two groups in severity of previously sustained burn injuries (Table 22). The assumption (null hypothesis) was that there was no difference and this was statistically proven (OR=1.083, 95% CI: 0.308-3.805, p=0.901). The null hypothesis was therefore not rejected which means that the presence of a burn scars within the family are not predictors for burn injury.

Table 22: Presence of Post-burn Injury Scar in Immediate Family Member

| Presence of scar on family member with history of burn injury | Cases (n=58) | Controls (n=45) | Odds Ratio (OR) | Confidence Interval (CI) | P-value |
|--|------------------------|---------------------------|---------------------------|---------------------------------|----------------|
| Scar present | 52 (89.7%) | 40 (88.9) | 1.083 | 0.308 – 3.805 | 0.901 |
| No scar not present | 6 (10.3%) | 5 (11.1%) | | | |

4.9: Burn Injury Prevention

When asked what they would do to protect themselves and family members from sustaining burn injuries, the commonest responses were: escape from scene (n=108, 26.7%), call for help (n=93, 23.0%), use water to put out fire (n=91, 22.5%) and keep children away from kitchen/fire/hot fluid (n=73, 18.1%). This is an indication that most did not know the correct practices for preventing burn injuries (Table 23).

Table 23: Opinion on ways of Preventing Burn Injuries within Family

| How do you think you can protect yourselves | Frequency (n=627) | Percentage |
|---|-------------------|------------|
| Exit from scene | 108 | 26.7 |
| Call for help | 93 | 23.0 |
| Use water to put off fire | 91 | 22.5 |
| Keep children away from kitchen/fires/hot fluids | 73 | 18.1 |
| Use of water or sand/soil on burning building | 50 | 12.4 |
| Proper handling of stoves, gas (Flammable material) | 49 | 12.1 |
| Use blanket to put off fire | 39 | 9.7 |
| Use of fire extinguisher | 19 | 4.7 |
| Protect fire places | 17 | 4.2 |
| Switch off main electricity switch | 15 | 3.7 |
| Educate the public including children | 14 | 3.5 |
| Don't leave children unattended | 14 | 3.5 |
| Use twigs/branches | 14 | 3.5 |
| Refrain from illegal connections/Improper wiring | 11 | 2.7 |
| Open windows | 4 | 1.0 |
| Pour water on the victim | 3 | 0.7 |
| Have fire fighters close | 2 | 0.5 |
| Stay sober, don't drink | 2 | 0.5 |
| Epileptic don't cook alone, comply with treatment | 2 | 0.5 |
| Care when bathing baby | 2 | 0.5 |
| Domestic quarrels/issues contribute | 2 | 0.5 |
| Stop using candles | 1 | 0.2 |
| Cylinder companies adhere to standards | 1 | 0.2 |
| Demolish unaffected wall & use as exit | 1 | 0.2 |

CHAPTER FIVE: DISCUSSION

5.1 Introduction

The age-and-gender-matched hospital-based case-control design was chosen for this study to minimize the effects of any extraneous independent variables and to therefore enhance the reliability of the results. This is important because effective prevention programmes depend on accurate determination of risk factors. A similar study design was used by Delgado et al in their study of risk factors for burns in children admitted in a burn unit in Peru. Their study however differed from this study in that it focused on children and, furthermore, the independent variables under consideration were socio-economic status and maternal education (Delgado et al 2010).

There was no age limit in this study and the independent variables were: occupation, level of education, knowledge of burn injury prevention and fire safety, residence (formal or informal) and mode of lighting the house and cooking. The following variables which were indirectly related to the outcome variable were also investigated to determine if they were predictors of burn injury: history of a family member having sustained a burn and whether or not they healed with a scar and whether or not they were hospitalized.

5.2 Socio-demographic Characteristics

Age and gender distribution

There were 202 respondents recruited into each of the two arms of this case-control study making a total of 404 subjects overall. The age range was 1 to 58 years with 42.6% (n=170, 42.6%) of the participants being below 5 years. This result is similar to findings of other studies which have shown that burn injuries are more frequent in children. The injuries are sustained mainly in homes (Delgado et al. 2001, WHO Burns Fact Sheet). In this study, 80.9% (n=161,

80.9%) sustained burn injuries in homes, 7.5% (n=15, 7.5%) in the workplace and the remainder in other places e.g. neighbour/friend's house, in a motor vehicle or by the roadside.

There were 212 (n=212, 52.5%) males and 192 (n=192, 47.5%) females giving a male to female ratio 1.1:1, consistent with results of other researchers who have reported burn injuries being more common in males (Peck MD, 2011). In south East Asia however, women have a higher rate of burns and account for 27% of burn deaths globally and 70% of burns mortality. The higher risk in women in that part of the world is as a result of their involvement in cooking and especially in the use of unsafe stoves, wearing of loose clothing, self-immolation and interpersonal violence (WHO Burns Fact Sheet, 2008b).

Where respondents were involved in filling the questionnaire, 93.3% (n=195, 93.3%) of them were parents and this is mainly because the majority of study participants (n=172, 42.6%) were children under 5 years and under the care of their parents and especially the mother (n=184, 88%). In a study of 109 burns patients at KNH by Nderitu et al, children under 5 years of age comprised 48.6% and they mainly had scald burns (Nderitu et al, 2006). Presence of a respondent, his/her occupation and their relationship to the injured victim were not found to be a significant risk factor for burn injuries in this study.

Occupation

Among the cases, 12.4% (n=24, 12.4%) were employed in the formal sector whereas the controls had 12.9% (n=26, 12.9%). The informal employment sector had 20.1% (n=39, 20.1%) and 18.9% (n=38, 18.9%) for the cases and controls respectively. Occupation did not stand out as a

risk factor in all categories in this study (OR= -2.32, 95% CI: 1.28-4.22, p=0.003). In the review of literature, no study had found this variable to be a risk factor for burn injuries.

5.3 Causes of Burns

The major causes of burns in this study were hot fluids (n=93, 46.3%) and fire/flame (n=81, 40.3%), a result similar to that of other studies done elsewhere (Agbenorku et al, 2011; Asuquo et al, 2009; Boukind et al, 1995; Forjuoh et al 1995; Muguti et al, 1994; Othman and Kendrick, 2013). Thirty per cent (n=25, 30%) of those with flame/fire burn injuries were as a result of stove explosions compared to 12.5% reported in a previous unpublished study done at KNH (Buni, 2006). The number of stove explosion injuries have therefore increased and measures to curb this risk factor should be urgently instituted. In a study on risk factors for stove explosion burns at KNH, Ombati et al found that the risk factors involved were improper handling of the kerosene wick stoves and point of purchase of the fuel (Ombati et al, 2013).

5.4 Risk Factors for Burn Injuries Admitted at KNH

Level of education

Those who had attended primary school and higher levels of education were 55.7% (n=108, 55.7%) and 48.8% (n=98, 48.8%) for the cases and controls respectively. There was nevertheless a smaller number with either secondary or tertiary education among the cases (n=39, 20%) compared with the controls (n=54, 28%) and conversely, there were fewer of the controls in primary school (n=42, 21.9%). This difference was found to be statistically significant after Chi Square correlation was performed ($X^2=9.849$, 95% CI, p=0.043). Level of education was also found to be a significant risk factor for burn injury when aggregated pre-school, nursery and

primary school was correlated with secondary school and tertiary level education (OR=2.32, CI: 1.28-4.22, p=0.003). Those with a lower level of education were found to be 2.32 times more likely to sustain burn injuries. In a review article by Edelman LS, low maternal education or lack of parental education were found to be one of the risk factors for burn injuries (Edelman, 2007).

Area of residence and type of housing

More people in the control group (n=111, 50.2%) lived in formal or planned settlements and fewer (n=88, 49.4%) in the informal settlements or slums but the difference between the 2 groups was very small and not statistically significant. For the cases, 49.8% (n=110, 49.8%) lived in formal settlements compared to 50.6% (n=90, 50.6%) who lived in informal settlements or slums. In both the cases and the controls, the difference between the informal and formal settlement groups was small and not statistically significant. In the analysis for the materials used to construct the dwellings, slightly more of the controls (n=117, 57.9%) lived in stone walled houses compared to the cases (n=100, 49.5%). When all building materials were considered however there was no difference statistically (p=0.863). Area of residence (either formal or informal) was selected as a variable in this study since it is a reflection of Social Economic Status (SES), which is a known risk factor for burns (Edelman, 2007; Delgado, 2001). From this study, SES as determined by the area of residence and type of housing was not found to be a significant risk factor for burn injury within the study population. The reason for this maybe because KNH is not patronized solely by the low income groups of the society.

Type of Energy used for lighting the house and cooking

Using the Chi-Square test the mode of lighting the house was found to be significantly different between the two groups ($X^2=0.022$, 95% CI, $p= 0.022$). However, the Odds Ratio could not be determined and logistic regression analysis performed because it was not possible to generate a 2x2 contingency table from the data. There were 8 participants ($n=8$, 9.9%) from among the cases who sustained burn injuries as a result of lamp explosions. These type of burn injury can be prevented by designing safer lamps sus as the ones designed by the Safe Bottle Lamp Foundation (SBLF) of Sri Lanka (WHO, 2011b; Mock, 2011; Lau, 2006).

There was also a significant difference between the two groups with regard to the type of fuel used for cooking ($X^2=26.843$, 95% CI, $p=0.001$). More of the cases ($n=107$, 53.0%) than the controls ($n=74$, 36.6%) exclusively used kerosene for cooking and the difference between the two groups was statistically significant. A burn injury was 1.935 times more likely to occur where there was exclusive use of kerosene as fuel for cooking (OR=1.935, CI: 1.303–2.874, $p=0.001$). The strength of association was confirmed by logistic regression ($p=0.000$).

5.5 Knowledge of Fire Safety and Burn Injury Prevention

More of the controls ($n=108$, 53.5%) were knowledgeable in fire prevention strategies than the the cases ($n=45$, 22.3%). The cases were 4.009 times more likely to sustain burn injuries due to their being less knowledgeable in fire safety and burn injury prevention (OR=4.009, 95% CI: 2.603-6.172, $p=0.000$). The difference between the two groups was also found to be statistically significant after logistic regression analysis ($p=0.000$). Of those who were knowledgeable, the

majority overall had either been taught at home or school (n=109, 71.7%). The others (n=43, 28.3%) learnt about fire injury prevention mainly from church or the media (radio or television).

5.6 Risky Practices of Burn Patients

Family history of burn injuries for both cases and controls

More of the cases (n=62, 30.7%) than the controls (n=47, 23.4%) had a history of burn injuries having previously occurred within their families. Family history of burn injury was 0.689 times likely to be associated with a new burn injury (OR=0.689, CI: 0.443–1.073, p=0.062). The association was also not found to be statistically significant using the Pearson chi-square (p=0.099) and logistic regression analysis (p=0.099). Previous family history of burn injury was therefore not a predictor for possible occurrence of burn injury. In his Ghanaian community-based study involving 630 children, Forjuoh (1996) found only 20 (n=20, 3.2%) had sustained burns twice in contrast to this hospital-based study where we found 110 (n=110, 27.2%) out of 404 had either sustained burns before or had relatives who had experienced a burn injury (Forjuoh, 1996). In their cross-sectional study conducted at KNH Nderitu et al found 20% (n=109, 20%) of burn patients had relatives who had sustained burns previously compared to 27.2% (n=110, 27.2%) found by this study.

Hospitalization and scarring among previously burnt family members

Previous admission to hospital of burnt family members and post-burn scarring were used as parameters for determining the severity of burn injury within families. History of hospitalization with burn injuries among family members was present in 68.3% and 47.8% of the cases and controls respectively. The cases were 2.354 times more likely to have a family member

(including themselves) previously hospitalized as a result of burn injuries. (OR=2.354, CI; 1.064-5.208, p=0.033). The association was confirmed after univariate logistic regression was done (p=0.033). In their study of risk factors for burns at home in Kurdish preschool children, Othman & Kendrick (2013) established that history of burns in other family members was associated with increased odds of burn injury (OR=2.8, 95% CI: 1.5-5.2).

History of severe burn injury having occurred within the family is therefore a predictor of burn injury or an indicator of a high probability of another household member sustaining burns again. This can be explained by the fact that all household members are subject to the same injury risk factors and particularly the children whose cognitive ability is low.

There was post-burn injury scarring among 89.7% (n=52, 89.7%) of the family of cases and 88.9% (n=40, 88.9%) of the controls. Those who gave no family history of scarring were 10.3% (n=6, 10.3%) and 11.1% (n=5, 11.1%) for the cases and controls respectively. Even though presence of a burn injury scars was common in both groups there was no significant difference between the two groups and therefore scarring was not identified as a predictor of burn injury in this study (OR=1.083, CI; 0.308-3.805, p=0.901).

5.7 Risk Factors Identified by this Study

The risk factors for burn injury identified by this study are;

1. Low level of knowledge of burn injury prevention and fire safety
2. Use of kerosene as a fuel for cooking in households
3. Low level of education

These risk factors can be realistically tackled to reduce the incidence of burn injuries. Education of burn injury prevention and fire safety can be delivered to communities using various channels

and at various levels (Albertyn, 2006). Use of safe cooking appliances and fuel can be enhanced through collaborations with stakeholders as well as through advocacy and legislation.

In Sri Lanka a surgeon helped reduce incidence of burn injuries through collaborations which resulted in the design of a safer kerosene wick lamp with a base designed to make it less easy to topple over (WHO, 2011a). In the developed world, burn injuries were reduced by amongst other measures, legislation which regulated the temperature of water from bathroom taps and use of fire retardant material for nightdresses. In Australia and New Zealand, burn injuries have been reduced through a program by which firemen give fire injury prevention lectures in schools (Niki et al, 1998).

CHAPTER SIX: SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

6.1 Summary:

This case control study has identified three risk factors in causation of burn injuries in the study population. The study objectives were realized and a basis for future studies and policy changes established.

6.2 Conclusions:

Two of several study questions which it was hoped this study would answer were: whether or not the main risk factors for burn injuries sustained by patients hospitalized at KNH were identifiable and whether or not the burn injuries were preventable.

This study has shown the following three risk factors to be important in the causation of burns in the study population in question;

1. Lack of knowledge of burn injury prevention and fire safety
2. Use of kerosene as a fuel for cooking in households
3. Low level of education

The results identified areas which can be targeted in programmes aimed at prevention of burn injuries. In the discussion it was explained how burn injuries can be prevented in Kenya and a conceptual framework has been proposed. This is a significant contribution to knowledge because burn injuries in Kenya are a public health problem like in other developing countries around the world. It is necessary to know the risk factors of burns in Kenya before embarking on preventive measures.

6.3 Recommendations:

Low and Middle Income Countries (LMIC) should come up with burn injury prevention models most suitable for their environments and in line with WHO's 'Burn Injury Prevention Programme'. Risk factors vary from one country to another and therefore it is imperative that the adopted or implemented burn injury prevention strategies be based on local research findings and in consideration of socioeconomic factors (Liao and Rossignol, 2000). The results of this research should help Kenya reduce the incidence not only of burns but also all types of injuries including road traffic accidents which are a national health care priority.

The 3 risk factors identified by this study can be tackled through public health strategies and advocacy for formulation of new policy and legislation. The World Health Organization has a conceptual framework in place for addressing the burden of injury in the developing world and a specific plan for prevention and care of burn injuries. Having established the risk factors through this case control study, burn injury prevention strategies specific for identified risk factors and based on the WHO model (Figure 1) should be formulated in the following ways:.

1. Fire safety and Burn Injury prevention

Ways of tackling the hazards posed by fire and other causes of burns in homes, institutions and all work places should be taught in primary, secondary and tertiary levels of education. The ministry of education should incorporate health education in the curriculum of primary and secondary schools. In addition to having fire-fighting equipment in institutions, offices, industries and other work places, it should be mandatory to have annual fire safety and injury prevention seminars or workshops. This would in the long term result in a large proportion of

the population being well informed on burn injury prevention. People should also be encouraged to have fire fighting equipment in homes or residential areas.

2. Kerosene Stoves and Lamps

This study has identified use of kerosene as fuel for cooking as a risk factor for burn injuries sustained in homes. The study by Ombati et al identified two risk factors specific to Kerosene stove explosion burns presenting at KNH. These are poor handling of stoves and use of adulterated fuel. Health education measures targeting home appliances that use kerosene should therefore be instituted by the Ministry of Health and stakeholders such as the Burn Society of Kenya (BSK). Efforts to manufacture safer home kerosene appliances should be made through collaboration with stakeholders including oil companies, stove and lamp manufacturers, researchers, relevant government ministries and engineers.

3. Education

Tackling low level of education as a risk factor for burns is a complex issue involving communities, non-governmental organizations and government. Future plans by the Government of Kenya to provide free secondary education and implementation of the Millennium Development Goals (MDGs) and Sustainable Development Goals (SDGs) are likely to result in reduced incidence of burns in addition to other benefits such as reduction of poverty (UN 2015 & UNDP 2015). Therefore burn injury prevention strategies should be aligned with these government plans and should include advocacy for the highest level of education for all and especially for women who are key caregivers for children under five years.

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APPENDICES

Appendix I: Declaration Form for Students

Appendix I Declaration Form for Students

UNIVERSITY OF NAIROBI
Declaration of Originality Form

This form must be completed and signed for all works submitted to the University for examination.

| |
|--------------------------------|
| Name of Student _____ |
| Registration Number _____ |
| College _____ |
| Faculty/School/Institute _____ |
| Department _____ |
| Course Name _____ |
| Title of the work _____ |

DECLARATION

1. I understand what Plagiarism is and I am aware of the University's policy in this regard
2. I declare that this _____ (Thesis, project, essay, assignment, paper, report, etc) is my original work and has not been submitted elsewhere for examination, award of a degree or publication. Where other people's work, or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.
3. I have not sought or used the services of any professional agencies to produce this work
4. I have not allowed, and shall not allow anyone to copy my work with the intention of passing it off as his/her own work
5. I understand that any false claim in respect of this work shall result in disciplinary action, in accordance with University Plagiarism Policy.

Signature _____

Date _____

Appendix II : Data Collecting Instrument

Questionnaire for cases & controls

(# 6, 7, 8 & 9 not required for patients without a burn injury)

Serial/Study #:.....

1) Name of patient.....

Admitting ward.....

Date of admission.....

Age.....

Gender.....

Occupation of patient

Education level reached by patient a) Never attended school

b) Primary school c) Secondary school d) Tertiary (College/University)

2) Name of respondent (incase of children/participants aged ≤ 18 years or unconscious patients and any other not able to communicate).....

.....

.....

3) Relationship of respondent to patient.....

4) Occupation of respondent.....

5) Level of education of respondent:

- a) Never attended school
- b) Primary school
- c) Secondary school
- d) Tertiary (College/University)

6) Residence of patient:

- a) Province/County.....
- b) District.....
- c) Division.....
- d) Location.....
- e) Estate/village.....
- f) Street.....

7) Where did you/the victim sustain the burn injury?

- a) Home
- b) Place of work (Specify).....
- c) Institution (Specify).....
- d) In a vehicle (Specify).....
- e) Other (Specify).....

8) Cause of your burn injury

- a) Hot liquid (Specify).....
- b) Electricity (Specify).....
- c) Chemical (Specify).....
- d) Hot surface (Specify).....
- e) Fire (Specify).....
- f) Other (Specify).....

9) Do you think your burn injuries could have been prevented?

(Circle or tick corresponding response)

- a) Yes
- b) No

10) If answer to above question 8 is 'Yes', how do you think they could have been prevented?

.....

.....

.....

.....

11) Have you ever been taught either formally or informally any fire safety or burn injury prevention strategies?

(Indicate response with circle or tick)

- a) Yes

- b) No
- c) If answer is 'yes', what are these preventive strategies?

.....

.....

.....

12) If answer to above question is 'Yes', where were you taught?

- a) Home (Taughtby parents, siblings, relatives, house help etc)
- b) School
- c) Church
- d) From radio/TV
- e) Internet
- f) Elsewhere (specify).....

13) Do you live in a formal or informal residential estate?

- a. Formal
- b. Informal

14) What are the walls of your house mainly made of?

- a) Stone
- b) Iron sheets
- c) Mud
- d) Timber

- e) Cardboard
- f) Other materials (Specify).....

15) What does your family use for lighting the house?

- a) Electricity
- b) Generator
- c) Kerosene
- d) Solar
- e) Other (Specify).....

16) What is your home's source of fuel for cooking?

- a. Kerosene (Paraffin)
- b. Gas
- c. Electricity
- d. Firewood
- e. Other (Specify).....

17) Have you or any of your immediate family members ever sustained a burn (Chemical, Electrical or Thermal)?

- a. Yes
- b. No
- c. Don't know

18) If 'Yes', specify who in your family has ever sustained a burn injury:

- a. Yourself.
- b. Mother.
- c. Father.
- d. Brother.
- e. Sister.
- f. Worker (House help etc)
- g. Relative living with you (Specify).....

19) Was the affected person(s) hospitalized/admitted in a hospital as a result of the burn?

- a. Yes
- b. No

20) Do you or the affected person(s) have a scar as a result of the burn?

- a. Yes
- b. No

21) Are there any fire prevention or fire safety appliances at the site where the patient sustained the burn?

- a) Yes
- b) No

22) If “yes”, specify/indicate which ones are available.....

.....

.....

.....

.....

23) How would you teach the members of your family to protect themselves from sustaining a burn injury in the event of fire?

.....

.....

.....

.....

Thank you for your time and for responding to the questions.

Appendix III: Informed Consent Forms (For Both Cases & Controls)

2 (a) English versions

This Informed Consent form is for patients of all ages hospitalized at the Kenyatta National Hospital with burns during the study period. We are requesting these patients to participate in this research project whose title is “Risk factors for burn injuries among patients hospitalized at the Kenyatta National Hospital in Nairobi: A case control study “.

Principal investigator: Dr.J.K.Wanjeri

Institution: School of Public Health - University of Nairobi

Supervisors: Mrs. Mary Kinoti & Dr. Tom H.A.M. Olewe

This informed consent has three parts:

- 1. Information sheet (to share information about the research with you)**
- 2. Certificate of Consent (for signatures if you agree to take part)**
- 3. Statement by the researcher**

You will be given a copy of the full Informed Consent Form.

Part I: Information sheet

My name is Dr. Kimani Wanjeri a Post-Graduate student at the University of Nairobi’s School of Public Health. I am carrying out a study to determine the risk factors for burn injuries seen at the Kenyatta National Hospital. Burns are a common cause of injuries in Kenya like in most other developing countries but the risk factors have not been studied. This study aims at finding ways of preventing the many burn injuries occurring in our set up after which recommendations for reducing their incidence will be made.

I am inviting you to participate in my study and you are free to either agree immediately after receiving this information or later after thinking about it. You will be given the opportunity to ask questions before you decide and you may talk to anyone you are comfortable with about the research before making a decision. After receiving this information concerning the study, please seek for clarification from either myself or my assistant if there are words or details which you do not understand,

If you agree to participate, you will be asked to provide personal information and other details related to burn injuries. All the information which you provide will be kept confidential and no one but the researchers will see it. The information about you will be identified by a number and only the researchers can relate the number to you as a person. Your information will not be shared with anyone else unless authorized by the Kenyatta National Hospital/University of Nairobi – Ethics and Research Committee (KNH/UoN-ERC).

Your involvement in this research will be through an interview only and you will not expose yourself to any risks if you consent to participate. Your participation is voluntary and refusal to participate in the research or withdrawal from it will not affect the treatment which you receive at this hospital. All the information that you give us will be used for this research only.

All patients hospitalized with burns during the study period are being invited to participate and will form the group referred to as ‘cases’ in the study. Those invited to form the group referred to as ‘controls’ will be selected by simple random sampling (a process similar to the tossing of the coin in making choices) from among patients hospitalized for diseases other than injuries.

This proposal has been reviewed and approved by the KNH/UoN-ERC which is a committee whose work is to make sure research participants like your self are protected from harm. It was submitted to them through the Director of the School of Public Health of the University of Nairobi with the approval of the two university supervisors. The contact information of these people is given below if you wish to contact any of them for whatever reason;

- Secretary, KNH/UoN-ERC
P.O. Box 20723 KNH, Nairobi 00202
Tel 726300-9
Email: KNHplan@Ken.Healthnet.org
- Director, School of Public Health – University of Nairobi
P.O. Box 19676 KNH, Nairobi 00202
Tel # 0202724639
- University of Nairobi research supervisors
Mrs Mary Kinoti,
School of Public Health, University of Nairobi
P.O. Box 19676 KNH, Nairobi 00202
Tel # 0202724639

Dr. Tom H. A. M. Olewe,

School of Public Health, University of Nairobi.

P.O. Box 19676 KNH, Nairobi 00202

Tel # 0202724639

Principle researcher:

Dr. Kimani Wanjeri,

Department of Surgery, University of Nairobi

P.O. Box 19676 KNH, Nairobi 00202

Mobile phone # 0722708051

Part ii: Consent certificate

I.....freely give consent of myself or for my proxy (Name.....) to take part in the study conducted by Dr. Kimani Wanjeri, the nature of which has been explained to me by him/his research assistant. I have been informed and have understood that my participation is entirely voluntary and I understand that I am free to withdraw my consent at any time if I so wish and this will not in any way alter the care being given to me or my proxy. The results of the study may directly be of benefit to me or my proxy and may assist in preventing burn injuries.

.....

Signature/left thumb print (Participant/Next of kin)

Date.....

Day/Month/Year

| |
|--|
| Thumb print of participant if illiterate (a witness must sign below) |
|--|

Statement by the witness if participant is illiterate

I have witnessed the accurate reading of the consent form to the participant, and the individual has had the opportunity to ask questions. I confirm that the individual has given consent freely.

Name of witness.....

Signature of witness.....

Date.....

Day/Month/Year

Part iii: Statement by the researcher

I have accurately read out the information sheet to the participant, and to the best of my ability made sure that the participant understands that the following will be done:

- Refusal to participate or withdrawal from the study will not in any way compromise the care of treatment.
- All information given will be treated with confidentiality.
- The results of this study might be published to facilitate prevention of burn injuries.

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability.

I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

A copy of this Informed Consent Form has been provided to the participant.

Name of researcher taking consent.....

Signature of researcher taking the consent.....

Date.....

Day/Month/Year

2 (b) Kiswahili version

Fomu ya idhini

Nambari ya hospitali.....

Nambari ya utafiti.....

(i) Sehemu ya kwanza –Maelezo:

Mimi ni Dkt Kimani Wanjeri kutoka shule ya Afya ya Uma (CommunityHealth) ya Chuo Kikuucha Nairobi (University of Nairobi).

Ninafanya utafiti wa kuchunguza nini husababisha majeraha ya kuchomeka ambaye huonekana katika hospital kuu ya Kenyatta.

Ningependa kukuchagua wewe ama mgonjwa wako katika utafiti huu wangu. Lengo ni kutambua jinsi ya kuzuia majeraha ya kuchomeka.

Katika utafiti huu utatakiwa kutoa tarifa yako binafsina tarifa kuhusu hali ya mazingira kwenye ajali ilitokea. Habari zote zitakazo kusanywa zitashughulikiwa kwa siri na hazitatambazwa ila tu kwa ruhusa kutokana na mkurughenzi mkuu wautafiti wa chuo kikuu na hospital kuu ya Kenyatta.

Sababu ya utafiti huu ni kutafuta jinsi za kuzuia madhara haya ili kuinua hali ya maisha ya jamii.

Kuhusika kwako kwenye utafiti huu hauna malipo yeyote ila ni kwa hiari yako mwenyewe na pia unaweza kujiondoa kwa utafiti wakati wowote bila hatari ya matibabu yako katika Hospitali Kuu ya Kenyatta. Naomba mimi ama wasaidizi wangu wakuu waulize maswali ambaye itajazwa kwa fomu maalum.

Habari yote ambayo utatuarifu ni ya siri kati yako nasi watafifiti na haitaenezwa

Kwa watu wengine.

Unaweza kuuliza maswali yeyote kuhusu utafiti huu na ukiridhika tafadhali jaza fomu ya

Idhini iliyopo hapa chini.

Unawezapiakuulizaswalilolotebaadayekwakupigasimu ya mtafitimkuu ama mkuuwashule ya afya ya jamii ama walimuwasimamizautafitiukitumianambarizasimuzifuatazo;

- Katibuwautafiti, Hospitalikuu ya KenyattanaChuokikuucha Nairobi. Sanduku la Posta 20723 KNH, Nairobi 00202. Nambari ya simu 726300-9.
- Murugenzi, Shule ya Afya ya Umakatikachuokikuucha Nairobi. Sanduku la Posta 19676 KNH Nairobi 00202. Nambari ya simu:
- WalimuwasimamizawaChuokikuucha Nairobi:
 1. Bi mkubwa Mary Kinoti, Sanduku la Posta 19676 KNH, Nairobi 00202. Nambari ya simu:
 2. Daktari Tom Olewe, Shule ya Afya ya Uma – Chuokikuucha Nairobi, Sanduku la Posta 19676 KNH, Nairobi 00202. Nambari ya simu:
- Mtafiti: DktKimaniWanjeri, Idara ya Upasuaji ya Shule ya Utabibu – Chuokikuucha Nairobi, Sanduku la Posta 19676KNH 00202. Nambari ya simu ya mkononi 0722708051.

(ii) Sehemu ya pili - Idhini:

Mimi(Jina).....kwa hiari yangu ama kwa hiari ya
mgonjwa wangu (Jina la Mgonjwa.....
.....)nimekubalikushirikikatika utafitihuu unaofanywanaDaktari
Kimani Wanjerikutokana hali ambazonimeelezwanasiokwamalipo ama shurutishololote.
Nimeelew kwambaninaweza kujiondoawa wakati wowote nitakapona hatuahi haitahatarishamatibabun
inayopata ama anayoipata mgonjwa wangu. Matokeo ya utafiti yawezakuwa ya
Manufaakwangu ama kwawagonjwa wengine kwajumlanayawezakusaidiakuzuia majeraha ya
kuhomeka inchini Kenya.

.....

Sahihi/ama alama ya kidolechagumbakatika sanduku→

Tarehe.....

Siku/Mwezi/Mwaka

Kidolechagumbakwawale
wasiojuakwandika
(Shahidiatiesahihihapachi
ni)

Jina la shahidi.....

Sahihi.....Tarehe.....

(Siku/Mwezi/Mwaka)

(iii) Sehemu ya tatu – Dhibitisho la mtafiti

Hiinikuidhinishayakwambanimemuelezamshiriki ama

msimamizi wake kuhusu utafiti huu na pinimempanafasi yakuulizamaswali. Nimemuelezayafuatayo;

- Kwambakushiriki ni kwahari yakemwenyewebilamalipo.
- Kushirikihakutasababishamadhara ama kuhatarishamaishakamwe.
- Anawezakujiondoakutokakwautafitihuu wakati wowote bilakuhatarishamatibabuanayo ipata katika hospital kuu ya Kenyatta.
- Habari ambazo atapeanahazitamgwazwahadharanibilaruhusakutokakwake (mshiriki) napaikutokakwamdhaminimkuuwautafitiwa hospital kuu ya Kenyatta nachuokikuuchamatibabu.

Jina la mtafiti ama msimamizi wake.....

Sahihi.....

Tarehe.....

(Siku/Mwezi/Mwaka)

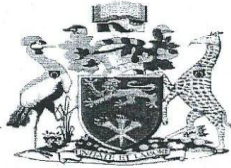
Appendix IV : Study Timeline/Workplan

| Activity | Time line |
|---|---|
| Preparation of proposal | Sept 2010 – Apr 2011 |
| Presentation to the School of Public Health | 28 th Apr 2011 (9.00am – 10.30am) |
| Submission to KNH/UoN - Ethics & Research Committee | August - Oct 2011 |
| Data collection | Mar 2011 – Aug 2012 |
| Data analysis | Sept - Dec 2012 |
| Report writing | Jan 2013 – Apr 2015 |
| Defense of the MPH dissertation | July 2015 |
| Dissemination & utilization of results | December 2015 |

Appendix V: Study Budget

| ITEM | Estimated cost (Ksh) |
|---|-------------------------|
| Stationery (Paper, pens etc), printing, photocopying and binding expenses | 30,000 |
| Computer/Internet literature search | 10,000 |
| 4 Research Assistants – 2 for cases and 2 for controls paid at the rate of ksh 1,000/day for 10 days each | 40,000 |
| Statistician | 70,000 |
| Contingencies/miscellaneous | 100,000 |
| Preparation of final document | 60,000 |
| Total | 310,000 |

Appendix VI: KNH/UON-E&RC Authorization/Study Approval Letter



UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
(254-020) 2726300 Ext 44355
Ref: KNH-ERC/A/266

KNH/UON-ERC
Email: uonknh_erc@unobi.ac.ke
Website: www.unobi.ac.ke



KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi
14th October 2011

Dr. Wanjeri Joseph Kimani
Dept. of Surgery
School of Medicine
University of Nairobi

Dear Dr. Wanjeri

Research Proposal: "Risk factors for Burn injuries among Hospitalized patients at Kenyatta National Hospital in Nairobi, Kenya: A case control study" P327//08/2011)

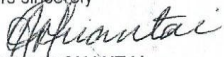
This is to inform you that the KNH/UON-Ethics & Research Committee has reviewed and **approved** your above revised research proposal. The approval periods are 14th October 2011 to 13th October 2012.

You will be required to request for a renewal of the approval if you intend to continue with the study beyond the deadline given. Clearance for export of biological specimens must also be obtained from KNH/UON-Ethics & Research Committee for each batch.

On behalf of the Committee, I wish you a fruitful research and look forward to receiving a summary of the research findings upon completion of the study.

This information will form part of the data base that will be consulted in future when processing related research study so as to minimize chances of study duplication.

Yours sincerely


PROF. A. N. GUANTAI
SECRETARY, KNH/UON-ERC

c.c. The Deputy Director CS, KNH
The Principal, College of Health Science, UON
The Director, School of Public Health, UON
The HOD, Medical Records, KNH
Supervisors: Mrs. Mary K. Kinoti, School of Public Health, UON
Dr. Tom H.A. M. Olewe, School of Public Health, UON

"PROTECT TO DISCOVER"

Appendix VII: Kiambu Level 4 Hospital Approval Letter for the Pilot S

28th Dec 2011

paid note

Receipt # 2/2650
(see overleaf) a

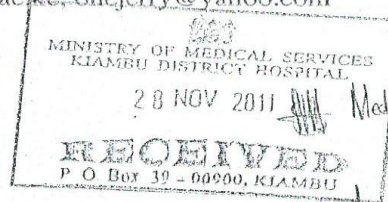
Dr. Joseph Kimani Wanjeri
P.O Box 58653 City Square
Nairobi 00200

Tel: 0722708051, 0733973434

Email: joseph.wanjeri@uonbi.ac.ke, onejerry@yahoo.com

28th November, 2011

The Medical Superintendent
Kiambu District Hospital
P.O. Box 39
Kiambu- 00900



Dear Sir/Madam,

RE: REQUEST FOR PERMISSION TO CONDUCT A PILOT STUDY AT YOUR HOSPITAL FOR A STUDY TO BE DONE AT THE KENYATTA NATIONAL HOSPITAL

I am a Master of Public Health (MPH) student at the University of Nairobi's (UoN) School of Public Health (SPH) and a lecturer at the UoN Dept of Surgery. I have been given approval for a case-control study on risk factors for burn injuries among burn patients hospitalized at the Kenyatta National Hospital (KNH) which I am doing as part fulfillment for the MPH degree. Like most studies, a pilot study to pretest the research tool/questionnaire is required and I would like to conduct it at your hospital if possible.

This letter is to request you to kindly allow me to interview a total of 20 patients hospitalized at the Kiambu District Hospital using the research tool (questionnaire) attached herewith. Also attached, is the KNH Ethical & Research Committee approval letter for this research and photocopies of my National and UoN student Identification Cards.

This study will take about two days only and it will not affect the treatment of your patients or the running of your hospital.

I look forward to hearing from you soon.

Thank you.

Yours sincerely,

Dr. Joseph K. Wanjeri
UoN SPH Student registration # H57/6259/09

16/12/11
Dr. Ndlovu (Surgeon)
Please go thru' this
and advice
Kamuk

21/12/11

Recommended for
approval

21/12/11

Dr. Ndlovu S