FACTORS ASSOCIATED WITH MORBIDITY AND MORTALITY IN CHILDREN WITH BURN INJURY AT MUHIMBILI NATIONAL HOSPITAL.

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By

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A Dissertation Submitted In Partial Fulfillment of the Requirement for the Degree of Master of Medicine (General Surgery) of the Muhimbili University of Health and Allied Sciences

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CERTIFICATION

The undersigned certifies that he has read and hereby recommends for acceptance by Muhimbili University of Health and Allied Sciences a dissertation entitled**, Factors Associated with Morbidity and Mortality in Children with Burn Injury at Muhimbili National Hospital** in partial fulfillment of the requirements for the degree of Master of Medicine (General Surgery) of Muhimbili University of Health and Allied Sciences.

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Dr. Akoko L.O.

Supervisor

_____

Date

DECLARATION AND COPYRIGHT

I, **Thadeo Nyamsha Maina**, declare that, this **dissertation** is my own original work and that it has not been presented and will not be presented to any other University for similar or any other degree award.

Signature……..**.....** **Date**…….

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DEDICATION

To my father the Late Mzee Jeconiah Obong'o Maina and my mother Kezia J. Maina.

It is their unconditional love and endless support that enabled me to be where am today.

ABSTRACT

Introduction: Burn injury consists of destruction of the skin and the underlying tissues, due to thermal, electrical and chemical causes. The majority of burns are thermal followed by chemicals, electrical and radioactivity. Burn injuries continue to be a significant public health problem worldwide and it is associated with high morbidity and mortality in developing countries including Tanzania. This study aimed at determining the factors associated with morbidity and mortality in children with burn injury at our institution.

Methodology: A descriptive, prospective, hospital-based study was conducted to document factors associated with the morbidity and mortality in children with burn injury at MNH in 2012-2013, involving observation of patients from admission to discharge or death. TBSA was calculated by the rule of nine for children above 10 years and for those below 10 the Lund and Browder chart was applied, swab for culture and sensitivity was taken from the wounds with clinical evidence of sepsis.

Results: A total of 150 children with burn injury were studied, with mean age of 3.25years. Scald were responsible for burns in 127 patients (84.7 %) while flame caused 20 burns(13.3%). Unsupervised play in cooking environment was the leading risk factor for burn. Most patients arrived to the unit late with an interval of 2 hours to 54 days, mean 33.6 hours; this had no effect on mortality, p-value 0.965. Most of the patients had complications, 77.3% (116) with anaemia being the most common isolated complication developed by 45 patients (38%). The mortality in this series was 23 children15.3% with electrolyte imbalance and septicemia being the leading killers. Other factors associated with mortality were TBSA, p-value <0.001. Seventy eight out of one hundred and six (72.6%) of the specimens had bacteria yield with ***S aureus*** being the commonest organism isolated, 32.1% (25), followed by ***Pseudomonus spp*** and ***Klebsiella*** and ***E coli.*** All the isolated S aureus were sensitive to penicillin.

Conclusion: Burn is still a big health problem in our society especially in children below two years, as it is associated with high mortality, 15.33%. The factors associated with morbidity and mortality include; TBSA and source of burn. As most of the children get burn injury while playing at home especially around the cooking places, this can be preventable. Diarrhoea which lead to electrolyte imbalance causing death is due to overcrowding and lack of restriction rules into the burn unit at MNH.

Recommendation: Community programmes to ensure adequate child supervision and general child wellbeing, particularly for those under fives, as well as parental education about burns are recommended to reduce childhood burns in Tanzania. Rules restricting unnecessary entry to the burn unit should be advocated. More wards are needed to the unit to prevent the overcrowding.

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ABBREVIATIONS

ABA	American Burn Association.
ARDS	Acute respiratory distress syndrome.
BMC	Bugando Medical Centre
LOS	Length of hospital stay
MMED	Masters of Medicine
MNH	Muhimbili National Hospital
SPP	Species
TBSA	Total body surface area
TOA	Time of arrival

CHAPTER ONE

1.0 INTRODUCTION AND LITERATURE REVIEW

Burn injury consists of destruction of the skin and the underlying tissues, due to thermal, electrical, or chemical causes. Most of burns are reported to be thermal, 80.4% followed by chemicals and electrical 6.2% and 3.6% respectively, while the remaining 9.9% are due to various other causes (radioactivity and electrical etc.)[1.]

Since 2001, the main classification system used throughout the world is superficial, superficial partial, deep partial, or full thickness[2] .Superficial burns involve only epidermis. Although painful, healing usually occurs within one week without any residual scarring, Superficial partial thickness burns involve only papillary dermis and epidermis. Burns of this depth are expected to heal in 1 to 2 weeks and should not result in visible changes to the skin beyond 6 months. Deep dermal partial thickness burns involve epidermis and dermis to reticular dermis. It is usually expected that burns of this depth would take longer than 3 weeks to heal and skin grafting is recommended to promote early wound closure and to reduce the degree of residual scarring[3.] Full thickness burns involve the whole thickness of the skin and possibly subcutaneous tissue. Skin grafting is essential since there is little potential for spontaneous healing[4.]

Precise evaluation of the extent of a burn is important because of the serious problem of the loss of large quantities of fluids and electrolytes from the burned area, as the skin is destroyed and can no longer prevent body fluids from evaporating. The blisters that form absorb fluids, depriving the body of them, The extent of the burn has to be known in order to estimate fluid replacement requirements[5,6.]

There are several ways of evaluating the extent of a burn. One very simple and relatively precise way is the “rule of nines”, devised by Wallace. According to this rule, the various parts of the body are divided into surfaces corresponding to 9% TBSA or its multiple of 2, (Fig. 1) with the exception of the perineum, which is calculated as 1% TBSA (Appendix 1).

This rule does not apply to children under the age of 10 years. The latter are assessed by using Lund and Browder Chart. (Appendix 2). Another simple rule for evaluating the extent of small-scale burns is based on the size of the patient's palm, which according to Colson is reckoned to be 1.15% TBSA[5.]

The physiologic impact of a burn depends on the percentage of TBSA involved and the depth determines the extent of wound care, the need for grafting, and the functional and cosmetic outcomes. First-degree burns are not included in the determination of percentage of TBSA involved and therefore not considered in the calculations for resuscitation fluid[8.]

Superficial and partial thickness burns usually heal spontaneously by migration of cells from epidermal appendages, that is, hair follicles and sweat glands. Third-degree burns or full-thickness burns extend through the epidermis and dermis, destroying the epidermal appendages. Also destroyed are the sensory nerves yielding a less painful injury. Leathery eschar forms on the third-degree burn from coagulated dead skin. These burns require surgical excision and grafting[8.]

The extent of injury in the burn patient is not limited to the obvious cutaneous damage. The burn patient experiences a systemic hyperdynamic response that can lead to burn shock. Burn injury can result in shock due to damage to the microcirculation with resultant capillary leak. In addition, in larger burn injuries, the release of chemical mediators causes a systemic increase in capillary permeability.[9.]

The leakage of fluids, electrolytes, and protein from the intravascular space into the interstitium results in massive burn edema and if the patient is not resuscitated adequately circulatory system collapse. Therefore burn shock results from both distributive and hypovolemic processes because of the generalized microvascular damage and the third-spacing of fluids. The area in which total body fluid is distributed is expanded by third-spacing and includes not only the intravascular space but also both the intracellular and

interstitial spaces. It is the ongoing dynamic fluid shifts that necessitate fluid resuscitation amounts that neither over- nor underresuscitate the patient with significant injury[10.]

Although the exact pathophysiology is not entirely understood, multiple chemical mediators that either increase capillary permeability or increase microvascular hydrostatic pressure are implicated. Burn injury results in an immediate inflammatory response with resultant release of a multitude of chemical and hormonal mediators. Some investigators believe that histamine and bradykinin are responsible for the early phase of burn edema formation. Other mediators contributing to the postburn increase in permeability include vasoactive amines, prostaglandins, hormones, leukotrienes, and components of platelet activation and the complement cascade[11.]

The massive tissue edema that occurs following large burn injuries results in intravascular fluid loss, leading to hypovolemia if the patient is not properly resuscitated. However, aggressive fluid resuscitation, while correcting the hypovolemia, can worsen the edema. Consequential tissue hypoxia and increased compartment pressures may ensue and the need for escharotomy or fasciotomy in circumferential injuries may be present[12.]

Management of Burn Patient include; Fluid resuscitation (guides to fluid resuscitation Appendix 3.); the most widely use d in UK is the Parkland Formular[10,11] nutrition support, dressing, infection control and surgical treatment. Early excision and skin cover and early mobilisation of the patient reduce the incidence of complications such as infection and deep vein thrombosis. Nowadays most burn units have an intensive program of physiotherapy and mobilisation without which the limb would progress to joint contracture.[8,10]

The complications and sequelae of burns depend on their gravity systems of the body involved. The most serious complications are those threatening the life of the patient directly like loss of fluids, infections, shock and multiple organ failure([5,7]) as well as inhalation injury manifested by hypoxia, Acute Respiratory Distress Syndrome (ARDS) and respiratory failure)[8,13,]

Some of the complications do not threaten the life of the patient directly; changes in the patient's appearance as wrinkles and scars that form as the burn heals generate various aesthetic problems and permanent disabilities when the wrinkles and scars affect mobility and/or limit the patient's movements causing functional problems or disabilities[14.]

Every year half a million people in the United States present to medical facilities in need of treatment for burn injuries. The most common injuries include those from scald, flame, electrical, and contact burns. Many of these injuries prove fatal; fire and burn deaths total more than 4,000 each year. A total of 3,500 deaths result from residential fires, while the remaining 500 deaths occur because of motor vehicle and aircraft crashes, contact with electricity, chemicals, hot liquids, and other sources[13.]

Burn injuries are very frequent and afflict approximately 1% of the population yearly. They are a source of heavy medical burden to medical systems worldwide. In the US alone, about 2 million burns are treated by medical staff yearly, and about 75,000 burns are serious enough to require hospitalization. In the UK, a similar situation is depicted in the statistics--burns constitute 1% of the ER workload, and 0.014% of the hospitalization. Morbidity and mortality from burns is mainly dependent upon: total body surface area (TBSA) that is involved in the burn, the depth of the burn and it's anatomical location, the age of the subject, prior medical history and the severity of adjacent injuries (especially pulmonological injury)[15.]

A study done on the epidemiology of burn injuries in the East Mediterranean Region showed factors associated with mortality to include older age (60 and over), a greater TBSA burnt, female gender, depth of burn and delay in receiving medical care and head and neck burns. Mortality for flame injuries is much higher than for scald injuries. While flame burn mortality rates are reported as 42% and 44% in all ages and 31% in children, mortality rates for scald injuries are reported by the same authors as 11%, 5% and 4% respectively[16.]

Another study done on factors associated with mortality in adult hospitalized burn patients at Tehran University of Medical Sciences in Iran revealed that the majority of burns were accidental (n = 1076, 81.5%). Regarding the mechanism of burn, burn with petroleum products was the most frequent. Mean percent burned total body surface area (TBSA) was 39.9% ± 25.8%. The mortality rate was 33%. Sepsis was the most common cause of mortality. The results of the study indicated that non work-related burns, burned TBSA and body surface area affected by second- or third-degree burns were independent determinants of mortality among adult hospitalized burn patients[17.]

In a retrospective analysis of case notes of 149 children with burns who presented to Hlabisa Hospital in Kwa Zulu Natal, South Africa, 88 (59%) were admitted. Of them 19 (22%) developed wound infections, 5(6%) developed contractures and 20 (23%) required a total of 32 surgical procedures, and one died. Burns were responsible for more pediatric patient days spent in hospital than any other condition except malnutrition. **[18]**

In Ghana, short term complications included infection and septicemia. Eighteen percent of childhood burns led to long-term physical impairment or disability including hypertrophic scarring and keloids, contractures, amputations, and other disfigurements.[1]

In most settings the majority of burn injuries are suffered by children below five years of age [(20, 21, 22)]. Childhood burn cases accounted for between 25 and 68 percent of all burns observed in community-based studies conducted in Africa (1980-2003). According to Forjuoh's review of burns of children in Africa children from birth to four years comprised about one-third of all burns.[19] The number of burn injuries and proportion of all injuries amongst children decreases with age as shown in Types of burns, almost everywhere, vary according to age group. For instance, scalds from hot liquids are found most frequently in toddlers, whereas flame burns are most frequently seen in older children. [(22)]

The prospective study of burns from June 2006-December 2007) at the Paediatric Surgery Units of the Imo State University Teaching Hospital in Nigeria involving a total of 53 patients, 31 were males and 22 were females [M:F = 1.4:1]. Patients in the age range of 2 years and below were the most at risk, constituting 47.2% of the patients. Hot water was the most common cause of burns, occurring in 31 (58.7%) of the patients, followed by flame burns, occurring in 14 (26.4%) of the patients. Forty-nine (92.5%) patients sustained their injuries at home. The most common complications were wound infection at the time of presentation involving 20 (32.1%) patients and anaemia requiring blood transfusion in eight (15.1%) patients. There was complete recovery in 46 (86.8%) patients, five (9.4%) had significant morbidity in the form of contractures and unsightly scars and two (3.8%) died on admission. One death was due to severe pneumonia and the other due to septicemia. [23]

A study done in Nigeria on Analysis of mortality in burn centres involved a total of 285 patients who sustained burns during the study period (1996-2000). Fifty-seven of the patients (20%) died, with flame burns causing more deaths than any other aetiology. The causes of deaths were acute renal failure (24 cases, 42.1%), septicemia (18 cases, 31.6%), acute respiratory syndrome (5 cases, 8.7%), shock (4 cases, 7.0%), and upper gastrointestinal bleeding due to peptic ulcer and severe anaemia (1 case each, 1.8%) Survival was seen to decrease as percentage burn surface area increased, with no survival among patients with 80% burn surface area or more. Most of the deaths (38, or 66.7%) occurred within the first week of admission.([24])

Between March 2001and September 2002, One hundred twenty-five adults were admitted with burns to the general surgical wards of Mulago Hospital in Kampala Uganda. During the study period where by 17% of adult burn patients were identified as having injuries resulting from assault with acid. The average extent of burn injury was 14.1% TBSA and sites most commonly affected included the face (86.7%), head and neck (66.7%), chest (53.5), and upper limbs (60.0%), The eyes were commonly injured (33.3%) leaving affected patients with partial or complete blindness. Fourteen patients (93.3%) were left with permanent

scarring and seven (46.7%) developed cervical or axillary contractures. Other complications included ectropion (33.3%), nostril stenosis (13.3%), microstomia (20.0%), paraphimosis (6.7%), and Curling's ulcers (6.7%). Eight patients (53.3%) received skin grafting[25.]

A cross sectional study was conducted at Bugando Medical Centre over a 3-year period from January 2008 to December 2010 to describe the pattern of childhood burn injuries and to evaluate their management outcome. A total of 342 burned children were studied. Males were mainly affected. Children aged ≤ 2 were the most accounting for 45.9% of cases. Intentional burn injuries due to child abuse were reported in 2.9% of cases. Scald was the most common type of burns (56.1%). The trunk was the most commonly involved body region (57.3%).Most of patients (48.0%) sustained superficial burns. Most patients (89.8%) presented to the hospital later than 24 h. The rate of burn wound infection on admission and on 10th day were 32.4% and 39.8% respectively. *Staphylococcus aureus* were more common on admission wound swabs, with *Pseudomonas aeruginosa* becoming more evident after 10th day. Conservative treatment was performed in 87.1% of cases. Surgical treatment mainly skin grafting (65.9%) was performed in 44 (12.9%) of patients. The overall average of the length of hospital stay (LOS) was 22.12 ± 16.62 days. Mortality rate was 11.7%. Delayed presentation following burn injury increases the likelihood of death as well as prolonged hospital stay as the child may only be brought to hospital once the wound has become septic[26.]

According to Mbembati, et al[27], more than 90% of children's burn injuries were related to cooking: 39% were related to hot water, 31% to hot food, 14% due to open flame and 9% due to cooking oil. Justin-Temu and colleagues also found that about 90% of children's burn injuries were related to cooking; the remaining injuries were a result of lighting: candles and small lanterns (*kibatari*). A child may fall into a fire, or more likely tip a pot of boiling liquid onto him or herself [28].

1.1 PROBLEM STATEMENT

Burn injuries continue to be a significant public health problem worldwide and it is associated with high morbidity and mortality in developing countries including Tanzania [18.] In Uganda, burn injuries has been reported to be one of the leading causes of morbidity and mortality and at Mulago Hospital, it is the commonest indication for admission reported in the surgical department[16.]

Burn injuries cause a stressful experience for burn victims as well as their family and the community in general .Patients in our environment with extensive burns frequently die, and for those with less severe injuries, physical recovery is slow and painful. In addition to physical injury caused by burns, patients also may suffer emotional and psychological trauma[17.]

The burden of burn injuries is in developing countries, the majority of deaths (98%) related to fire burns are in developing countries, These injuries are associated with poverty and are mainly related to fire accidents with fire in home environment, Most of these burns are preventable[18.]

1.2 RATIONALE

Few studies have been done relating to burn injuries in children in our setting (MNH) especially after the formation of a children's' burn unit.

The findings in this study will help to emphasize the magnitude of the problem of burn injury in children at MNH and will hopefully stimulate further research, education programs, and preventative strategies so as to improve management of burn injury and reduce morbidity and mortality.

The study will generate a Dissertation as partial fulfillment for an award of Masters of Medicine degree at the Muhimbili University of Health And Allied Sciences.

1.3 OBJECTIVES

1.4 Broad objective

To determine the factors associated with morbidity and mortality among burn patients in children admitted at MNH in 2012-2013.

1.5 Specific objectives

1.51 To relate TBSA burnt with morbidity and mortality in children with burn injury at MNH 2012-2013.

1.5.1 To determine the common causes of mortality in children with burn injury at MNH 2012-2013.

1.5.2 To correlate the effect of the time interval between injury and admission with morbidity and mortality in children with burn injury at MNH 2012-2013.

1.5.3 To determine the common complications of burn injury in children at Muhimbili National Hospital MNH at 2012-2013.

1.5.4 To determine the common organisms causing sepsis in children with burn injury and evaluate the antibiotic sensitivity at MNH 2012-2013.

1.5.5 To correlate TBSA and some common complications of burn injury in children with period of hospitalization at MNH 2012-2913.

CHAPTER TWO

2.0 METHODOLOGY

2.1 Study design

A descriptive, prospective, hospital-based study involving observation of patients from admission to discharge or death to determine the factors associated with the morbidity and mortality in children with burn injury at MNH in 2012-2013.

2.2 Study period

10 months, from March 2012 to December 2013

2.3 Study area

The study was conducted in Muhimbili National Hospital (MNH) burn unit, a teaching and national referral center located in Dar es Salaam, Tanzania.

2.4 Study population

All children admitted at burn unit in Muhimbili National Hospital.

2.5 Inclusion criteria

Any child admitted in burn unit whose mother/guardian consent for the study

2.6 Exclusion criteria

The children who did not come for follow up in the clinic and those absconded from the ward.

2.7 Sample size

All the patients, 150, who were attended at the burn unit during the study period were recruited.

2.8 Data collection

The parent/guardian of every child who agreed to participate was thoroughly informed about the study. Then he/she was requested to sign the consent form. A Questionnaire (appendix A) was used to collect the necessary information. The Questionnaire consists of three main parts: demographic data, clinical presentation, physical examination and the outcome (death or discharge).

For all patients with clinical evidence of wound sepsis, swab was taken for culture and sensitivity.

2.9 Data Analysis

All filled questionnaires were given identification numbers before entering into the SPSS statistical package. Coding was done and data entered into SPSS, Cross tabulations were done for defined independent variables to obtain table of results. Then x^2 test, frequency, prevalence, was calculated.

2.10 Ethical consideration

Before carrying out the study permission was obtained from the MNH management. Ethical clearance was sought for conducting the research from the Research Ethics Committee of Muhimbili University of Health and Allied Sciences

CHAPTER THREE

3.0 RESULTS

Table 1: Social Demographic Characteristics

VARIABLE	FREQUENCY	PERCENTAGE
AGE (YEARS)		
<2	79	52.7
2-4	48	32
>4	23	15.3
SEX		
MALES	87	58
FEMALES	63	42
RESIDENCE		
ILALA	54	36
KINONDONI	60	40
TEMEKE	26	17.3
UP COUNTRY	10	6.7

In this study a total number of 150 children with burn injury were recruited, the age ranged from 6 months to 12 years with a mean of 3.25 years. Male patients were the majority at 87(58%) with male to female ratio of 1.4:1. Most of the burnt children were below two years of age, 79(52.7%), while 48(32%) were between 2 to 4 years and 23(15.3%) were above 4 years old. Majority of these children, 140(93.3%) were from Dar es Salaam region with Kinondoni district contributing the most 60 (40%) of the total patients in the study followed by Ilala 54(36%) and 26(17.3%) were from Temeke district and only 10(6.7%) were received from upcountry (Table 1)

Table 2: Burn Injury (Source and Situation Led to Injury).

VARIABLE	FREQUENCY	PERCENAGE
SOURCE OF BURN		
SCALD	127	84.7
FLAME	20	13.3
ELECTRICAL	1	0.7
CHEMICAL	2	1.3
SITUATION LEADING TO BURN		
PLAYING	70	46.7
FEEDING	21	14
WALKING	40	26.7
OTHERS	19	12.7

The commonest source of burn in this study was scald, 127(84.7%) followed by flame 20 (13.3%), chemical 2(1.3%) and only one child (0.7%) had electrical burn. Most of these children were burnt while playing 70(46.7%), followed by walking 40(26.7%) and 21(14%) sustained burn while feeding. **[Table 2]**

Table 3: Relationship between Source of Burn and Age.

	SOURCE OF BURN				
AGE GROUP	**SCALD**	**FLAME**	**ELECTRICAL**	**CHEMICAL**	**TOTAL**
<2	75(59.06%)	4(20%)	0(0%)	0(0%)	79(52.67%)
2-4	40(31.5%)	7(35%)	1(100%)	0(0%)	48(32%)
>4	12(9.45%)	9(45%)	0(0%)	2(100%)	23(15.33%)
TOTAL	127(84.66%)	20(13.33%)	1(0.66%)	2(1.33%)	150(100%)

Scald burn was most common in children below 2 years at 75/127(59%) followed by those between 2-4 years at 40/127(31.5%). Eighty percent of flame burn occurred in children of 2 years and above. **[Table 3]**

Table 4: parts of the body involved in bur

PART OF THE INVOLVED	FREQUENCY	PECENTAGE
HEAD AND NECK	7	4.7
TRUNK	12	8.0
UPPER LIMB	26	17.3
LOWER LIMB	6	4.0
BUTTOCKS AND GENITALIA	2	1.3
MORE THAN ONE PART	97	64.7
TOTAL	150	100

Most of the children, 97/150 (64.7%) sustained burn injury in more than one part of the body. Upper limbs were the most involved 26(17.3%) in isolated burns followed by the trunk 12(8.0%), head and neck 7(4.7%), lower limbs 6 (4%) while genital and buttocks were the least involved 2(1.3%). **[Table 4]**

Table 5.The Relationship between Mortality, TBSA and Length of Hospital Stay

	LOS(DAYS)				
	<20	**20-40**	**>40**	**TOTAL**	
MORTALITY					
TOTAL NUMBER	78(52%)	31(20.67)	41(27.33)	150(100%)	
DEAD	19(82.61%)	3(13%)	1(4.35%)	23(15.3%)	
TBSA					
<10%	27(69.23%)	5(12.82%)	5(17.95%)	39(26%)	P- Value 0.09
10-20%	37(45.12%)	21(25.62%)	24(29.27%)	82(54.66%)	
21-30%	6(35.29%)	3(17.65%)	8(47.06%)	17(11.33%)	
31-40%	4(50%)	2(25%)	2(25%)	8(11.33%)	
>40	4(100%)	0(0%)	0(0%)	4(2.66%)	

The length of hospital stay ranged from 1-154 days with a mean of 35.6 days. Most of the patients78 (52%), stayed in the ward for less than 20 days, followed by those who stayed for more than 40 days, 41 (27.33%) while 31(20.67%) had a stay of between 20-40 days.

Mortality rate of 15.3 % (23/150) was observed, with only one dying after hospital stay of more than 40 days. Nineteen deaths (82.6%) occurred during the first 20 days in hospital. Eighty two patients (54.7%) had TBSA of between 10-20% while 39 had TBSA of less than 10%. The longest hospital stay was in those with TBSA 21-30% at 8(47.0%) followed by between10-20% at 24(29.3%). **[Table 5]**

Table 6: Complications of Burn Injury.

COMPLICATIONS	FREQUENCY	PERCENTAGE
ANAEMIA	45	38.8
DIARRHOEA	22	19
CONTRACTURE	4	3.45
RESP TRACT INFECTION	2	1.72
MALNUTRITION	5	4.3
MORE THAN 1 COMPLICATION	38	32.76
TOTAL	116/150	77.3

Proportionally more patients 116 (77.3%), developed complications with anaemia being the commonest isolated complication occurring in 45 (38.8%) followed by diarrhea 22(19%). Thirty eight (32.8%) of the patients had more than one complications.**(Table 6).**

Table 7: Relationship between TBSA and Complications

TBSA	ANAEMIA	DIARRHOEA	OTHERS	MORE THAN 1	TOTAL
<10%	8(20.51%)	7(17.95%)	3(7.7%)	3(7.7%)	39
10-20%	31(37.8%)	12(14.63%)	5(6.1%)	19(23.17)	82
21-30%	5(29.41%)	2(11.76%)	2(11.76%)	7(41.18%)	17
31-40%	0(0%)	1(12.5%)	1(12.5%)	6(75%)	8
>40%	1(25%)	0(0%)	0(0%)	3(75%)	4
TOTAL	45(30%)	22(14.67%)	11(7.33%)	38(25.33%)	150

NB: Others included RTI (2), Malnutrition (5) and contracture (4).

Twenty one out of 39 (55.9%) of the children admitted with TBSA <10%, developed complications while 67 out of 82 (81.7%) and 16 out of 17(94.12%) of those with TBSA 10-20% and 21-30% respectively developed complications. All children admitted with TBSA above 30% had complications,

The percentage of the patients with more than one complications were 7.7%, 23.2%, 41.2%, 75% and 75% for TBSA ;<10%, 10-20%, 21-30%, 31-40% and >40% respectively. **[Table 7]**

Table 8: Causes of Death

CAUSE OF DEATH	FREQUENCY	PERCENTAGE
RESPIRATORY DISTRESS	2	8.7
ELECTROLYTE IMBALANCE	5	21.74
ANAEMIA	2	8.7
SEPTICAEMIA	3	13
MORE THAN ONE CAUSE	11	47.83
TOTAL	23	100

The mortality was 15.3% (23/150) with most of deaths due to more than one cause followed by electrolyte imbalance by 21.7% (5/23), septicemia by 13% (5/23), and anaemia and respiratory distress each accounting for 8.7% (3/23). **[Table 8]**

Table 9: Factors affecting Mortality in Burn Patients, n=150

VARIABLE	ALIVE	DEAD	% DEATH	
TBSA				
0-10%	39	0	0	Range 5-75%
11-20%	73	9	11	Mean 20.4%
21-30%	11	6	35.29	P-Value < 0.001
31-40%	4	4	50	
>40%	0	4	100	
TOTAL	127	23	15.33	
TIME OF ARRIVAL(HOURS)				
<12	58	10	14.71	Range(2-1296)
12-24	30	6	16.67	Mean 33.4
>24	39	7	15.22	P-Value 0.965
AGE (YEARS)				
<2	66	13	16.4	Range 0.5-12 year
2-4	42	6	12.5	Mean 3.25 years
>4	19	4	17.4	P-Value 0.8
SOURCE OF BURN				
SCALD	109	18	14.17	P-Value 0.6
FLAME	20	5	25	
ELECTRICAL	1	0	0	
CHEMICAL	2	0	0	

The observed mortality was increasing with increase in TBSA burn and the observed difference was found to be statistically significant, p-value <0.001. The observed difference in death by time of arrival was not statistically significantly associated with mortality, p-value 0.97. Age was also not found to be a significant cause of death, p-value 0.8, so was source of burn (p-value0.6). **[Table 9]**,

Table 10: Results for Culture and Sensitivity.

	DRUGS								
ORGANISMS	AMI	CEF	CIP	CLOX	AUG	GENT	AMOX	VANCO	TOTAL
S.AUREUS	XXX	XXX	XXX	25(100%)	XXX	XXX	XXX	15(60%)	25(32.1%)
PSEUDONOMOUS	14(100%)	14(100%)	XXX	XXX	XXX	XXX	XXX	XXX	14(18%)
E.COLI	8(100%)	8(100%)	8(100%)	XXX	XXX	XXX	XXX	XXX	8(10.26%)
KLEBSIELLA	12(100%)	5(41.67%)	XXX	2(16.67%)	2(16.67%)	2(16.67%)	1(8.33%)	XXX	12(15.38%)
STEPTOCOCCUS	XXX	3(100)	XXX	XXX	XXX	XXX	XXXX	XXX	3(3.85%)
PROTEUS	6(100%)	XXX	XXX	XXX	6(100%)	XXX	XXX	XXX	6(7.7%)
MULTIPLE ORGSNISMS	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	7(9%)
OTHERS	XXX	XXX	XXX	XXX	XXX	XXX	XXX	XXX	3(3.85%)
TOTAL									78(100)

NB; AMI-AMICACIN, CEF-CEFUROXIME, CIP-CIPROFLOXACIN, AUG-AUGMENTINE, -AMOXICILLIN, VANCO-VANCOMICIN.

XXX-NOTSENSITIVE.

The results for culture and sensitivity were found for 106 patients, different types of organisms were isolated in 78 patients (72.55%). The commonest organism isolated from the wounds of these patients was ***S. aureus*** 25(32.1%), followed by *Pseudomonas species* 14(18%), ***Klebsiella species*** 12 (15.38%), *E. coli* 8*(*10.26%), *Proteus* spp 6(7.7%).

The multiple microorganisms were isolated from the wounds of 7 out 78 patients (9%), *Streptococcal spp* and other microorganisms (fungi) were found in only 3 patients each (3.85%). All S. aureus isolated 25 (100%) were sensitive to cloxacillin, 15 out of 25 (60%) were sensitive to vancomycin. E.coli isolated from all 8 patients were sensitive to 3 drugs namely; amikacin, cefuroxime and ciprofloxacin. Klebsiella spp isolated from the wounds of 12 patients were sensitive to the following drugs; amikacin 12(100%), cefuroxime 5(41.67%),cloxacillin, augmentin and gentamicin 2 each (16.67%) and amoxicillin 1(8.33%). Proteus spp isolated from the wounds all the of all 6 patients were sensitive to both amikacin and augmentin. Streptoccocal spps isolated from the wound of 3 patients all were sensitive to cefuroxime

CHAPTER FOUR

4.0 DISCUSSION

A total of 150 children who sustained burn injury of which males and children below two years of age were the majority. And almost all of the admissions came from within the city, with only 6.7% (10) coming from upcountry. These findings are similar to those by Chalya et al [26] in Bugando and Okoro et al [23] in Nigeria. Why male predominance? This could not be explained by either of these studies including mine, but the age composition of children in the society may be is predominantly male and male children are presumably considered to be more aggressive than their female counterparts. But this is the age when children are exploring and are naïve to recognize dangerous objects including hot substances and need a lot of supervised adventures.

Scald burn has still remained the most common source of burn injury in Dar es Salaam as was previously documented by Mbembati et al [22] and Chalya et al [24]. Unsupervised child activity has remained the leading predisposing factor together with unsafe cooking and feeding environments. Not keeping dangerous objects away from children was also responsible for some of the burns as some burnt in attempt to light a candle while others were playing with match sticks. These are also similar to findings by Temu and colleagues [28] in the same region.It was also also observed that scald burn was decreasing with age, being most common below 2 years and flame burn was increasing with age, most common above 4 years a finding which is similar to Kalayi's. [21]

Majority of patients (59%) with scald burn were below 2 years of age, while majority with flame burn 9 out of 20(45%) were the children at the age of above 4 years. This is the same finding with the study done by Kalayi GD. [21] The reason for this is that the older the child the greater the risk of being involved in flame burn as they are capable of lightening the candles and matches.

The mortality of 15.3% was observed among the burnt children which is higher than that found in Bugando Medical Centre by Chally et al[26] which was 11.7%, and also than that found in Imo State teaching university by Okoro et al[23] , These differences could be probably due to the fact that Muhimbil as a National Hospital receives more serious patients than Bugando.

Flame burn injury has been reported to cause more death than other sources of burn. [16, 24] In my study children with flame burn injury had the highest mortality of 25%, while those with scald burn the mortality was 14.17%, no patient died following electrical or chemical burns. Even though this difference was not statistically significant, it is worth taking note of. The differences in the number could be responsible for the failure to demonstrate a significant difference. Unlike scald burn, flame burn is usually associated with inhalational injury which is a cause of theoretically assumed high mortality.

Most deaths, (82.6%) occurred within 20 days of admission the finding which is almost the same as that done in burn centres in Nigeria by Olaintan et al[24] which reported 66% of death to occur within the first week of admission.

Children who had sustained larger TBSA burn injury had higher mortality than those with smaller burnt surfaces and the observed difference was statistically significant, p-value <0.001. This is in keeping with findings from different studies **[15, 16, 17, 24]** which had that there exists a direct association between TBSA and mortality rate. Same studies had shown that larger surface burnt is correlating with occurrence of severe electrolyte imbalance, infections and anaemia which are the leading killers. The same explanation could be used for the relationship between TBSA and LOS. Children with smaller TBSA burnt had shorter duration of hospital stay and vice versa

Eleven of 23 (43.83%) who died following the burn injury died from more than one cause. However the commonest single cause of death was electrolyte imbalance 5(21.74%) followed by septicaemia 3(13%). Anaemia and respiratory distress contributed to the death of 2(8.7%)

patients each. Septicaemia and respiratory distress have been identified by different authors ([30, 31]) as leading causes of death following burn injury in children; anaemia also has been mentioned as a cause of death following burn [24]

The time interval between time of injury and arrival to the hospital did not affect the mortality of the children in this study (p-0.97). Those who arrived before 12 hours following injury constitute the majority, 68 out of 150(45.33%). Of these 13(16.4%) died, There were 36(24%) patients admitted between 12-24 hours and 6(16.67%) of them died. Those admitted after 24 hours of the injury were 46 making 30.67% of the total admission and 7(15.22%) of them died. These findings are different from other studies ([16, 26]) which showed that delayed arrival to hospital was associated with increased mortality. This can be explained by the reason that most of the patients attending MNH are referred from other hospitals after being resuscitated.

Infections, contracture have been consistently mentioned as the most common complications of burn injuries by different authors. [19, 23, 25, 26] .In this study the majority of the children 116 (77.33%) developed different complications in the ward. However the most common complication was anaemia, 45 out of 116 patients (38.8%), more than one complications were developed by 38(32.76%) patients , diarrhea was reported among 22 (19%) patients, malnutrition and contracture were reported among 5(4.3%) and 4(3.45%) respectively. Only 2(1.72) children developed respiratory tract infection in the ward.

Anaemia requiring blood transfusion and respiratory tract infections have been mentioned in several studies ([7, 30]) to be among the commonest complications of burn in children. Presence of darrhoea which was not mentioned in other studies was observed in these patients. It could be contributed by the overcrowding nature of the burn unit at MNH and lack of entry restriction rules to the burn unit, this makes poor sanitary measure.

The results for culture and sensitivity were found in 106 patients, of which 28 of them (27.45%) had no bacterial growth and in 78 (72.55%) different types of organisms were isolated**.** The commonest organism isolated from the wounds of these patients was S. aureus, 25 out of 78 (32.1%), followed by Pseudomonous spieces 14(18%), Klebsiella spieces 12 (15.38%), E. coli 8(10.26%), Proteus spp 6(7.7%). Multiple microorganisms were isolated from the wounds of 7 out 78 patients (9%), Streptoccocal spp and other microorganisms (fungi) were found in only 3 patients each (3.85%).

Challya et al in their study[26] mention both S. aureus and P.auregenosa to be the most common organisms growing in the wound of the patients, S. aureus being most commom on the day of admission and P.aureginosa being the most common on 10^{th} day of admission. This can be explained by the fact that these are the normal flora of the skin so making them easily accessible to the wound following burn injury.

All S. aureus isolated were sensitive cloxacillin, 15 out of 25 (60%) were sensitive to vancomicin (Talble10).

CHAPTER FIVE

CONCLUSION

Burn is still a big health problem in our society especially in children below two years, as it is associated with high morbidity (long hospital stay and complications like; anemia, diarrrhoea, sepsis, contractures etc) and high mortality (15.33%).

The factors associated with morbidity and mortality include; TBSA and source of burn.

As most of the children get burn injury while playing at home especially around the cooking places, this can be preventable.

Diarrhoea which leads to electrolyte imbalance causing death is due to overcrowding and lack of restriction rules into the burn unit at MNH.

RECOMMENDATION

Community programmes to ensure adequate child supervision and general child wellbeing, particularly for those under five, as well as parental education about burns are recommended, to reduce childhood burns in Tanzania.

Referrals from upcountry anticipated as this is the only hospital with a designated paediatric burn unit in the country. But MNH is largely fed by referrals from within the city regional hospitals (93.3%). More studies need to be done on the level of burn care in the other regional and district hospitals within the country for comparison of results and reasons for non referral of their cases to MNH.

Rules restricting unnecessary entry to the burn unit should be advocated.

More beds are needed to the unit to prevent the overcrowding.

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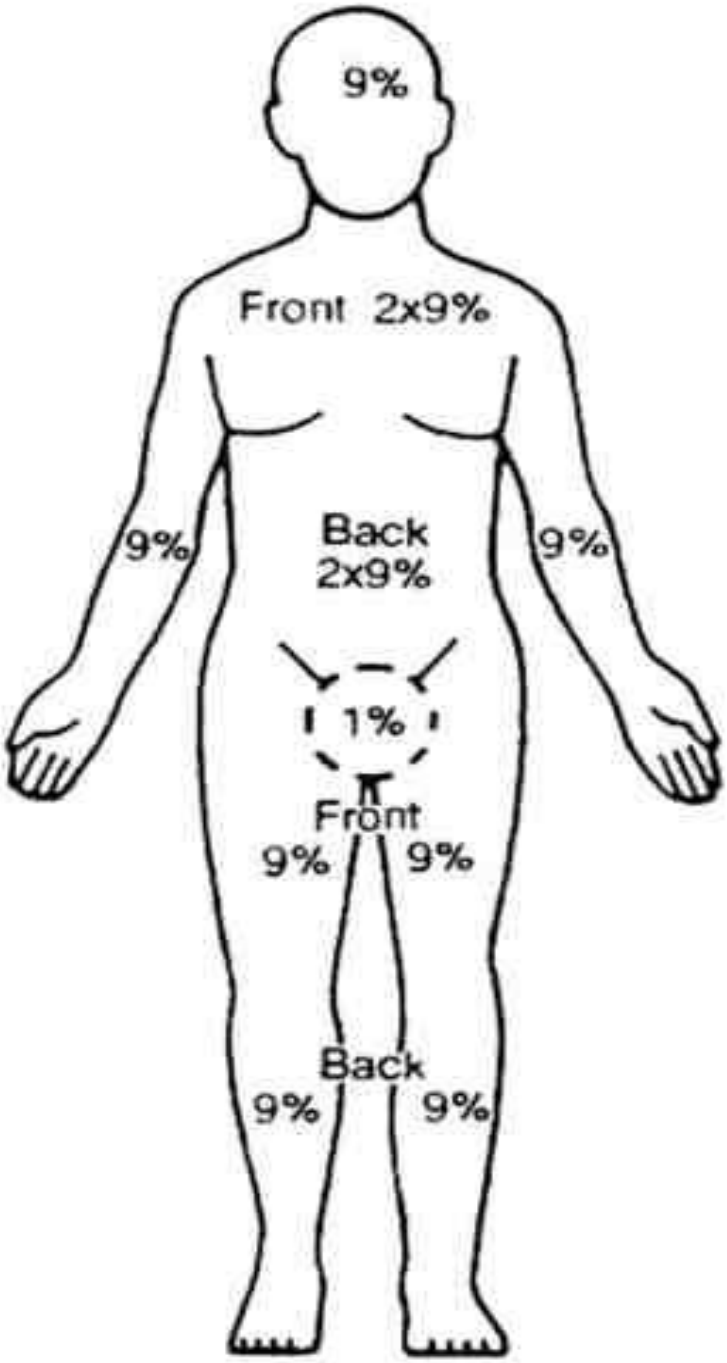
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APPENDIXES

Appendix I: The Rule of Nine



Appendix II: Lund and Browder Chart –Army General Hospital

Burn Estimate and Diagram
Age vs Area

Initial Evaluation

Cause of burn _____

Date of Burn _____

Time of Burn _____

Age _____

Sex _____

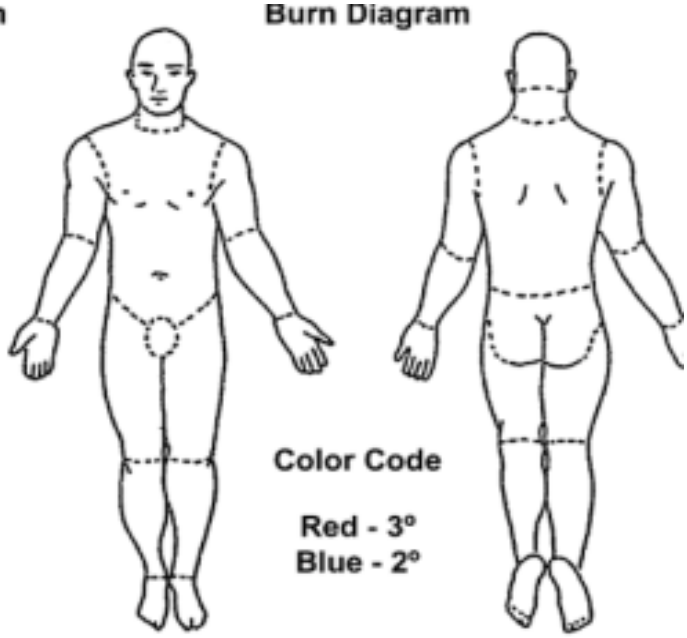
Weight _____

Date of Admission _____

Signature _____

Date _____

Burn Diagram



Color Code

Red - 3°
Blue - 2°

Area	Birth 1 yr.	1–4 yrs.	5–9 yrs.	10–14 yrs.	15 yrs.	Adult	2°	3°	Total	Donor Areas
Head	19	17	13	11	9	7				
Neck	2	2	2	2	2	2				
Ant. Trunk	13	13	13	13	13	13				
Post. Trunk	13	13	13	13	13	13				
R. Buttock	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2				
L. Buttock	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2				
Genitalia	1	1	1	1	1	1				
R.U.Arm	4	4	4	4	4	4				
L.U.Arm	4	4	4	4	4	4				
R.L.Arm	3	3	3	3	3	3				
L.L.Arm	3	3	3	3	3	3				
R. Hand	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2				
L. Hand	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2	2 1/2				
R. Thigh	5 1/2	6 1/2	8	8 1/2	9	9 1/2				
L. Thigh	5 1/2	6 1/2	8	8 1/2	9	9 1/2				
R. Leg	5	5	5 1/2	6	6 1/2	7				
L. Leg	5	5	5 1/2	6	6 1/2	7				
R. Foot	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2				
L. Foot	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2	3 1/2				
						Total				

Parkland Formula

Resuscitation fluid volume for the first 24 hours - 3 to 4 × total body surface area (%) × body weight. Half of this fluid is given in first 8 hours and other half is given over remaining 16 hours. Hartmann solution is used, but other isotonic fluid may be used. The above formulae are only guide and the adequacy of fluid resuscitation is best monitored by clinical assessment. Urinary output is the best guide to adequate tissue perfusion, in an adult one should aim at 30 to 50 ml of urine output / hour

In our setting Muhimbili National Hospital the commonly used guide is the Modified Brooke Formulary.

Modified Brooke Army General Hospital Formular.

A.1st 24 hours 1. Adults 2ml/kg body wt/TBSA-Crystalloid for resuscitation.

2Litres of Dextrose 5% for M**aintenance**

2. Children 3mls/kg/TBSA-Crysralloid for Resuscitation

Maintenance

100mls/kg/24hrs for the 1st 10kg body weight

1000+ 50ml/kg/24hrs for (11-20)kg body weight.

20ml/kg/24hrs for each kg over 20kg.

B. 2nd 24hours 1. Adult .1ml/kg/%burn **for Resuscitation**

0.5ml/kg/%burn-Crystalloid

0.5ml/kg/%burn-Colloid

2. Children 1.5ml/kg/%burn for **Resuscitation.**

0.75ml/kg/%burn-Crystalloid

0.75ml/kg/%burn-Colloid

Maintenance in 2nd 24hrs is the same as in the 1st hour above

Appendix III: Questionnaire

Serial no. _____

Hospital reg number _____

1. Age(yrs) _____
2. Sex…….

3. Area Of Residence _____

4. Date of a) Admission…….
   b) Discharge……Go to question 6.
   c) Death……

5. Cause of death……

6. How long did it take from the time the child sustained burn to when he/she presented at MNH……

7. Source of burn…(a) scald (b) flame (3) electrical (4) chemical (5) others

8. Situation led to burn. (a) playing (b) walking (c) feeding (d) others

9. Parts of the body involved……

10. Calculated Total burn surface area……..

11. Outcome of the burn in the ward (Complications) ……..

12. Results of Swab Culture and sensitivity…….

Appendix IV: Informed Consent Form

ID no…….

Consent to participate in the study on factors associated with morbidity and mortality among children admitted with burn injury in the burn unit at MNH.

Greetings! My name is Dr Thadeo Nyamsha Maina.I am a postgraduate student at MUHAS, studying the factors associated with morbidity and mortality among children admitted with burn injury at MNH.

What participation involves

If you agree for your child to participate in the study, you will be interviewed, and physical examination will be done on your child and also swab will be taken from those children whose wounds appear clinically infected

Confidentiality

All information collected on questionnaires will be entered into computer with identification number. The questionnaires will be handled secretly in order to maintain confidentiality.

Risks

There is no risk associated with this study

Right to withdraw and alternatives

Taking part in this study is completely voluntary choice. If you choose not to participate in the study, your child will continue to receive all services that he/she would normally get from the hospital.

Benefits

If you agree to take part in this study, we will all benefit from knowing the factors associated with morbidity and mortality among children admitted with burn injury in the burn unit at MNH.

Whom to contact

If you have any question about the study, you should contact Dr Nyamsha TM. (0784313262 OR O714872231) .

Signature

Do you agree?

Participant agrees…….. Participant does NOT agree……

I …… have read the content of this form .My questions

have been answered. I agree to participate in this study**.**

Signature of guardian…….

Signature of witness…… Date of signed consent…….

Appendix V: Fomu ya Ridhaa (Swahili Version)

Mambo yanayochangia matatizo pamoja na vifo miongoni wa watoto walioungua Hospitali ya Taifa Muhimbili.

Nambari ya usaili …….

Salaaam! Mimi naitwa Dr Nyamsha Thadeo Maina. ni mwanafunzi wa uzamili Chuo Kikuu cha Sayansi za Afya. Nafanya utafiti wa kuchunguza Mambo yanayochangia matatizo pamoja na vifo miongoni wa watoto walioungua Hospitali ya taifa Muhimbili

Madhumuni ya utafiti

Kujua Mambo yanayochangia matatizo pamoja na vifo miongoni wa watoto walioungua Hospitali ya taifa Muhimbili.

Jinsi ya kushiriki

Kama utakubali mwanao ashiriki ,nitakuhoji maswali machache kasha nitamfanyia mwanao vipimo, vilevle nitachukua majimaji kwenye vidonda kwa ajili ya uchunguzi wa maabara.

Utunzaji wa siri

Taarifa zitatunzwa kwa siri kwa kutumia herufi au nambari bila majina ya mgonjwa

Madhara /Athari

Hakuna athari au madhara yoyote yanayotegemewa yatokanayo na utafiti huu.

Uhuru wa kushiriki

Kushiriki kwenye utafiti ni hiari yako Unaweza kujitoa wakati wowote Kama utachagua kutoshiriki, mwanao ataendelea kupata huduma kama hapo awali hapa wodini .

Faida ya utafiti

Ukishiriki kwenye utafiti huu , utaelewa Mambo yanayochangia matatizo pamoja na vifo miongoni wa watoto walioungua Hospitali ya taifa Muhimbili.

Taarifa

Endapo unahitaji kupata maelezo kuhusu haki zako au taarifa ,wasiliana na Dr Nyamsha Thadeo Maina.(0784313262 au 0714872231)

Je unakubali kushiriki kwenye utafiti? (weka alama) vema ndiyo /hapana

Mimi ....., nimeelezwa/nimesoma maelezo haya maswali yangu yamejibiwa.

Sahihi ya ndugu/shahidi .....

Sahihi ya Mtafiti .....

Tarehe……