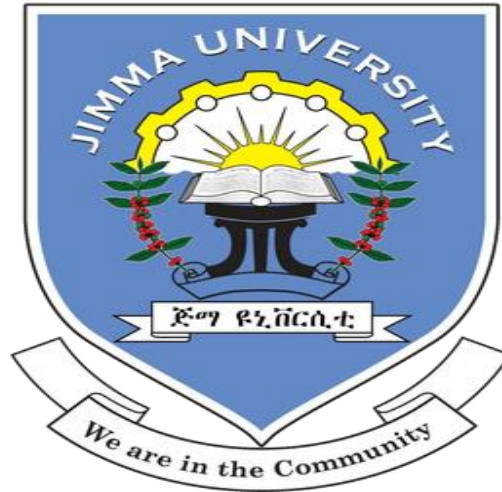


**JIMMA UNIVERSITY INSTITUTE OF HEALTH SCIENCE;  
SCHOOL OF MEDICINE, DEPARTMENT OF SURGERY**



**PATTERN OF PRESENTATION AND MANAGEMENT OUTCOME OF  
PEDIATRIC BURN PATIENTS AT JUMC: SOUTHWEST, ETHIOPIA**

**By: Getaneh Belay (MD)**

**A THESIS TO BE SUBMITTED TO THE DEPARTMENT OF SURGERY,  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR  
SPECIALITY OF GENERAL SURGERY**

**JIMMA, ETHIOPIA**

**Jan, 2022**

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## Declaration

### ASSURANCE OF PRINCIPAL INVESTIGATOR

I, the undersigned agrees to accept responsibility for the scientific ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the faculty of Medical Sciences in effect at the time of grant is forwarded as the result of this application.

Name: \_\_\_\_\_

Signature: \_\_\_\_\_

Name of the institution: \_\_\_\_\_

Date of submission: \_\_\_\_\_

This thesis has been submitted for examination with the approval as the University advisor.

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Name and Signature of the second advisor: \_\_\_\_\_

## Abstract

**Introduction:** Burn is a skin and tissue damage caused by agents like fire, scald, electricity, sunlight and chemical or nuclear radiation. Burn injury is a major global public health problem accompanied by a high risk of mortality and morbidity with estimated annual death is over 310,000. Nearly 75% of burns in young children are due to scald burns. Infants have the highest death rates and large surface area of burn, inhalational injury, poverty, presence of sepsis imposes great factor for mortality and morbidity. It is very crucial for every burn institution to know the specific pattern, cause and management outcome of burn injuries for appropriate treatment and prevention of burn injuries. Very little is known about the patterns and clinical presentation of pediatric burn injuries in developing countries including Ethiopia. There is no pediatric burn study conducted in JUMC.

**Objectives:** To assess the clinical presentation and management outcome of pediatric burn patient at JUMC from Aug, 31, 2020 to Aug, 31, 2022

**Methods:** A Hospital based cross-sectional 2 years retrospective study was conducted in JUMC. Data was collected from patients' chart and were cleaned, coded, checked for completeness, content and quality of data collected supervised to ensure the quality of data and entered into SPSS version 26 for analysis. Descriptive statistics and logistic regression were used to analyze the data and significance is set at P value of  $< 0.05$ . Graphical presentations and logistic regression were used to present the result findings and to ascertain association.

**Results:** Of the 92 paediatric burn patients admitted to JUMC burn unit during the study period, 62% (57) had sustained scald burn while 35.9% (33) of the patients are admitted due to flame burn. 60.9% (56) of the patients had a 2<sup>nd</sup> degree superficial burn with lower extremity and trunk being the most common sites of burn injury. Around 14.1% (13) of the patients developed complication the most common being post burn contracture. A 13% (12) of the patients died while being managed. Larger number deaths were found in children  $< 5$  years and in a patient with high total body surface area burns.

**Conclusion & recommendation:** The common causes of burns in pediatric age group is scalds which are largely preventable. Children need due attention and care as they are easily exposed to burn injury when left alone at home.

**Keywords:** Pediatric, Outcome, Major burn, Complications

## Acknowledgement

First of all, I would like to thank Almighty God who endured me through all these research preparations. I wish to express my sincere gratitude JUMC, department of Surgery for creating this golden opportunity to conduct the research. I would also like to thank all burn unit staffs and card record team staffs of JUMC for their kind cooperation, assistance and support during data collection. In particular, I extend my deepest thanks to my instructor's **Dr. Gersam Abera** and **Dr Mohamod A/Fita** for their guidance on how to develop this research.

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## **Abbreviations and Acronyms**

WHO-----World Health Organization

JUMC-----Jimma University Medical Center

STSG-----Split Thickness Skin Graft

DVT-----Deep Venous Thrombosis

I and D-----Irrigation and Debridement

E.C----- Ethiopian Calendar

G.C----- Gregorian Calendar

ABA-----American Burn Association

TBSA----- Total Body Surface Area

ETB----- Ethiopian Birr

LMIC----- Low- and Middle-Income Countries



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# 1.INTRODUCTION

## 1.1. Background

Burn is a skin and tissue damage caused by agents like fire, scald, electricity, sunlight and chemical or nuclear radiation. Burn injury is a major global public health problem accompanied by a high risk of mortality and morbidity(1).The World Health Organization (WHO) estimates that the annual death due to burns is over 310,000, and low and middle income countries accounts for 95% of all annual burn deaths(2).

Globally, nearly 96,000 children under the age of 18 were fatally injured as a result of a fire-related burn of which majorities of injuries occur in low- and middle-income countries (2). The majority of burns to young children occur as accidents in the home environment usually from scalds which are mainly from hot water and other heated liquids. Contact burns from household appliances such as oven doors, hot irons and wood stoves are also common(3).

In sub-Saharan Africa, it is estimated that between 18,000 and 30,000 children under the age of 18 died annually as a result of burn-related injuries (4). These injuries were rated as the second most common cause of accidental death among African children younger than 5 years of age(1). Burn injuries are very common in developing countries. Burn victims typically come from poor families in rural regions, where fires are necessary for daily living and primary care is practically non-existent(3).

The high incidence of burn injuries in children is attributable to children's impulsiveness, lack of awareness, higher activity levels, natural curiosity, and total dependency on their caregiver (3). Burns in children differ in multiple aspects from adults and may result in a more severe devastating injury (4). These injuries include, acute life-threatening complications (Fluid loss, airway obstruction, renal failure, super-infection) and chronic complications (significant disfigurement, disability and psychological trauma) (4). Additionally, burns account for the greatest length of stay of all pediatric hospital admission injuries and the management of pediatric burns remains complicated, challenging and extremely costly even in well-equipped and modern burn units (2).

Children have a relatively thinner dermis, so any given thermal insult will sustain a deeper burn than the adult (1). The epidemiological patterns of burns vary significantly based on age, sex, economic status, local customs, social, and environmental circumstances. Smoke inhalation is strongly associated with mortality, despite improvements in the care of burns.(4)

Infants have the highest death rates, while those aged between 10 and 14 years have the lowest. The death rate climbs again for 15–19-year-olds (5). Burns are the only type of unintentional injury where females have a higher rate of injury than males (3). The fire-related death rate for girls worldwide is 4.9 per 100 000 population versus 3.0 per 100 000 for boys.(1)

Burn can be assessed using the estimate of the depth, and total body surface area burned (TBSA)(5). Additionally, burns are classified as superficial, partial, and full-thickness, depending on the depth of injury to the skin. Furthermore, it can vary from mild to severe, depending on the total body surface area burned (TBSA), depth, and location of the burn(6).

Researches in the epidemiology of burn injury in many developed and high-income countries made a great contribution for the primary and secondary prevention of fires and burns (2). Unfortunately, many developing countries with a significant incidence of burns do not have adequate data for epidemiological analysis including Ethiopia. So, this study is aimed to assess the magnitude, presentation and management outcomes of pediatric burn at JUMC burn unit over the past three years.

## **1.2 STATEMENT OF THE PROBLEM**

Burn injuries are among the most devastating of all injuries and a major global public health problem (4). Burn injury is a major global public health problem accompanied by a high risk of mortality and morbidity. Globally, nearly 96,000 children under the age of 18 were fatally injured as a result of a fire-related burn (8). Burns which occur in low to middle income countries generally lack the necessary infrastructure to reduce the incidence and severity of burns (9). A sufficient knowledge of the epidemiological characteristics of burns is necessary for their prevention. Sustained research and study on the epidemiology of burns in many developed and high-income countries such as the United States has made a great contribution to primary and secondary prevention of fires and burns (5). Burn injuries are largely considered as being preventable. However, one needs to know the patterns and causes of burn injuries if intervention measures are to be effective (1).

## **1.3 SIGNIFICANCE OF THE STUDY**

Since children are the windows of hope for the future development and existence of a country, it is a great deal to concern about their health and safety. It is very crucial for every burn institution to know the specific pattern, cause and management outcome of burn injuries for appropriate treatment and prevention of burn injuries. In the developing countries like ours, there is a wide gap between the number of burn patients and available resources to manage them. Because of limited availability of specialized burn unit, we have not been able to lower the burn related deaths as compared to the western world. Very little is known about the patterns and clinical presentation of pediatric burn injuries in JUMC. This study will determine the presentation and management outcomes of pediatric burn injuries, which are the prerequisite for planning preventive measures and improving the effectiveness of services delivered by burn care facilities.

## 2. LITERATURE REVIEW

Burn is a trauma where tissue damage is brought on by heat, chemicals, electricity, radiation or the sun (6). Burn injuries are amongst one of the most devastating of all injuries, having a great impact on the patients physically, socially, economically, physiologically and psychologically. Burns are still one of the top causes of death and disability in the world(7).

WHO reported that while fire causes the majority of burn-related deaths in children, scalds and contact burns are an important cause in overall morbidity from burns, and a significant cause of disability (7). Even in high-income countries, children under the age of five have the highest rate of hospitalization from burns, followed by 15–19-year-olds(10). Global estimates revealed that the highest number of pediatric burn admissions per capita is found on the African continent (11). WHO established that between 18,000 and 30,000 children aged 5 years or younger die annually of fire-related injuries in sub-Saharan Africa (12).

The most frequent cause of burn injuries in children is found to be scald in many literatures (6). This might be due to children's attitude in playing (stay) at home or in the kitchen with their mother or guardians where drinks and liquid foods are being prepared (8). Toddlers were more affected by scald burn probably because children start to investigate their environment and learn walking by grabbing different equipment and vulnerable to injury when they are left unattended near hot fluids (4). Another known causes of pediatric burn is electrical, thermal, chemical and radiation burns are among listed causes (1).

WHO found that mortality and morbidity from burns are strongly associated with poverty(7). Many studies also found strong determinant of burn outcome and nutritional status of the patients (5,6). It is also found that extent and depth of burn, presence of inhalational injury, age of the patient, early intervention, proper fluid resuscitation, prehospital intervention, duration of hospital stays are main determinants of burn outcome(13).

Burns are the only type of fatal injury that occurs more in low-income and middle-income countries in the Eastern Mediterranean, Western Pacific Regions and African countries(14). Numerous study conducted showed that poverty as main risk factors for pediatric burn(15).

Socioeconomic factors that increase the risk of childhood burns include: low rate of literacy within the family; living in overcrowded dwellings or with cluttered areas in the home; failure to properly supervise children; a history of burns among siblings; and the absence of laws and regulations relating to building codes, smoke detectors and flammable clothing(16). Fireworks pose a significant risk for children, particularly adolescent boys(12). Fireworks have been banned in many high-income countries, but in most low- and middle-income countries, there are no laws restricting their use.(16)

According to study done in Ondokuz Mayıs University Samsun, School of Nursing, Turkey, it indicates that 18% of burn patients are children under 5, and the most common aetiology in this age group is scalds(9). Burd and Yuen reported that the highest incidence of hospitalised paediatric burn patients is in Africa and the lowest is in the Americas(8). Europe, the Middle East, and Asia show similar figures, but the considerably larger population of Asia indicates that it bears over half of the world's paediatric burn population(11). Studies showed that around 90% of burn occur in LMIC with the highest incidence is in South East Asia(16). Children 0–5 years account for 50% of all burns in children in India(13).

Numerous studies has been conducted and the result of their study showed that Africa as continent had a greater burden of pediatric burn and greater number of pediatric burn has been recorded in Africa(14,15,16). Study made at Red Cross Children's War Memorial Hospital and University of Cape Town, South Africa on Pediatric burn care in sub-Saharan Africa indicated about 70-85% of burn cases are known to happen among children less than 5 years, mostly happening in and around the house, and hot liquid is found to be the most common causative factors followed by flame burn(10). Another study was made at South Africa on pediatric burn injuries over a period of 15 years indicated that 80% of burn injuries occurred in children 0–4 years of age with around 90% of burn injuries occurred in or around the child's home(11). This study found scald injuries as the cause of burn in 74% of the cases followed by flame burn ( 11%)(11).

The study in Nigeria made over 289 pediatric burn over the period of 10 years indicates, pediatric burn constitutes 45.3% of all burn admission, of which 63.7% are found between 0-5 years, 21.1% between 6-10 years with scald burn being the commonest etiology(16).

Study made at southern and central Tunisia over a period of 1 year, in 2017, showed pediatric burn admission accounted for 35% of admission with 44.7% of the burn victims being under 4 years of age(12). Another study conducted at this country also reported 61% of the burn occurred among boys as compared to 39% of girl victims with 95% of burn accident being happened at home(13).

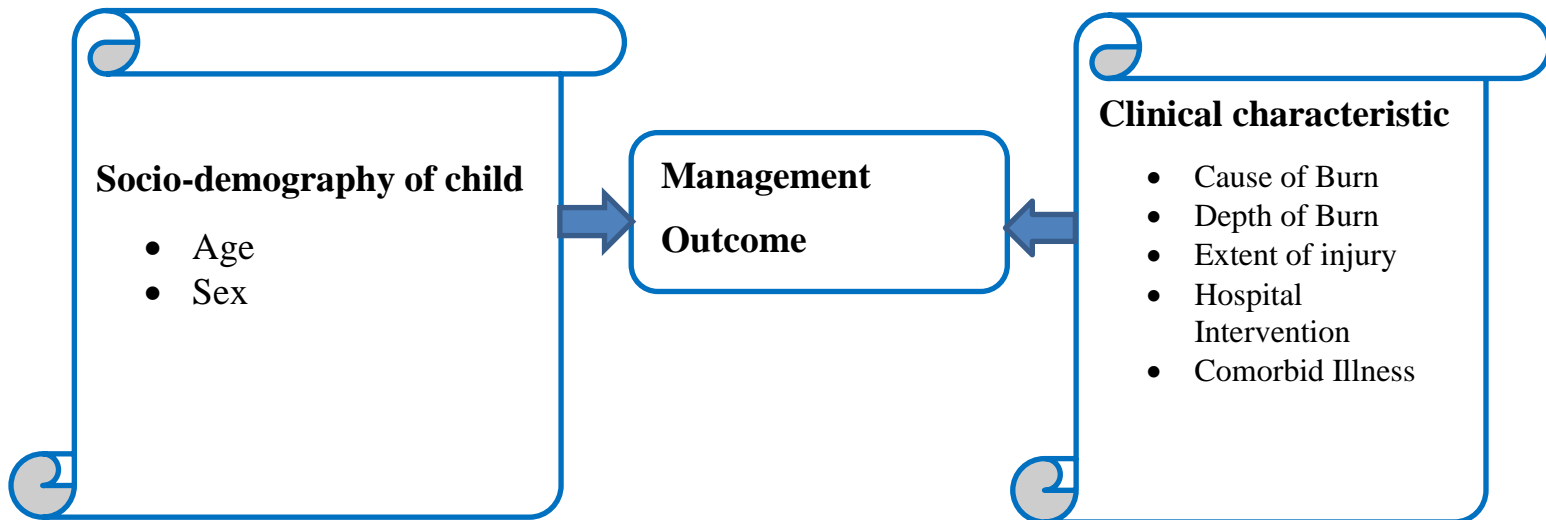
According to study done in 2014 G.C in Ethiopia at Yekatit 12 Hospital showed that the most common causes of pediatric burn is found to be scald in 60% of all injuries and followed by flame burns at 32.9% and 80.1% of the victims had a burn extent of less than 20% TBSA(2).

Research was made at Felege Hiwot Referral Hospital in Bahir Dar town, Northern part of Ethiopia in 2017 G.C on prevalence of burn injuries among children and they found the prevalence was 0.46% which is higher among females comprising 62.7% and scald burn is found to be to be the most common accounting for 42.2 %(7).

Another study was made in Ethiopia on Management Outcome of Burn Injury and Associated Factors among Hospitalized Children at Ayder Referral Hospital, Tigray, 2020 G.C and it showed that scald burn accounts for 69.4% followed by flame burn which accounts for 17.3%(3). The study showed 85% cases of scald burn occurred within the age group of 0-4yrs and 24.3% of patient who did not get fluid resuscitation were discharged with complications(3). Another study done at this Hospital showed that duration of presentation, extent of injury, length of stay, age, fluid resuscitation in 24 hours, and nutritional status of the patient were found to be statistically significant with burn outcome in pediatric age group(6).

Pediatric burn injuries are least explored areas among other injuries. Very little is known about the patterns and clinical presentation of burn injuries in Ethiopia, specifically in JUMC. This study will determine the magnitude, clinical presentation and outcome of pediatric burn injuries, which are the prerequisite for planning preventive measures and improving the effectiveness of services delivered by burn care facilities.

## 2.1 CONCEPTUAL FRAMEWORK



**Figure1:** Conceptual frame work for research on clinical presentation and management outcome of pediatric burn patient at JUMC

## 3. OBJECTIVES

### 3.1 GENERAL OBJECTIVES

- To assess the patterns of presentation and management outcome of pediatric burn patients at JUMC

### 3.2 SPECIFIC OBJECTIVES

- To describe pattern of clinical presentation of pediatric burn
- To assess common causes pediatric burn injuries
- To assess the management outcomes of pediatric burn injuries



## **4. METHODOLOGY**

### **4.1 STUDY AREA**

The study is conducted at Jimma, Oromia JUMC. JUMC is one of the oldest public hospitals in the country, having been established in 1938 as a military hospital under Italian colonial occupation (1936–1941). It is located in the town of Jimma, 352 km southwest of the capital Addis Ababa. Since 1984, JMC has been a training center for health workers including doctors, nurses, pharmacy technicians, laboratory technicians and environmental health experts. It is the only teaching and referral hospital in the southwestern part of the country, with a catchment population of around 15 million. JUMC has 900 beds, including 192 beds in the surgical ward from which Plastic and burn unit accounts for 28 beds from these 12 beds are assigned for Burn patients. There are 7 Nurses, 2 Plastic and Reconstructive Surgeon, 2-4 residents caring for the Plastic and burn units as a unit.

### **4.2 STUDY DESIGN**

- A hospital based cross-sectional study was conducted from Aug 31 2020 to August 31 2022 G.C

### **4.3 SOURCE POPULATION**

- Source population for this study is all burn patients admitted to JUMC burn unit between 2020-2022 G.C

### **4.4 STUDY POPULATION**

- All patient less than 18 years of age who sustained burn injury and admitted to burn unit of JUMC during study period.

### **4.5 ELIGIBILITY CRITERIA**

#### **4.5.1 Inclusion Criteria**

- All burn patient less than 18 years admitted to JUMC burn unit during study period

#### **4.5.2 Exclusion Criteria**

- Incompletely documented cards and lost medical records

## 4.6 SAMPLE SIZE AND SAMPLING PROCEDURES

- All pediatric burn patient admitted to JUMC burn unit during study period were included.

## 4.7 SAMPLING TECHNIQUES

All pediatric patient admitted to burn unit during study period were selected from burn admission and discharge log book and listed using their card number.

## 4.8 MEASUREMENT VARIABLES

### 4.8.1 Dependent Variables

- Management outcome of burn injuries

### 4.8.2 Independent variables

- Age
- Sex of the patient
- Cause
- Depth of burn
- TBSA
- Pre-hospital intervention
- Co morbid illness
- Resuscitation
- Surgical intervention

## 4.8 OPERATIONS DEFINITIONS

**Pediatric age group:** all children less than 18 years old

**Complications:** is any complication that develop during phase of burn management or on follow up from abnormal wound healing during study period.

**Total body surface area (TBSA):** is an estimate of the percentage of total body surface area involved in burn exposure and injury

**First-degree (superficial) burns:** are superficial and involve just only the epidermis. These burns have a red, hyperemic appearance of the surface, which, along with the hypersensitivity and discomfort, is typical of these injuries.

**Second-degree burns (partial thickness):** involve the epidermis and part of the dermis(papillary) layer of skin. Moist, pink appearance that blanches with pressure, along with extreme pain and hyperesthesia, blister is common in these injuries.

**Deep second-degree burns:** the epidermis, papillary dermis, and various depths of the reticular (deep) dermis have been damaged. Hyposthesia, dry, white pink appearance is the common findings.

**Third degree burns or full-thickness burns:** epidermis, dermis, and different depths of subcutaneous and deep tissues have been damaged. A dry, white, or charred appearance is common with absent pain.

**Scald:** is a type of burn injury caused by hot liquids or gases

**Outcome:** patient recovery with or without complication or death.

**Incompletely documented card:** a patient chart that lacks full history and physical examination

**Major Burn:** Those with > 10% TBSA according to American Burn Association guideline

#### **4.9 DATA COLLECTORS AND DATA COLLECTING PROCESS**

Data was collected by trained health workers and supervised by principal investigator. The trained collector was involved in data collection process using the data collection sheet. Burn patients admitted to burn unit of JUMC is initially identified from burn unit log book. Pediatric burn patient admitted to burn units are identified based on their identified card number, and their chart records are retrieved from card room and all relevant information are collected from their charts after taking legal permission from hospital administration. The collection is started from Aug, 2022 G.C.

#### **4.10 DATA COLLECTION INSTRUMENTS**

An extraction format that contains study variables of interest were prepared in English language to extract relevant information about age, sex, address, clinical features, extent and depth of burn, intervention given, investigations, diagnosis on admission, co morbidities and final patient outcome. Data was collected on excel sheet. A computer was used for collected data as storage.

#### **4.11 DATA QUALITY CONTROL MEASURES**

Data collectors were trained and regular follow up was made. Content and quality of data collected daily supervised to ensure the quality of data. Improperly collected data were refilled using inclusion criteria after communicating personally to data collectors. Pre-test was done on 5 % of records before the actual data collection started to make sure that the data collecting sheet is capable of yielding the required data for the study and some modifications were done according to the results found. The data were collected from patient charts that were registered by ward physician. The data collection format was checked for its completeness and gaps identified were corrected immediately.

#### **4.12 DATA PROCESSING AND ANALYSIS**

After data collection, each questionnaire was given a unique code by the Investigator. Data was analyzed by SPSS version 26. Frequency distribution was done for appropriate variables. The generated data was compiled by frequency tables, charts, and graphs. Data was double entered to confirm cleanliness. Descriptive statistics and multiple logistic regression were used to analyze categorical variables and significance is set at P value of  $< 0.05$ .

#### **4.13 ETHICAL CONSIDERATION**

Ethical clearance was obtained from JU, Institutional Health Research Ethics Review Committee. Then, official letter for cooperation and permission was delivered to the JUMC and to all responsible bodies to get permission for the study. Moreover, brief explanation was given to the hospital manager concerning the purpose of the study and the procedures used to

collect the data. After getting permission, patient's charts that fulfilled the criteria were selected. Confidentiality of data collected was kept and names of the patients were not included during data collection

#### **4.14 DISSIMINATION OF THE RESULT**

The finding of the study will be presented to the Department of Surgery at JU and shared with JUMC, to other targeted health facilities. It will also be disseminated through presentations in different professional association meetings and annual conferences. Further attempt will be made to publish it on national and international scientific journals

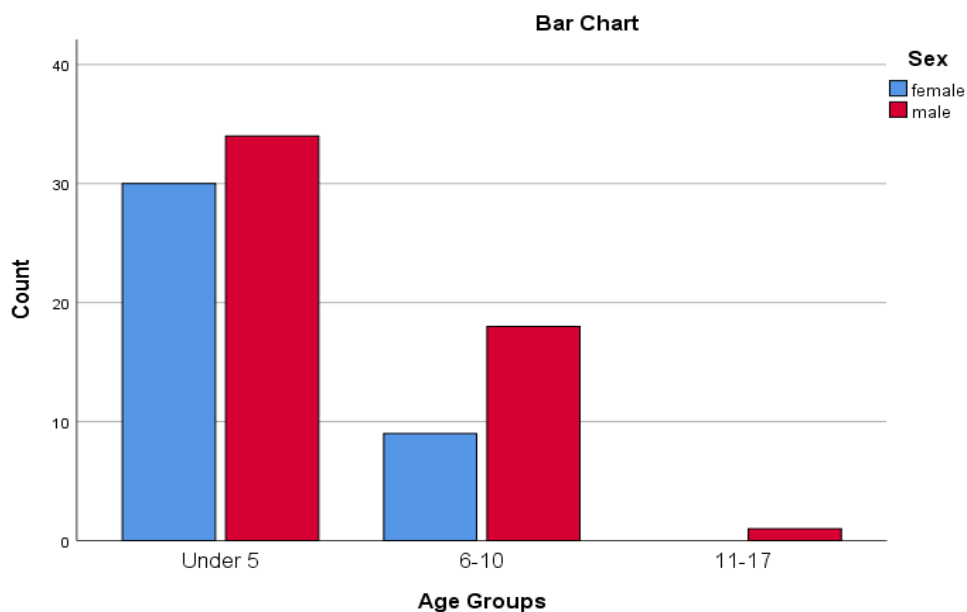
## **5. Results**

A total of 173 burn patients had been admitted to JUMC burn unit from Aug 30, 2020- August 30, 2022 G.C. Among them 92 (53.1%) patients were in a pediatric age group.

### **Socio-demographic characteristics of the patients**

Of 92 paediatric burn patients admitted, 71(77.2%) were from Jimma zone, mainly from Jimma town while the rest came from different woreda around Jimma. Total of 14 (15.2%) patients were referred from Southern Nations, Nationalities, and Peoples' Region and other rural parts of Ethiopia. Most of the patients are from rural area 63 (68,4%).

In this study 39 (42.4%) of the paediatric burn victims were females while 53 (57.6%) of the victims were males (1.35:1). Mean age of the children was 4.5 years. Children  $\leq$  5 years accounts for largest proportion of the burn victims accounting for 64 (69.6%) paediatric burn injury. The number of children who sustained a burn injury decreases as their age increases. Male victims are dominant in all age category.



**Figure 2. Frequency of pediatric burn within age category**

### **Causes of burn injury**

This study showed that the most frequent cause of burn in paediatric age group was scald burn which accounts for **62%** (57) of the cases, followed by flame burn which accounts for 35.9% (33) of pediatric burn. Electrical burn accounts for 2.2% (2) of causes of burn. A 47.8% (44) of scald burn were due to splashing of hot water while 9.8% (9) were due to hot coffee on the body. Children <5 years accounts for the largest number of scald injury, while in those 11-17 age groups, flame burn was found to be the commonest cause of burn.

<b>Cause of Burn</b>	<b>Frequency</b>	<b>Percent</b>
Electrical	2	<b>2.2</b>
Flame	33	<b>35.9</b>
Scald	57	<b>62.0</b>
<b>Total</b>	<b>92</b>	100.0

**Table 1. Causes of Burn**

## Extent and Depth of Burn Injury

The study showed that majority of the patients have sustained burn injury involving >10% of total body surface area which accounts 64.1% (59) and 15.2% have sustained above 25% of Total body surface area. (Table 2).

Only 29.3% (27) of patients sustained a burn injury of 5-10% TBSA. From those less than 10% of TBSA 21 patients had multiple sites of injury which involves either face or perineum.

This study showed that most of the victims had a major burn as per American Burn Association severity classification. A 60.9% (56) of the patients had developed superficial partial thickness burn, while 20.7% (19) had deep partial thickness burn. Only 16.3% (15) of patients had 3<sup>rd</sup> degree burn.

TBSA	Frequency	Percent
Less than 5	6	6.5
6-10	27	29.3
11-15	17	18.5
16-20	17	18.5
21-25	11	12.0
Above 25	14	15.2
Total	92	100.0

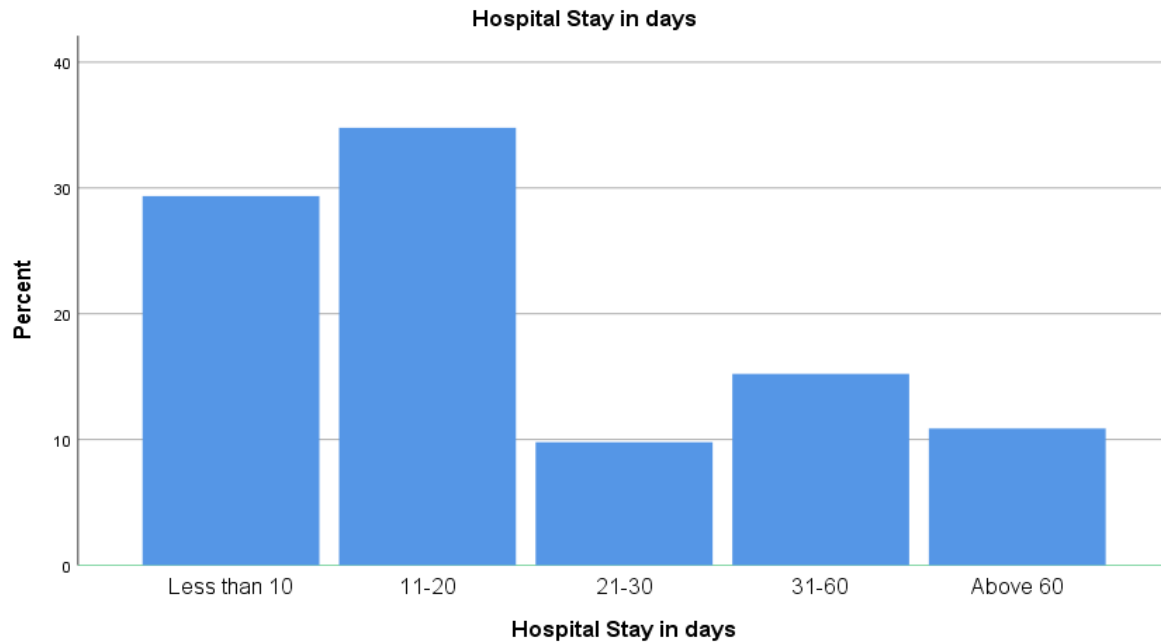
**Table 2. TBSA of paediatric burn**

## Duration of time before medical intervention

The study showed 54.3% (50) of the patients seek health facility within the first 24hours after sustaining burn and 70.7% (65) patients got pre hospital intervention at nearby health facility before arrival to the hospital.

## Hospital stays in days

This study showed that the mean length of hospital is 25.46 days (SD: 27.176: Range 1-180 days). 64.1% of patients stayed less than 20 days.



**Figure 3. Length of Hospital stay**

### **Anatomic location of burn**

According to this study 47.83% (44) of patients sustained burn injury involving upper extremity, while 54.35% (50) of the patients had burn to their trunks. Around 50% (46) had sustained burn to their lower extremity and 14.13% (13) and 10.87% (10) of the victims had a burn involving perineum and face respectively. Most of the patient had burn injury to more than one anatomic site

### **Co morbid Illnesses**

Only 9.8 % (9) of the patients had known co morbid illnesses. All these patients are known epileptic patients on follow up. Most patients 55.5% (5) with comorbid illness who sustained burn injury were found to have major burn.

### **Interventions Taken in the Hospital**

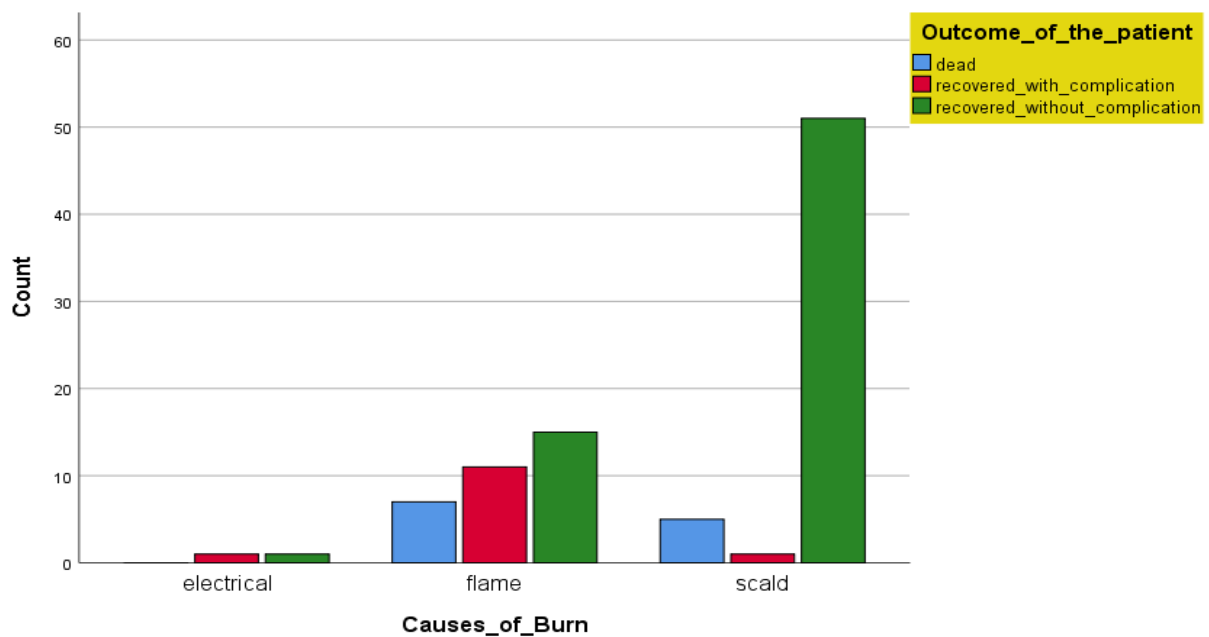
This study shows all paediatric burn admitted to burn unit got wound care and 92.39 (85) of patient get analgesics. 40.22% (37) patients had been resuscitated with ringer lactate on initial arrival to JUMC emergency OPD. 82.61% (76) patients had been treated with systemic antibiotics while only 44.57% (41) of patients are undergone I and D. Ulcer prophylaxis had been given only to 15.22% (14) of patients while only 1.38% (1) of patient is given DVT prophylaxis.



The study showed that 15.22% (14) of the patients burn wound had been covered by split thickness skin graft while only 4.3 % (4) of the patients had been treated with contracture release and amputation is done for 4.3% (4) patients. It is found that escharotomy was done for 1.1% (1) of patients diagnosed to have neglected compartment syndrome clinically.

## Complication

The study showed, around 14.1% (13) of the patient recovered with long term complications and the common complication is post burn contracture in 61.5% (8) patients during the study period. Additionally, 39.5% (5) patients developed extremity gangrene from which 4 undergone amputation and 1 patient declined the surgery. Cross-tab analysis showed that 58% (7) of death and 84.6% (11) of long-term complications is occurred in flame burn compared to the others (fig.3). The study showed that 62% (5) of patients who developed contracture are those who sustained initial burn injury to lower extremity. No patients had developed keloid.

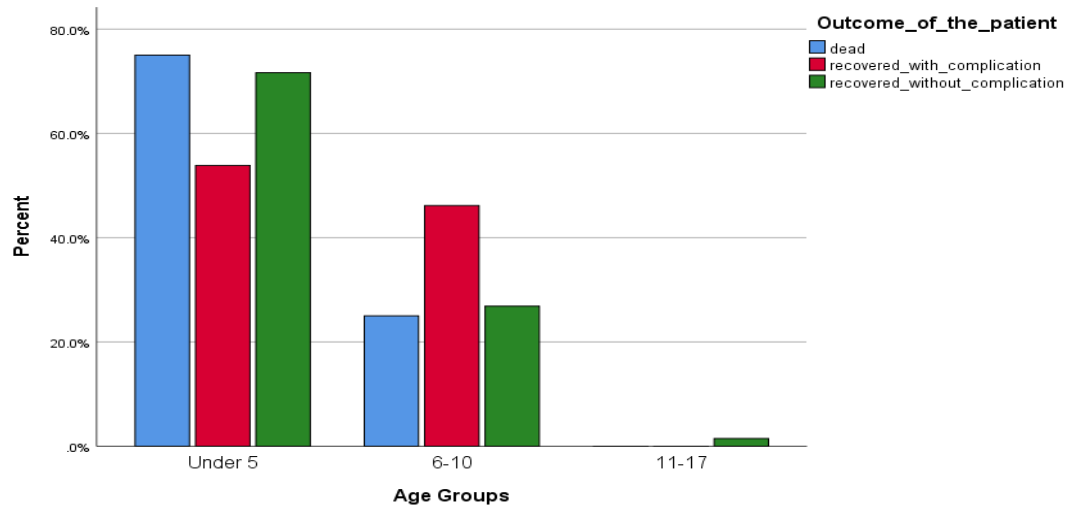


**Figure 4. Patient outcome within type of burn**

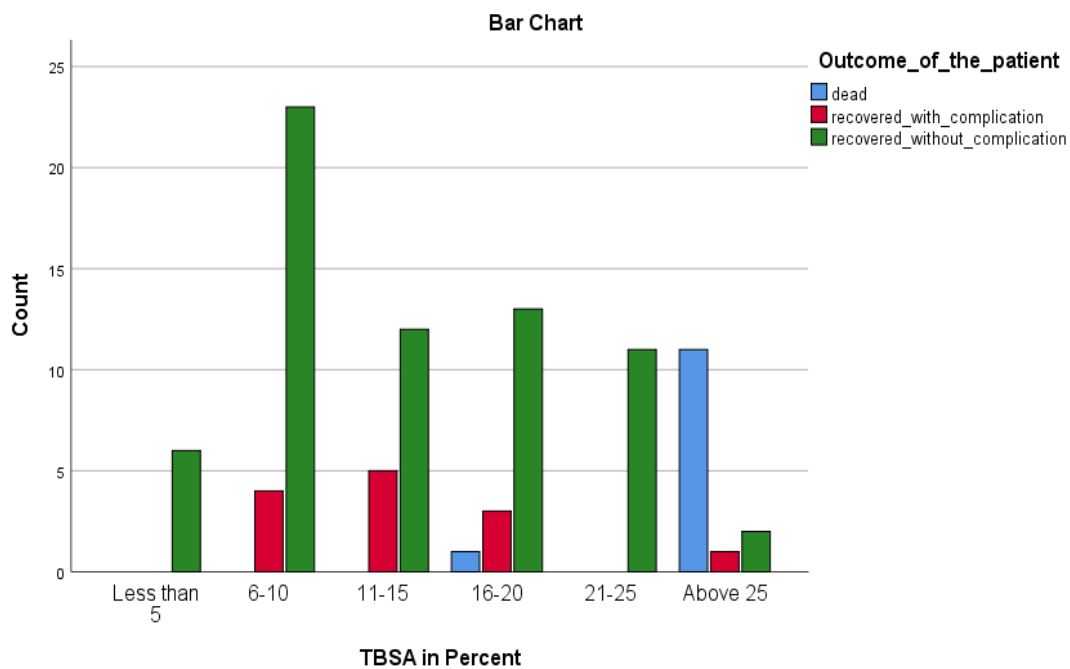
## Outcome

There were 12 deaths found during study period which accounts for 13% mortality rate. The study showed large number of deaths are found in children < 5years of age (75%) (Fig.4) and those with major burn (>10% TBSA) (Fig.5). In the bivariate analysis, TBSA and depth of

injury were found to be statistically significant with burn outcome ( $P= 0.001$ ). After multiple logistic regression was performed to ascertain the effect of age, sex, cause of burn, depth and extent of burn, resuscitation with crystalloid on patients recovered with complication and who ended up on death. There is no statistically significant association found.



**Figure 5. Patient outcome within age category**



**Figure 6. Number of deaths with respect to TBSA of burn**

## 6. Discussion

Burn injury is one of the most devastating and disabling trauma to human being and it remains a serious threat to the well-being of the pediatric population and still has major cosmetic and functional consequences. It is one of the commonest causes of hospitalization in pediatric population.

Burns were frequently seen in preschool period and children aged between 0 and 5yrs. This study showed that highest proportions of burn injuries were seen between age 0 and 5 years which accounts for 69.6% paediatric burn. The study done at University of Cape Town, South Africa, shows comparable results showing children <5 years accounts for 73.1% paediatric burn injury(17). Similar study done at India also shows 60% of paediatric burn occurs in children < 5years(5). Study done at Ayder Referral Hospital, Tigray showed 64.1% paediatric burns happen in children <5yrs (3). WHO also reported that highest proportion of paediatric burn occur between 0 and 5years(18). This similarity may be due to the fact that children in this age group always want to discover their surroundings and more supervision is essential as the child gains manipulative skills that are coupled with in satiable playing around the kitchen and lack of parental supervision which were leading predisposing factors for burns in children of this age group(1).

This study revealed that 9.8 % of the patients had known comorbid illnesses. Patients with comorbid illness who sustained burn injury were found to have high extent of injury. The study conducted at Felege Hiwot referral hospital shows comorbid illness accounts for 15.7% from this half of them are known epileptic patient(1). This low rate can be explained by poor documentation of some comorbid illness such as Down syndrome our cases.

This study showed scald as the leading cause (62%) of paediatric burn. Study done at Yekatit 12 Hospital showed 60% of cause of paediatric burn to be scald(2). Similar study done at Ayder referral hospital showed 64.7% of cause pediatric burn to be scald injury(3). This can be explained by the fact that children stay with their mothers or caregivers at home and would probably be left playing in the kitchen environment; as a result, they can get scalded by liquid foods being cooked by their parents or caregivers.

This study showed that 72.8% of patients had < 20% of TBSA of burn. The study conducted in Israel which shows around 83% of paediatric burn of <20 TBSA(19). The study done at Yekatit 12 Hospital also showed around 80.1 % of paediatric burn patients had < 20% TBSA

of burn(2). This a slightly higher extent of burn injury in our setup may be due to open fire cooking methods and most patient are from rural area whose guardians lack good awareness.

This study revealed that trunk and lower extremity is the commonest anatomy to be involved (54.3%) and (50 %) respectively. This finding was similar with a study conducted in Yekatit 12 hospital (2). This can be explained by the fact that scald burns frequently occurred when children reached for hot liquid while playing, by pulling a hot substance from a cooking stove. This could result in spillage of the hot substance on the children's extremities and trunk.

According to this study 72.8% of the patients were discharged without complication. The study conducted at Ayder referral hospital showed 82.7% were discharged without complication and 17.3% with complication(3). Another study from South India found that 74% of children with burns were discharged with improvement (5). Another study conducted in Nigeria showed that 70.1% cases were favourably managed without complications(9). Most of the study has comparable results, this can be explained by the fact that scald burns which is the commonest cause in pediatrics results in superficial injury which is associated with less physiologic disturbance and less complication up on healing.

This study showed majority of patients with flame burn ended up with complications which mainly contributes to functional loss. Various studies have shown similar results, with flame burns causing deeper burns, resulting in increased loss of function, cosmetic disruption, and complications from prolonged patient hospitalization.

This study showed that the mean length of hospital is 25.46 days and majority 64.1% stayed for less than 20 days. The study which was done Yekatit 12 Hospital concluded he mean length of hospital stay was 21.25 days (range: 1-257 days) days.(2).

This study showed 13% of patients died during the study period. This finding is higher than study done at Yekatit 12 hospital with mortality rate of 7.85%(2). Another study in southern India showed that 20% of children died. In Iranian study the mortality of pediatric burn patient was 5.6%(4). Another study which was done in South Gondor Zone Ethiopia showed that the mortality in burn victim children is 8.5%(20). This high mortality in this study can be explained by fact that there is lack of standard burn unit and low number of trained professionals in our setup.

## **Limitations of the study**

Since this study was a retrospective study, including other characteristics that can only be assessed by observation or history taking was not possible. Some of the selected cards were lost. There were also incompletely written charts.

## **Conclusion**

Most often, the causative agent of children's burns was a scald, followed by a flame. Children under 5 years of age had the highest proportion of burn and the number of children who sustained a burn injury decreases as their age increases. Most of the injuries were confined to the trunk and extremities.

The majority of the burns were superficial partial thickness burns and most of pediatric burn patients were discharged without any complications. The mortality was 13% and TBSA and depth of injury was significantly associated with pediatric burn outcome. The common comorbid condition identified in pediatric burn is epilepsy in which flame injury is the most common type.

Finally, burn injuries are common throughout the world specifically in undeveloped countries like ours where people frequently use traditional burning stoves and open fire cooking. There is also lack of availability and access to burn care unit or facility and proper treatments are limited.

Pediatric burn continues to lead to significant public health burden especially in Low- and Middle-income countries (LMIC). Majority of the burns are from preventable causes and it is important to know its association with high mortality, morbidity and long-term disability and disfigurement in many of these countries.

## **Recommendations**

- The leading causes of burn are hot water, coffee, oil, and soup which are preventable. Playing around open fire cooking stove and lack of parental care were leading predisposing factors for burns in children. Crawling children are especially at risk of burns since they move around the house they should be kept in their bed or room while caregivers are cooking and shouldn't be left unattended. It's better to separate cooking area from living area.

- It is advisable to give health education to caregiver about safe cooking environment
- Special training should be given for professional working in burn unit to give maximal care.
- The interdepartmental link between Burn unit and Physiotherapy unit has to strengthen to prevent complication like contracture
- Further researches are needed to assess proper implementation of management principle in handling and to assess factors affecting outcome.
- Coordinated efforts are needed to reduce the incidence of burn injuries and high mortality, morbidity, and other long-term disability through effective burn prevention campaigns and improved care for injured patients.
- Epilepsy patients need better care and be aware of burn injuries.

## References

1. Gessesse FG, Yitayew YA. Epidemiology of burn injury among children ' s attended felege hiwot referral hospital in bahir dar town , amhara regional state , Ethiopia , 2017. 2020;10(1):21–7.
2. Tadele a. Magnitude, clinical presentation, and outcome of pediatric burn injuries at yekatit 12 hospital, addis ababa, ethiopia. 2014;
3. Alemayehu S, Afera B, Kidanu K, Belete T. Management Outcome of Burn Injury and Associated Factors among Hospitalized Children at Ayder Referral Hospital ,. 2020;2020.
4. Smolle C, Cambiaso-daniel J, Forbes AA, Wurzer P, Hundeshagen G, Branski LK. ScienceDirect Recent trends in burn epidemiology worldwide : A systematic review. Burns: <http://dx.doi.org/10.1016/j.burns.2016.08.013>
5. Dhopte A, Tiwari VK, Patel P, Bamal R. Epidemiology of pediatric burns and future prevention strategies — a study of 475 patients from a high-volume burn center in North India. *Burn Trauma* [Internet]. 2017;1–8.
6. Lee KC, Joory K, Moiemmen NS. History of burns : The past , present and the future. 2014;2(4):169–80.
7. Golshan A, Patel C, Hyder AA. A systematic review of the epidemiology of unintentional burn injuries in South Asia. *J Public Health (Oxf)*. 2013 Sep;35(3):384-96. doi: 10.1093/pubmed/fds102. Epub 2013 Jan 14. PMID: 23321681.
8. Koç Z, Sağlam Z. Burn epidemiology and cost of medication in paediatric burn patients. *Burns*. 2012;38(6):813–9.
9. Olawoye OA, Iyun AO, Ademola SA, Michael AI, Oluwatosin OM. Demographic characteristics and prognostic indicators of childhood burn in a developing country. *Burns* [Internet]. 2014;40(8):1794–8. Available from: <http://dx.doi.org/10.1016/j.burns.2014.04.008>
10. Albertyn R, Numanoglu A, Rode H. Pediatric burn care in sub - Saharan Africa. 2014;3(2).
11. Wesson HKH, Bachani AM, Mtambeka P, Schulman D, Mavengere C, Stevens KA, et

- al. Pediatric burn injuries in South Africa: A 15-year analysis of hospital data. *Injury* [Internet]. 2013;44(11):1477–82.
12. Ghorbel I, Bouaziz F, Loukil K, Moalla S, Gassara M, Ennouri K. ScienceDirect Epidemiological profile of burns in children in central and southern Tunisia : A 67-case series. *Arch Pédiatrie* [Internet]. 2019;26(3):158–60.
  13. Hashemi SS, Sharhani A, Lotfi B. A Systematic Review on the Epidemiology of Pediatric Burn in Iran. 2017;1–8.
  14. Wang S, Li D, Shen C, Chai J, Zhu H, Lin Y, et al. Epidemiology of burns in pediatric patients of Beijing City. *BMC Pediatr* [Internet]. 2016;1–7. Available from:
  15. Lee CJ, Mahendraraj K, Houg A, Marano M, Petrone S, Lee R, et al. Pediatric Burns : A Single Institution Retrospective Review of Incidence , Etiology , and Outcomes in 2273 Burn Patients ( 1995 – 2013 ). 2016;579–85.
  16. Banerjee S, Shumba C. A systematic review of epidemiological patterns and proposed interventions to address pediatric burns in Nigeria. *Afri Health Sci*. 2020; 20(2): 991-999. <https://doi.org/10.4314/ahs.v20i2.56>
  17. Van Niekerk A, Rode H, Laflamme L. Incidence and patterns of childhood burn injuries in the Western Cape, South Africa. *Burns*. 2004 Jun;30(4):341-7. doi: 10.1016/j.burns.2003.12.014. PMID: 15145192.
  18. Sengoelge M, El-Khatib Z, Laflamme L. The global burden of child burn injuries in light of country level economic development and income inequality. PMID: 28316905; PMCID: PMC5345966.
  19. Goldman S, Aharonson-Daniel L, Peleg K; Israel Trauma Group (ITG). Childhood burns in Israel: a 7-year epidemiological review.. Epub 2006 Apr 18. PMID: 16621302.
  20. Tiruneh, C.M., Belachew, A., Mulatu, S. *et al.* Magnitude of mortality and its associated factors among Burn victim children admitted to South Gondar zone government hospitals, Ethiopia, from 2015 to 2019. *Ital J Pediatr* **48**, 12 (2022).



## Annex

This Extraction Format is prepared to assess, presentation and management outcome of pediatric burn patient at JUMC. This will be filled by the data collectors from patient record charts.

### I. Socio-demographic data of the child

- a) Age -----
- b) Sex-----
- c) Address -----
- d) Card Number-----

### II Socio demographic data of the parent or guardian

- a) Age-----
- b) Sex-----
- c) Marital status of parents or guardians 1) married 2) single 3) divorced
- d) Educational status of the parent or the guardian 1) Uneducated 2) Educated
- e) Relation of the care taker to the child 1) Parent 2) Grandparent 3) specify---
- f) Phone Number-----

### III Clinical Data

- a) Causes of burn 1) scald 2) flame 3) electrical 4) chemical 5) specify-----  
-----
- b) If the cause of burn is scald, what type it is 1) hot water 2) hot milk 3) hot tea 4) hot coffee 5) soup 6) specify
- c) Place/setting/ of injury 1) home 2) work place 3) school 4)specify-----  
-----
- d) Anatomic site of burn 1) upper extremity 2) Lower extremity 3) trunk 4) head and neck 5) Face 6) perineum 7) Inhalational Injury 7) specify-----
- e) Depth of burn 1) first degree superficial burn 2) 2<sup>nd</sup> degree partial thickness burn 3) 2<sup>nd</sup> degree deep burn 4) 3<sup>rd</sup> degree burn 5) 4<sup>th</sup> degree burn
- f) Extent of burn (% of total burn surface area) -----
- g) Duration of burn in hours before getting medical intervention-----
- h) Any pre hospital Intervention 1) yes 2) No

- i) If pre hospital intervention given, what type of interventions were given-----  
-----
- j) Length of Hospital stay in days-----
- k) Mechanism of injury 1) intentional 2) unintentional
- l) Any known comorbid illnesses 1) Yes 2) No
- m) If yes 1) epileptic 2) RVI 3) down syndrome 4) cerebral palsy 5) specify
- n) Intervention taken 1) resuscitation 2) pain control 3) GI – ulcer prophylaxis  
4) DVT prophylaxis 5) Antibiotic 6) wound care 7) I/D 8) STSG 9) Flap  
Coverage 10) specify-----
- o) Outcome of the patient 1) recovered without complication 2) dead 3)  
recovered with complication
- p) If complication encountered 1) hypertrophic scar 2) keloid 3) contracture 4)  
specify-----