



## Evaluating Burn Injuries at the University of Sierra Leone Teaching Hospitals Complex, Freetown.

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### ABSTRACT

**Background:** As with most low- and middle-income countries (LMICs), burns are a major public health problem in Sierra Leone, yet they are poorly studied. This retrospective study of burn injuries at the Connaught Hospital unit of the University of Sierra Leone Teaching Hospitals Complex aims to bridge this gap by examining the patterns and outcomes of burn injuries over a two-year period and comparing these findings with previous studies from the same region.

**Methods:** A total of 146 patients were included in the study over a two-year period from January 1, 2021, to December 31, 2022.

**Results:** The 146 patients seen during the study period represented an average rate of 1.39 cases per week. The median age was 3.9 years (range: 2 months to 56 years) with 59.4% male involvement. Eighty percent suffered from scalds, mostly from hot water. The modal percentage of Total Body Surface Area (%TBSA) affected was 10% (range: 1–75%), and 68.1% had superficial partial thickness burns. The %TBSA of scalds was significantly smaller than that of flame burns. The most common complication was anaemia.

**Conclusions:** Burns continue to pose a significant challenge in Sierra Leone and the situation has not changed significantly over the past decade. There is a need to institute burn preventive measures in the country and to have dedicated functioning burns units to address this common public health problem.

**Key words:** Burns, Sierra Leone, Scalds, Flame burn.

### 1. INTRODUCTION

Fire has been both a friend and foe to humans since prehistoric times, and burn-related injuries are a significant public health issue globally.<sup>1,2</sup> They are responsible for a substantial number of disability-adjusted life years (DALYs) and are the fourth most common cause of trauma-related death worldwide.<sup>2</sup> Low- and middle-income countries (LMICs) are disproportionately affected, accounting for 70% of reported cases globally.<sup>3-5</sup>

The epidemiology of death from burns varies by environment, influenced by a range of factors including socioeconomic status, cultural practices, occupational hazards, access to and quality of healthcare, prevention and health education, materials used in housing, emergency services, and the presence of legislation and public health policies.<sup>2,5-8</sup> These elements differ significantly between LMICs and high-income countries (HICs), leading to varying epidemiology of burns in these settings.<sup>9</sup> Globally, the most common causes of burn deaths are related to flames, hot liquids, and surfaces, with age, sex, behavioral patterns, and environmental factors acting as significant risk factors.<sup>10</sup> Furthermore, outcomes of burn treatment are markedly worse in LMICs compared to advanced countries, likely due to disparities in the quality of healthcare, including the availability of advanced pre-hospital trauma care systems and sophisticated hospital care.<sup>7</sup>

Regarding the African continent, and Sierra Leone in particular, there is a notable lack of published data on burns.<sup>6,11</sup> For example, a literature search using "burns" and "Sierra Leone" as keywords on

Google Scholar yielded just three burns-specific articles: an abstract of a conference presentation, a case report of a tanker explosion, and a community-based study.<sup>12-14</sup> This retrospective study at Connaught Hospital within the University of Sierra Leone Teaching Hospitals Complex, Freetown, aims to augment the knowledge base of burn injuries in Sierra Leone by investigating the pattern of presentation and outcomes of burn injuries, thereby aiding stakeholders in comprehending and addressing the issue more effectively.

## 2. PATIENT AND METHOD

This study was a retrospective, cross-sectional analysis of burn patients presenting to Connaught Hospital, part of the University of Sierra Leone Teaching Hospitals Complex in Freetown, Sierra Leone, from January 1, 2021, to December 31, 2022. Connaught Hospital, a 300-bed facility with 123 surgical beds, lacks a dedicated burn unit, although it currently has two plastic surgeons who joined its service in 2021. However, it features an 18-bed accident and emergency (A&E) unit, where all burn injury cases receive initial assessment before they are either transferred to other wards or discharged home. Sierra Leone is a coastal country in West Africa with more than two-thirds of the population living in rural areas.<sup>15</sup> Burns incur an estimated 195 DALYs per 100,000 people annually worldwide.<sup>15</sup> About 10.8% of government expenditure is used for healthcare.<sup>16</sup>

The treatment protocol for burn patients at our center includes resuscitation according to the Advanced Trauma Life Support (ATLS) protocol for burns patients, when indicated. Thereafter, all patients receive immediate wound care, which includes debridement depending on the extent of the burn injury, cleaning with an antiseptic solution, followed by saline irrigation, and the application of silver sulfadiazine cream. The wounds are then wrapped with sterile gauze and crepe bandage. Dressings are changed based on the extent of wound exudate—daily, every other day, or once every three days. This continues until the wounds heal. Wounds that do not heal within three weeks or those that are deep partial or full thickness are scheduled for split-thickness skin grafting. Antibiotics are administered routinely.

Data collected for the study include socio-demographic information, injury mechanism, burn injury aetiology, injury location, estimated burn size and nature, affected body parts, inhalational injury, treatment administered, and patient outcomes from the hospital records. Due to the nature of data collection, only cases that were admitted to the ward were included.

The percentage of total body surface area (%TBSA) burned was determined using the Lund and Browder chart for both children and adults, and the rule of palm for assessing smaller areas. Based on the burn severity and any comorbid conditions, patients were either discharged from the A&E or admitted to the wards for further inpatient treatment.

### 2.1 Data Analysis

The collected data were entered into IBM SPSS Statistics for Windows, Version 25 (IBM Corp., Armonk, N.Y., USA) for comprehensive analysis. For categorical variables, frequencies were calculated to summarize and describe the data. Continuous variables were analysed using either the mean or the median, contingent upon the distribution's normality. Both charts and tables were employed for graphical representation of data.

### 2.2 Ethical Consideration

No formal ethical approval was sought for this retrospective study, however patient confidentiality and anonymity was ensured and data security was ensured throughout the study process

### 2.3 Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## 3. RESULT

Over the course of two years, 146 patients with acute burns were treated at the emergency department and admitted to the wards of the Connaught Hospital, USLTHC, Freetown, Sierra Leone. This represents a rate of 1.39 patients per week and 6.88% of all cases presenting to the hospital's emergency unit during the study period.

### 3.1 Age and Gender

The median age of the patients in the study was 3.8 years with a range of two months to 56 years (IQR 1 – 4.5 years). Neonates, infants, and pre-school children (<6years old) accounted for

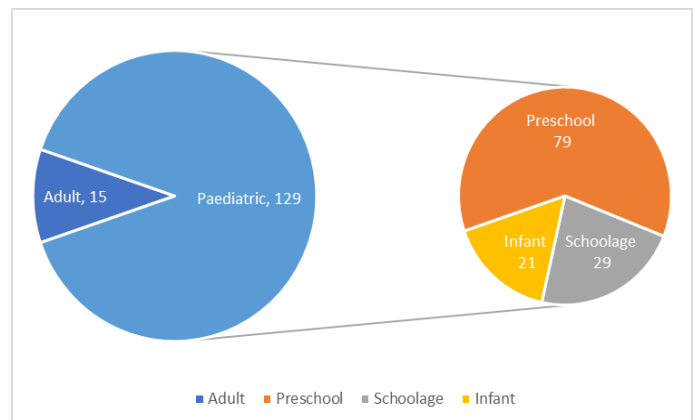


Figure 1: Age distribution of burn injury patients

74.7% of the total number of patients (Figure 1). Only 15 (10.3%) patients were adults older than 14 years. There were 58 (40.6%) females and 85 (59.4%) males with a female-to-male ratio of 0.67:1.

Table 1: Comparison of Mean Ages Across Different Age Groups of Burn Patients

	Female (SD)	Male (SD)	P-Value
All Paediatric age group	3.1 (2.5)	2.3 (2.1)	0.46
Infant (Months)	12.3 (1.8)	11.3(1.5)	0.021
Preschool (Years)	5.5 (5.7)	2.5 (3.3)	0.028
School Age (Years)	10.3 (3.8)	5.9 (3.8)	0.91
Adult (Years)	28.6 (9.3)	37.2 (14.4)	0.121
All Cases (Years)	5.3 (7.9)	6.4 (12.4)	0.05

An analysis comparing ages across different groups showed that, overall, females were younger than males. However, within specific paediatric subgroups, such as infants and preschoolers, females were significantly older (Table 1).

### 3.2 Temporal Attributes

There was no statistically significant difference in day of the week, weekend versus weekday, or month of the year for presentation of burn patients. Eighty-two (56.2%) of the burns occurred in the rainy season, while the remaining 62 (42.5%) occurred in the dry season.

### 3.3 Mechanism of Injuries

Of the 134 cases whose mechanisms of injury were recorded, 120 (89.5%) were due to accidental spillage of hot water and other food-related liquids, while direct flame burns from kerosene stoves, cooking gas explosions and electrical flash burns were responsible for the remainder (Table 2). One child sustained his burn injury while he was having an epileptic fit. One hundred and thirty-two (91.03%) burns occurred accidentally, 8 (5.5%) were work-related, 4 (2.7%) were suspected to be self-inflicted, and one

**Table 2: Causes of burn injuries**

	Frequency	Percentage
<b>Scald</b>		
Hot Water	102	76.1%
Hot Cooking Oil	10	7.4%
Hot Soup/Beverage	8	6.0%
<b>Flame</b>	12	8.6%
<b>Electricity</b>	2	1.4
<b>Total</b>	134	100%

(0.7%) was a result of an assault. One hundred and ten (75.8%) injuries occurred in the presence of eyewitnesses.

### 3.4 Presentation

The modal %TBSA was 10%, ranging from 1-75%. The median TBSA from scalds were significantly smaller than the TBSA from flames and scalds predominantly affect the paediatric age groups (Table 3). However, the duration of admissions for flame and scald were not significantly different from each other. Ninety-six (68.1%) patients had superficial partial thickness burn, 37 (26.2%) had mixed thickness burn while 4 (2.7%) each had deep partial thickness or full thickness burns. Most patients had involvement of multiple regions, however, the lower limbs followed by the upper limbs were the most commonly involved when the injuries were limited to a single body part. Almost one out of every three patients had associated conditions at presentation with anaemia (29, 64.4%) being the most common (Table 4).

**Table 4: Associated injuries and conditions at presentation**

	Frequency	Percentage
Anaemia	29	64.4
Burn Wound Infection	5	11.1
Sepsis	3	6.7
Inhalational Injury	3	6.7
Ocular Involvement	2	4.4
Aspiration Pneumonia	1	2.2
Compartment Syndrome of Both Hands	1	2.2
Respiratory Tract Infection	1	2.2
<b>Total</b>	45	100%

### 3.5 Treatment

All patients receive immediate wound care, which includes cleaning with antiseptic fluid, saline irrigation, antibiotics, and the application of silver sulfadiazine cream. Of the twenty-nine patients who had anaemia, twenty-four received blood transfusions. Three patients (2.1%) underwent debridement in the operating theatre, in addition to wound care in the ward, while seven (4.8%) had split thickness skin graft. Thirty-one patients (21.2%) were diagnosed with malaria following a positive rapid diagnostic test and were treated with antimalarials in addition to appropriate burn management.

**Table 3: Association between type of burn and TBSA, Age and Admission Duration**

	Median	IQR	P-value
<b>Percentage TBSA</b>			
Flame	13%	7.5-14%	0.047
Scald	10%	6.75-14%	
<b>Duration of Admission in Days</b>			
Flame	10days	3-27days	0.600
Scald	11days	8-15days	
<b>Age</b>			
Flame	11.0yrs	3.8-30yrs	<0.001
Scald	3.0yrs	1.3-5yrs	

### 3.6 Outcomes

Nine (6.2%) of the burn cohort died, while eleven (7.5%) discharged themselves against medical advice. Table 5 presents a detailed mortality analysis for those who died during admission. It reveals that four of the nine deceased patients (44.4%) were aged two years or younger. Additionally, two-thirds of those who died were male. The percentage of total body surface area (%TBSA) burned in fatal cases ranged from 22% to 75%, with an average of 45.7%. Autopsies were requested for all patients lost to burns, as burn cases are considered coroner's cases in Sierra Leone. Despite the requests, autopsies were not performed on any of the cases due to cultural and other challenges in implementing this law.

## 4. DISCUSSION

Compared with reports from studies conducted in Sierra Leone over the past two decades, the trajectory of burns as shown by the current study at the country's primary surgical referral hospital has not changed significantly.<sup>12,13</sup> A household burn survey conducted approximately ten years ago revealed that 3.98% of participants had experienced at least one burn injury.<sup>12</sup> The same study also indicated that paediatric age groups were predominantly affected, with scalds responsible for almost 90% of the burn injuries.<sup>12</sup> This study has shown that burn remains highly prevalent in Sierra Leone. The incidence of 1.4 burn injuries per week noted in this study is almost twice the weekly incidence reported from a teaching hospital in southwest Nigeria.<sup>3</sup> Furthermore, as that study pointed out, this poses a significant burden for the hospital given the difficulties in treating burn injuries in a developing nation such as Sierra Leone.<sup>3,6</sup>

Comparing our findings with those reported by Jackson-Cole et al. a decade earlier from the same hospital, we observed a slight reduction in weekly burn injury cases, from 1.67 to 1.4.<sup>13</sup> However, there has been a notable shift in the gender predominance; the male-to-female ratio has changed from 1:0.79 to 1:0.67, indicating an increase in male predominance. Similarly, while the age distribution remains predominantly paediatric in both studies, the prevalence of scalds as the primary cause of burn injuries has risen from 73% to 80%.<sup>13</sup>

The gender distribution of burns reported in literature has not consistently favored any particular gender.<sup>2,6</sup> However, our study concurs with the findings of Forjuoh et al. in Ghana, which, while observing no significant overall gender difference, noted that females tend to become more affected by burns as they grow older. This pattern suggests that among paediatric burn patients, females tend to be involved more as they approach school age. This obser-

**Table 5: Mortality analysis**

Age	Sex	Cause	%TBSA	Survival in days	Cause of Death
56 Years	M	Naked flame	75	9	Sepsis
38 Years	F	Naked flame	73	2	Respiratory failure
2 Years	F	Scald (hot oil)	64	2	Respiratory failure
30 Years	M	Naked flame	56	5	Respiratory failure
2 Years 11 months	M	Scald (hot water)	39.8	7	Sepsis
7 Years	M	Scald (hot water)	30.5	11	Sepsis
3 Years	F	Scald (hot water)	28.5	9	Sepsis
7 Months	M	Scald (hot water)	22.5	2	Hypovolemic shock
1 Years 9 Months	M	Scald (hot water)	22	4	Respiratory failure

vation likely reflects cultural expectations for female children to assist their mothers in the kitchen, increasing their exposure to open flames and hot liquids as they grow older. In contrast, boys are more likely to engage in outdoor activities, facing different types of risks.<sup>6,17,18</sup>

Previous studies have reported a high proportion of burns among paediatric and elderly populations in HICs compared to LMICs.<sup>6,19</sup> The reason for this disparity has been attributed to the extended family systems in LMICs, which provide informal social and emotional support to the vulnerable, unlike the nuclear family system prevalent in HICs.<sup>4,8,19</sup> However, this dynamic appears to be changing with the adoption of western lifestyles in many LMICs.<sup>13,15</sup> The findings of our study, in which the vast majority of cases are in the paediatric age groups, seem to support this trend. However, it is worth noting that the proportion of burn injuries among the elderly above 65 years old in our study is zero. The reason for this discrepancy has been attributed to underreporting in the elderly.<sup>15,17</sup> This is corroborated by the report from a community-based study conducted across four LMICs, which showed that in Sierra Leone specifically, the prevalence of burns among those over 65 years old was 2.8%.<sup>15</sup>

The causes of burns vary from one environment to another.<sup>2,6</sup> Scalding from hot liquids have been found to be quite common worldwide, responsible for burns in one-third to one-half of cases across all age groups.<sup>6</sup> Our study conforms to this general pattern, with scalds accounting for the majority of burn injuries. As expected, scalds from hot water were the most common cause, aligning with reports from other LMICs.<sup>3,15,20-23</sup> Kadiri et al. posited that in areas lacking bathroom water heating facilities, people often resort to heating water in the kitchen and carrying it to the bathroom, during which spillage can occur.<sup>3</sup> Furthermore, cooking over open flames on the ground, rather than using stoves and cookers, which are usually taller, gives children easier access to potentially hazardous objects. Burns from open flames are relatively common in societies where combustible materials such as thatch roofing are used for housing, where people wear loose cotton clothing, and where open flames are used for lighting (such as candles and lanterns) and cooking.<sup>6,8</sup> Generally speaking, electrical and chemical burns are relatively rarer in LMICs compared to HICs.

When considering the extent of injuries, most of the injuries have low %TBSA which aligns with the findings from Vilasco and Bondurand in Cote d'Ivoire and Kadiri et al in Nigeria.<sup>3,23</sup> Our study also showed that the %TBSA of scalds was significantly smaller than that of flame burns. Regarding the depth of burn injuries, almost three-quarters were superficial partial thickness burns. This, coupled with the low %TBSA, suggests that most patients fell into the minor burns category, which may explain the low rate of surgical

treatment in this study. This situation is fortuitous given the lack of resources for burn care at our facility. With no dedicated burn unit, only two plastic surgeons, and no formally trained burn care support staff, it is evident that the hospital is ill-equipped to manage severe cases. To compound matters, the absence of health insurance and widespread poverty mean that most patients may not be able to afford the available care, leading to delays in initiating treatment and a high rate of discharge against medical advice.<sup>23</sup>

Anaemia was the most common complication among our patients. This aligns with the literature, as studies have shown that up to three-quarters of patients with more than 20%TBSA require red blood cell transfusions.<sup>24</sup> There are several potential causes of anaemia in burn patients, including direct blood loss from the burned surface, dilution due to fluid resuscitation, wound infection, sepsis, and surgical treatment of burns or their complications.<sup>24,25</sup> Later, critical illness anaemia can also develop.<sup>24,25</sup> In our setting, a high rate of poor nutrition, particularly among children, exacerbates this issue. This poor pre-morbid nutritional status is likely to make anaemia more prevalent among our patients.

Another striking finding from our study is the high rate of malaria diagnoses requiring treatment. The implication is that in malaria-endemic regions, clinicians must consider more than just wound infections, sepsis, and respiratory tract infections when investigating persistent fever in burn patients. Testing for malaria is essential, as treating it can eliminate an additional source of morbidity, reduce financial waste on unnecessary antibiotic treatments and investigations, and alleviate patient and caregiver anxieties.

This study's 6.2% mortality rate is lower than the 10% rate reported ten years ago from the same hospital.<sup>13</sup> We cannot determine if this improvement is due to better management, as the previous report did not discuss the severity of burn injuries, but this might not be unconnected with the fact that two plastic surgeons joined the service of the hospital around the time of commencement of the current study. However, our mortality rate falls within the 5–35% range reported from the region.<sup>3,4,8,18,23</sup> Our study's 7.5% rate of discharge against medical advice (DAMA) indicates that patient's withdrawal of consent from medical care remains a significant problem in the country. Indeed, it appears to be increasing, as the previous study reported only a 3.6% DAMA rate. This trend highlights that DAMA is a major issue in the West African subregion.<sup>23</sup> In conclusion, the landscape of burn injuries at Connaught Hospital has remained largely unchanged over the past decade. Scalds from hot liquids continue to be the most common cause of burns among our patients, with children being disproportionately affected. There is a pressing need to implement changes that address the underlying causes of burns in the environment. This should include the introduction of effective paediatric burn prevention programs, emphasizing health education for both parents

and children. Additionally, implementing fire hazard prevention programs, especially in slums, instituting legislation for minimum safe housing standards, and improving healthcare provision are crucial steps.<sup>17,26</sup>

#### 4.1 Limitations

This study's main constraint is its dependence on a retrospective data, which is inherently hindered by a high rate of missing data. Retrospective chart reviews may not capture all pertinent variables that could affect outcomes, thereby introducing biases in result interpretation. Factors including the details of the burns, specific treatment methods, timing of interventions and outcomes may not be well-documented, thereby impacting the ability to make conclusive interpretations from the data. These constraints emphasize the necessity of conducting prospective research and implementing stricter data collection techniques to provide a thorough and precise examination of burn damage outcomes.

#### Contributor Roles Taxonomy (CRediT) Statement

Conceptualization: JA, KSO

Methodology: JA, KSO

Data Curation: JA, KSO

Formal Analysis: KSO

Investigation: JA

Writing - Original Draft: KSO

Writing - Review & Editing: JA, KSO, MEHS

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