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Prevalence and characteristics of paediatric burns at the National Reconstructive Plastic Surgery and Burns Centre, Korle Bu Teaching Hospital, Ghana

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ABSTRACT

Introduction: Burn injuries among children have emerged as a significant global public health concern, accounting for substantial morbidity and mortality worldwide. Low and Middle-Income Countries bear a significant burden of paediatric burn injuries. In Ghana, limited data exists on the prevalence, characteristics and outcomes of paediatric burns. This study provides vital data on the local burden and epidemiology of paediatric burns at Ghana's main burns treatment center. The findings have significant value in informing prevention strategies, allocating resources, and improving quality of paediatric burn care.

Study objective: To establish the prevalence and characteristics of paediatric burns injuries in Ghana's leading burn center.

Methodology: A retrospective cohort study analyzed data from 662 adult and paediatric patients who presented with burns from all over Ghana between 2020 and 2022. The study encompassed medical records of paediatric burn cases (aged 0–14 years) admitted to the center from January 2020 to December 2022. A purposive sampling technique was used to select cases based on the inclusion criteria and elimination of cases with 20 % missing data. A total of 335 paediatric records were reviewed.

Data analytical methods: Descriptive statistics, such as frequencies, mean, percentages were used to establish period prevalence and demographic characteristics of paediatric burns. Chi-square analysis and univariate logistic regression was utilized to explore associations between categorical variables, and predictors of burn outcome.

Results: The period prevalence of paediatric burns was found to be 50.6 %. Paediatric burn cases predominantly affected males (57.6 %). Majority of cases fell within the age range of 1 to 5 years (70.1 %). Hot water emerged as the leading cause (58.4 %), whiles superficial partial thickness burns (51.9 %) was the predominant type of burn. Most cases involved burns affecting less than 20 % Total Body Surface Area (59.0 %). Multi-part body injuries were common (87.2 %), with the lower limb being the most affected (25.36 %). The mortality rate was calculated to be 21.0 %. Higher TBSA was a significant predictor of mortality ($p < 0.001$).

Conclusion: This study found a high prevalence of paediatric burns with hot water and foods being the predominant causes. Higher TBSA predicted lower chances of survival. The findings have scientific value in informing prevention strategies, allocating resources, and improving the quality of care.

1. Introduction

Globally, burns injury has been identified as a leading cause of morbidity and death among children [1]. Burns injury rank as the third most frequent cause of mortality among children aged 1–9 years [2]. The majority of burn cases, which make up an estimated 90 %, are found in low- and middle-income countries (LMICs), with Africa and South East Asia bearing the majority of this disease burden [3,4]. Children under the age ten bear the brunt of the burden of burn injury, reflecting the urgent need for tailored interventions and effective prevention strategies [1,5].

Each year, around 300,000 new cases of burns are reported among

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Table 1
Demographic characteristics of paediatric burns cases.

Variables	N (%)	M ± SD
Sex		
Male	193 (57.6 %)	
Female	142 (42.4 %)	
Age range		
Less than 1 year	14 (4.1 %)	3.61 ± 3.124
1–<5 years	234 (70.1 %)	
5–<10 years	64 (19.1 %)	
10–14 years	23 (6.7 %)	

children under the age of five in sub-Saharan Africa [6]. It is estimated that annually, between 18,000 and 30,000 children under the age of 18 lose their lives due to burn-related injuries in sub-Saharan Africa [7]. The concerning annual occurrence of roughly 300,000 fresh cases of burns among children below the age of five in Sub-Saharan Africa emphasizes the significant public health challenge being faced [6]. This highlights the urgent requirement for comprehensive research initiatives and intervention strategies in the African region [4,8].

To address this pressing issue, a comprehensive understanding of the epidemiology of paediatric burns in Africa is essential. In Ghana, a weighted annual incidence rate of 63 per 1000 children (equivalent to 6.4 % of children per year) has been documented [4]. Data from other regions in Africa, including Zimbabwe, Nigeria, Cote D'Ivoire, and Angola, highlight the substantial scale of paediatric burn injuries [9]. However, research concerning the prevalence of paediatric burns injuries and predictors of burn outcomes in Ghana is limited, highlighting an area of insufficient understanding that requires attention. Consequently, this study seeks to address the existing gaps in the understanding of the prevalence and characteristics of paediatric burn injuries, focusing specifically on the context of Ghana, while offering insights that can contribute to global efforts in paediatric burn injury prevention and management.

The aim of this study is to investigate prevalence of paediatric burns in Ghana by providing a detailed description of burn characteristics, encompassing types, depth, body parts affected, and outcomes utilizing data from Ghana's premier burns center.

2. Methods

A retrospective cohort study design was employed, utilizing data from the National Reconstructive Plastic Surgery and Burns Centre (NRPS & BC) at Korle Bu Teaching Hospital in the Greater Accra Region, Ghana. The study encompassed medical records of paediatric burn cases (aged 0–14 years) admitted to the center over a 3-year period, from January 2020 to December 2022. A statistical power calculation [10] using a precision of 0.05 and a prevalence rate of 32 % based on a study in Uganda [11] and a 95 % confidence level was used to estimate a minimum sample of 330.12 cases to be reviewed. A purposive sampling technique was used to select 335 cases based on the inclusion criteria and eliminating 5 cases with ≥20 % missing data. Experts differ on the threshold for missing data exclusion. While Schafer [12] proposed 5 %, Bennett [13] suggested over 10 %, and Peng et al. [14] proposed 20 %. Data was collected using a structured data collection tool that captured the age, sex, type, cause and depth of burn, TBSA, body part(s) involved and outcome of burn. Ethical approval was obtained first from the University of Witwatersrand (26/05/23, M230512 MED23-05-033) and Institutional Review Board of KBTH (7/09/23, KBTH-IRB 000166/2023). Patients records were stored securely using data encryption, restricting access to authorized personnel only.

Data was analyzed with the Statistical Package for Social Sciences (SPSS) software, version 23. Descriptive statistics, such as frequencies, mean, percentages were used to establish period prevalence and demographic characteristics of paediatric burns. Inferential statistics such as Chi-square analysis and univariate logistic regression was utilized to explore associations between categorical variables, and predictors of burn outcome. The calculation of prevalence was done by dividing the number of paediatric cases reviewed for the study period over the total number of burn cases admitted including adults and expressing it as a percentage.

$$\text{Prevalence rate} = \frac{\textit{Number of Paediatric cases reviewed}}{\textit{Total number of admitted cases}} \times 100$$

$$\text{Prevalence rate} = \frac{335}{662} \times 100$$

$$\text{Prevalence rate} = 50.6\ \%$$

3. Results

A total of 335 paediatric patients' records out of 662 of the cases admitted at the burn center from 2020 to 2022 were reviewed for analysis. Records of patients above the age of 14 years and those with 20 % missing data were excluded.

3.1. Demographic characteristics of paediatric burn cases

Majority of the cases (n = 193, 57.6 %) were males, while 142 (42.4 %) were females. The ages of paediatric cases ranged from 15 days to 14 years, with a mean age of approximately 3.61 ± 3.12 years. Table 1 below shows the demographic characteristics of cases reviewed in this study.

3.2. Prevalence of burns

The period prevalence of paediatric burn injuries calculated for 2020 to 2022 at the NRPS & BC of the KBTH was estimated to be 50.6 %. The majority of paediatric burn cases occurred in children aged between the ages of 1 and 5 years (n = 234, 70.1 %) (Table 2).

3.3. Causes and types of paediatric burns

Hot water was the most common cause, accounting for 188 (58.4 %) of cases. Hot foods, including soup, stew, oil, tea and oats, was responsible for 74 (23.0 %) of burns, while flames caused 39 (12.1 %) of burns. Other causes of paediatric burns recorded which were relatively rare, included gas explosions (n = 19, 5.9 %) and electrical burns (n = 2, 0.6 %). Fig. 1 below shows the various causes of burn injury (Table 3).

Superficial partial thickness burns were the most prevalent, accounting for 167 (51.9 %) of the total cases, followed by mixed thickness burns (n = 115, 35.7 %). Fig. 2 illustrates the type of burn recorded from cases review.

3.4. Distribution of body parts involved in paediatric burns

There were 43 cases where burn injuries affected a single body part, representing approximately 12.83 % of the total cases. In contrast, majority of cases (n = 292, 87.17 %) involved burns affecting multiple body parts. The most involved body part recorded was lower limb (n = 225, 25.36 %) followed by the trunk (n = 207, 23.33 %) and upper limb (n = 174, 19.61 %). Head injuries accounted for 82 (9.24 %) of the total

Table 2
Body parts involvement in paediatric burn injuries.

Variables	F (%)
Distribution of body part	
Single body part	43 (12.8)
Multiple body parts	292 (87.2)

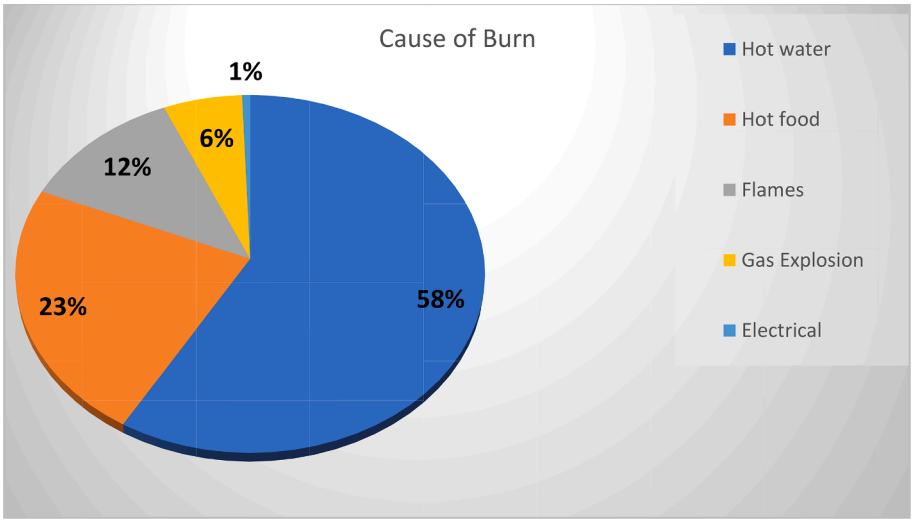


Fig. 1. Cause of paediatric burn injury.

Table 3
TBSA and Outcome of Paediatric Burns.

Variables	Frequency (N = 335)	M ± SD
% TBSA		
Less than 20	197 (60.0)	
20–40	95 (29.0)	20.16 ± 14.05
40–60	31 (9.5)	
Above 60	5 (1.5)	
Burn Outcome		
Died	67 (21.0)	
Discharged	252 (79.0)	

number of cases, while neck injuries constituted 25 (2.82 %) cases. Buttock injuries also comprised 86 (10.82 %) of cases, while perineal injuries accounted for 78 (8.79 %) cases (Fig. 3).

3.5. TBSA and outcome of paediatric burns

The TBSA, representing Total Body Surface Area of paediatric cases ranged from 1 % to 100 %, with a mean value of 20.16 % ± 14.05. The distribution of the TBSA of paediatric burn injuries, the majority of cases (n = 197, 60.0 %), fell into the category of burns affecting less than 20 % TBSA, followed by 20 %–40 % TBSA (n = 95, 29.0 %). Burn cases above 60 % TBSA were relatively rare, representing only 5 (1.5 %) of paediatric cases. In relation to the outcome of paediatric burn injuries, 67 cases did not survive their burn injuries, representing a mortality rate of 21.0 %. A significant majority of burn cases (n = 306) were discharged after treatment, accounting for a recovery rate of 79.0 %. The distribution of TBSA and burn outcome are presented in Table 5. Furthermore, results from Fig. 4 shows that higher TBSA was associated with increased mortality with the highest mortality rate (100 %) observed in patients with burns covering more than 61 % of their body.

3.6. TBSA as a predictor of paediatric burn outcomes

The univariate regression analysis revealed that higher TBSA scores were significantly associated with lower odds of survival ($p < 0.01$) as illustrated in Table 4 The cross-tabulation of TBSA level and treatment outcome highlighted that almost all patients with minor burns survived (100 %), as did the majority of moderate burns patients (94.1 %). However, 26.0 %of patients with major burns died to their injuries as illustrated in Table 5.

4. Discussion

The period prevalence of paediatric burn injuries at the NRPS & BC of the KBTH was estimated to be 50.6 % for the years 2020 to 2022. This

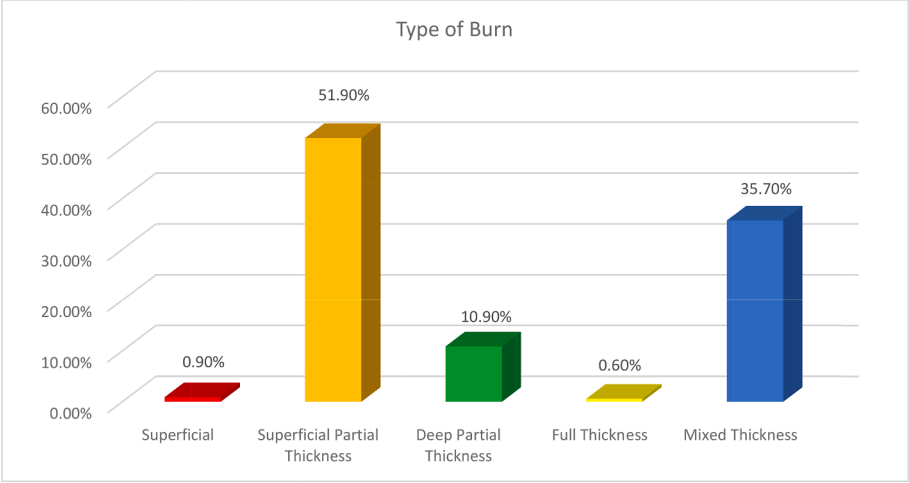


Fig. 2. Type of paediatric burns.

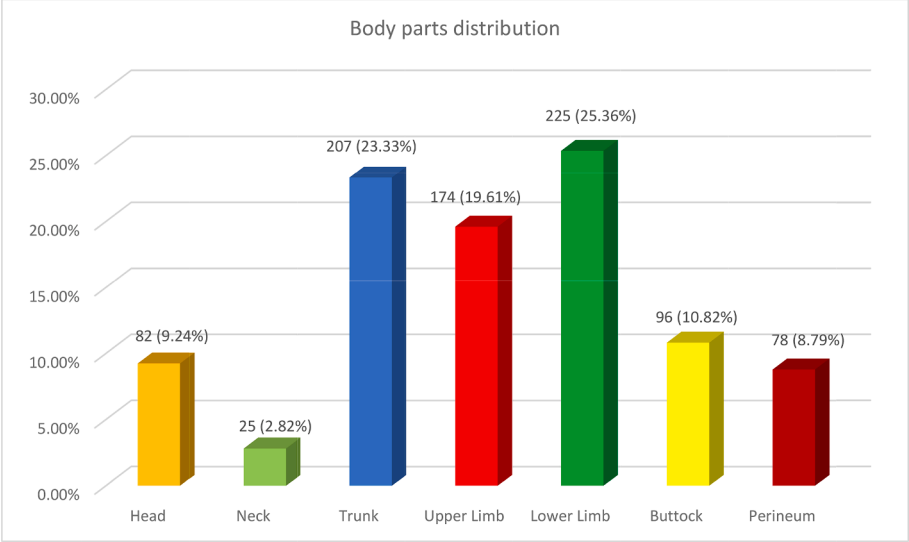


Fig. 3. Distribution of anatomical sites involved in paediatric burn injury.

Table 4
Univariate Logistic Regression Analysis of Predictors on Treatment Outcome.

Predictors	AOR	S.E.	(df)	95 % C.I. Lower–Upper	P-value
TBSA Score	0.90	0.01	48.9(1)	0.87–0.92	0.00
AGE	1.11	0.06	3.1(1)	0.99–1.24	0.07
Gender	0.81	0.30	3.3(1)	0.47–1.39	0.44

Confidence Interval = CI, Degrees of Freedom = df, Adjusted Odds Ratio = AOR, Significance = P-value, Standard Error of AOR = S.E.

highlights the significant burden of paediatric burn injuries in Ghana and is consistent with global reports especially in the Sub-Saharan African Region [3–6]. Similar findings of striking burden of paediatric burns have also been reported elsewhere. Davies et al., [15] reported more than 50 % of paediatric cases among burn cases in European hospitals. Findings from the Western Regional Hospital of Nepal reported a prevalence rate of 61 % [16]. In contrast, a study conducted in China, revealed a prevalence of 28.6 %, which is lower than that reported in the current study [17]. A comparatively lower prevalence rate between 17 and 25 % has also been reported in India [18]. On the other hand, a similar study in Uganda reported a relatively lower prevalence rate of 32.0 % of all hospital admissions [11]. The findings suggest that Ghana records a relatively higher prevalence of paediatric burn injuries compared to other countries such as China, Nepal and Uganda [17,18,11]. This highlights the pressing need for focused efforts from government, public and private stakeholders and advocacy groups to address this public health challenge within the country. Furthermore, the disparities in prevalence rates highlight the need for prevention strategies tailored to the specific contexts and challenges faced in different regions.

In line with previous research, this study found that gender and age distribution for paediatric burns was skewed towards males (56.7 %) and children below the age of five (70.1 %) respectively [11,19,16]. Stocken et al. [19] reported approximately 60.0 % male paediatric burn cases in Australia. Studies have similarly reported 66.4 % males in Nigeria [20], 52.4 % in Uganda [11] and 58 % in South Africa [21]. A possible explanation of this trend has been attributed to the fact that, boys tend to exhibit higher levels of physical activity and are aggressive in behavior compared girls [22]. Contrary findings have also been reported in few studies where females were dominant in paediatric burn cases in Asia [24]. In addition, the current study revealed a mean age of approximately 3.61 ± 3.124 years with the majority of cases occurring in children aged between the ages of 1 and 5 years. Similarly, previous epidemiological studies have established a high prevalence of burns among children less than 5 years [4,21]. This age group is widely recognized as particularly vulnerable to burn injuries due to their natural curiosity, lack of hazard awareness, and limited motor skills [20].

The most common cause of paediatric burns in the current study was hot water, accounting for 56.3 % of cases followed by hot foods (22.2 %). This finding is consistent with existing literature, which often identifies scald burns from hot liquids as a leading cause of burns in young children [19,22]. In the Ghanaian context, children may accidentally spill or come into contact with hot foods or liquids whiles around their parents in the kitchen. The kitchens are often open with hot foods left on the floor. Similarly, Başaran & Özer [23] mentioned that, traditional kitchens are typically positioned in areas where children play, families gather to eat, socialize and sometimes sleep, potentially

Table 5
TBSA Level and Treatment Outcome Cross-tabulation.

Independent Variable	Level	Treatment Outcome		Total	P-Value
		Alive	Died		
TBSA Level	Minor	9 (100)	0 (0)	9	0.00
	Moderate	64 (94.1)	4 (5.9)	68	
	Major	179 (74.0)	63 (26.0)	242	

Minor Burn (<5% TBSA) Moderate Burn (5–10 % TBSA) Major Burn (>10 % TBSA):
Source: American Burn Association Burn Injury Severity Grading.

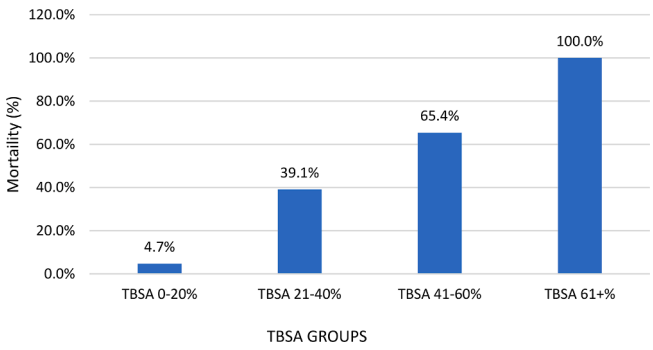


Fig. 4. Mortality distribution by TBSA Groups.

increasing the risk of scald of burns in children. Rode et al. [25] revealed a high prevalence scald injury of paediatric burns in the Ashanti Region of Ghana, accounting for 62 % of cases. Some studies have also reported contrary findings on the primary causes of burns among paediatric burn patients. For example, Mehta et al. [4] reported a high prevalence of flame-related incidents (53.0 %) while scalds accounted for 38 % of burn cases. Fadeyibi et al. [20] also reported 66.4 % of flame injuries as the primary cause of burns. These variations in the primary causes of paediatric burns may be attributed to age differences and differences in contexts [26] Since hot water and hot foods were identified as the most common causes of paediatric burns, parents and caregivers need to be educated about the risks associated with these hazards and the importance of implementing safety measures in the kitchen and other areas where children may be exposed to hot substances.

The complexity and severity of burn injuries in paediatric patients is revealed in the multiple anatomical sites involved. We found multiple body part involvement in majority of the cases similar to the findings of other studies [21,22]. This finding may be attributed to the limited ability of children to recognize the initial source of injury and protect themselves from additional injuries. The lower limb was the most frequently involved body part, accounting for 25.36 % of cases followed by the trunk (23.33 %) and upper limb (19.61 %). This finding is in line with the fact that children, especially toddlers, often explore their surroundings and may unintentionally touch or step on hot surfaces, leading to burns on their lower and upper extremities. Contrary to these findings some studies have also reported more frequent upper limb involvement [20–22]. Buttock and perineal injuries although relatively small, can be vulnerable, especially in infants and young children who spend a significant amount of time sitting.

On a positive note, majority of burn cases (75.7 %) were discharged after treatment, indicating a high recovery rate. A mortality rate of 21.0 % suggests that paediatric burn injuries can be life-threatening, especially in cases of severe burns and associated complications. The mortality rate in the current study is relatively high compared with previous studies in Liberia (14.2 %) and Angola (9.1 %) [3]. The key predictor of burn outcome was TBSA. Higher TBSA scores were generally associated with more severe burns, prolonged recovery periods and a higher risk of complications, including sepsis and multi-organ failure, which can lead to increased mortality rates [20,22,26]. Therefore, while the high discharge rate following treatment is encouraging in this study, the relatively higher mortality rate cautions healthcare providers about timely and comprehensive medical interventions, particularly for cases involving larger total body surface area (TBSA) burns, to minimize the risk of complications and improve patient survival.

5. Conclusion and recommendations

The study highlights a concerning prevalence of paediatric burns in Ghana, particularly among children aged 0–5 years. Superficial partial thickness burns were the most prevalent, often affecting multiple body parts, with the lower limbs being the most frequently involved. Scald burns, especially from hot water, were identified as the primary cause, underscoring the need for targeted prevention strategies and educational programs for caregivers on their domestic environment. The mortality rate among severe cases was notable, emphasizing the potential life-threatening nature of these injuries. However, the majority of patients were discharged after treatment, indicating a promising recovery rate when proper treatment protocols are put in place. The major predictor of paediatric burn outcomes was TBSA score. Higher TBSA score was generally associated with lower chances of survival. Considering the mortality rate of 20.0 % among severe cases, there is a pressing need to ensure access to quality care, potentially through inclusion of paediatric burn care under full insurance cover. Furthermore, caregivers need to be educated about the risks associated with scald burns, particularly from hot water and foods, and provided with educational programs to create a safe domestic environment. Awareness should also be raised about prioritizing kitchen safety in households with preschool-aged children. High prevalence of paediatric burns in Ghana calls for the collective effort of government engagement, stakeholder collaboration, policy formulation, and regional sub-committee initiatives to elevate awareness surrounding paediatric burn injuries across the nation.

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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