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Pattern of burn injuries and short-term outcome of management in a limited resources area

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ABSTRACT

Burn injuries are a significant global public health issue, ranking as the fourth most common type of trauma after traffic accidents, falls, and interpersonal violence. They predominantly occur in low- to middle-income countries, where resources often lack to prevent and manage burns. This study examines the demographic features, causes, and short-term outcomes of burn injuries in Al-Managil Teaching Hospital, Sudan. A descriptive, retrospective, and prospective hospital-based study was conducted, with data collected from 88 patients' files. The mean age of patients was 15.1 years, with 63.6% being children under 15, predominantly those under five. Scalds were the leading cause of burns (60.2%), followed by flame injuries (38.6%). Most burns occurred at home, often during food preparation. Partial-thickness burns were most common (83%), with a minority presenting mixed or full-thickness burns. Traditional remedies were used by 33% of patients, contributing to complications like infections and delayed hospital visits. The mortality rate was 2.2%, with deaths occurring in young children from rural areas. This study highlights the vulnerability of young children to burn injuries due to developmental factors and inadequate supervision. Females were more affected than males, likely due to their roles in food preparation in hazardous environments. The study emphasizes the need for better burn prevention strategies, particularly in rural areas and among high-risk groups, to reduce the incidence and severity of burn injuries. Improving public awareness and first aid knowledge is crucial for mitigating the impact of burns in resource-limited settings.

Keywords: Burn, Short-Term Outcome, Limited Resources, Scald, Traditional Remedies

1. INTRODUCTION

Burn injuries are amongst the most overwhelming of all injuries and a prominent global public health catastrophe (Forjuoh, 2006; Peck et al., 2008). Burns are the fourth most common type of trauma worldwide, next to traffic accidents, falls, and interpersonal ferocity (Odondi et al., 2020). About 90% of burns befall in low to middle-income countries, countries that largely dearth the essential setup to lessen the incidence and sternness of burns (Mathers et al., 2006).

Demographic features of burn injuries

The most susceptible groups to burn injuries are children, females, and the elders (Lari et al., 2000; Golshan et al., 2013). Lack of supervision for children, frailty, and comorbid illnesses in the older, clothing made of flammable materials, parental illiteracy, overcrowded housing, pre-existing impairments in children, and low socioeconomic status are key risk factors for burn injuries (Forjuoh, 2006; Samie and Mohamed, 2007; Peck and Toppi, 2020).

Age

Founded on a retrospective review of 139 studies on the epidemiology of burns globally, including local studies, between 1974 and 2007, nearly one-third of the whole burns occurred in infants and toddlers to the age of four years (Forjuoh, 2006; Golshan et al., 2013). In certain parts, such as the Ivory Coast and India, burns in this age group account for close to half of all childhood burns (Gupta et al., 1992; Adamo et al., 1995). Related to high-income countries (HIC), children under five years of age in lower-middle-income countries (LMIC) have a disproportionately more significant rate of burns (Golshan et al., 2013). This greater rate of burns is also actual for children from HIC who live in deprived districts (Istre et al., 2002). Children below five years constituted 75% of the patients with male predominance. Patients older than 60 years undergo disproportionately higher percentages of hospitalizations owing to burns in contrast to the overall population.

A prospective study from Egypt flanked by 1995 and 2001 showed that burns in the elderly account for 2.3 % of all treated burns and 7.1% of all hospital admissions; this is a high percentage if we consider the study area where the elderly encompass 5.8% of the entire population. The bulk of burns happened in elderly persons from low-income families, 85.5% (Hemeda et al., 2003). The most common reason for death for older women with burns was cooking-related injuries resulting in clothing ignition, according to a retrospective review of 759 burn patients admitted to a US burn unit between 1990 and 1994 (Ryan et al., 1997). Use of a gas cooker, isolation, slowed behavioral responses, mental and physical incapacities, and inability to access assistance were contributing factors. The medical, economic, and social loads of burns will upsurge as the proportion of the elderly rises in both higher-income and developing countries (Dissanaikie and Rahimi, 2009).

Sex

Sex differences in burn incidence differ by age, country, and national income category. Our community and other Countries like Egypt and India have a higher percentage of burns among females. Researchers in Angola, Bangladesh, China, Côte d'Ivoire, Kenya, Ethiopia, and Angola reported greater cases in boys (Adamo et al., 1995; Lari et al., 2000; Mabrouk et al., 2003; Yongqiang et al., 2007; Mashreky et al., 2008).

Residency

An approximation of the frequency with which children are hospitalized all over the sphere for handling burns is a level of 8 per 100,000 (Burd and Yuen, 2005). In Sudan, (55%) of patients were from rural, and the majority (65%) belonged to low socioeconomic class families (Samie and Mohamed, 2007). A rural community survey in Ethiopia identified burns as the second most common injury among children under 15 years old (Demamu, 1991). Burns were consequently the chief reason for admission for injury to pediatric hospitals and graded number three as a cause of casualty duty call (Tamrat, 1981).

Place of burn

Most burn injuries happen in home situations, with food preparation being the most common activity (Attia et al., 1997; Mabrouk et al., 2003; Golshan et al., 2013). Pediatric burns occur more frequently in households where youngsters are unsupervised (Forjuoh, 2006). Elderly people are similarly expected to put up with a burn in the home, outside, or during labor. Burns to adult women occur customarily at home, while burns to mature men occur mostly outdoors or in the workplace.

Aetiology and cause of burn

Flame injuries and scalds are the leading causes of global burns in children and adults (24, 25). A retrospective review of 127,016 hospitalized burn patients between 1999 and 2008 from 79 US hospitals established that the most frequently identified causes of burns were scald flame, interaction with hot objects, electrical and chemicals (Forjuoh, 1998; Sanghavi et al., 2009; Taylor et al., 2013). In Sudan, the main cause of pediatric burns seems to be scald. A published paper studying 60 pediatric patients admitted to Khartoum Teaching Hospital (KTH) with moderate to severe burn injuries found that scalds comprised 60%, followed by flame 36.7% and electrical burn 3.3%. In another study assessing long-term complications of burns in patients who were treated conservatively in general surgical units carried out at Soba University Hospital (SUH) and Khartoum Teaching Hospital (KTH), children constituted 69% of victims of scalds.

For adults, flames are the main cause; in the study mentioned, flames compromised 42%, followed by scalds 35.5%, electrical burns accounted for 9.8%, and contact burns for 10.7% (Samie and Mohamed, 2007; Al-Shareef et al., 2012). In several homes in lower-middle-income countries (LMIC), principally in countryside parts without electrification, exposed flames are common, with floors of huts with open firesides used for cooking and warmth, candles, small kerosene and naphtha cookers and kerosene lamps. The fire danger from these bases is augmented by the absence of enclosure for open fires, floor-level, location of fires and stoves, shakiness of utensils, neighbouring storage of volatile and combustible fuels, igneous clothing and housing materials, and absence of exits (Sawhney, 1989; Courtright et al., 1993; Lari et al., 2000; Forjuoh, 2006). Crave injuries from kerosene cookers have been recognized in Egypt, Ethiopia, India, Angola, Pakistan and other LMICs. Scald burns occur from boiling tap water baths, hot foodstuffs and liquids, and heated cooking oils (Sawhney, 1989; Nega and Lindtjorn, 2017).

2. METHODS

Study design setting and study period

A descriptive, retrospective, prospective, hospital-based, cross-sectional study was conducted at Al-Managil Teaching Hospital between April 2021 and April 2023.

Study area

Al-Managil is located in Gezira state in central Sudan, western Wad-Madani city. It is the capital of Al-Managil, the largest locality in the state, with about 1.25 million people, most of whom are farmers. Al-Managil Teaching Hospital is founded in the 1960s. The hospital has seven departments: Surgery, Medicine, Obstetrics and Gynecology, Pediatrics, ENT, Ophthalmic and Dermatology. There are three units in surgical departments, two wards with 20 beds for each. There is one major theatre consisting of two operating rooms. The workload has been increasing during the last few years, which might be attributed to the excellent outcomes for the patients and the fast delivery of services they receive, in addition to a bustling outpatient department that provides services for new patients as well as follow-up services for patients requiring further dressing and treatment.

Study population

Target population

The study targeted all patients with burn injuries who were admitted to Al-Managil Teaching Hospital.

Specific population

Patients with burn injuries presented to the hospital during the study period.

Inclusion criteria

Patients with burn injuries who presented to the hospital during the study period and agreed to participate were included.

Exclusion criteria

Patients with long-term burn complications will not count. Patients who were admitted and escaped the management, had incomplete medical records or refused to participate in the study were excluded.

Data collection tools

Data was collected from the hospital medical records office, and a pre-formed questionnaire was used to review all patients with burn injuries who were managed in MTH from April 2021 to April 2023. A total of 88 Patients were reviewed. Variables studied include information on socio-demographic features of the study populations, the time lapse between the time of burn incident and time of arrival to hospital, use of traditional remedies in pre-hospital, cause of burn, depth of burn, and percentage of body surface area involved, presence of other associated injuries. We also studied the presence of comorbidities like epilepsy, DM, CKD, and HTN were assessed. Dates of admission and discharge, length of hospital stay, presence of inhalation injury, complications, wound infection, operations and outcome were also studied.

Data analysis

The collected data was coded and fed into the computer to handle statistical and mathematical procedures, display the analyzed data, and present it graphically using the SPSS software package 20.

Statistics

Descriptive statistics were reported as percentages of studied variables. Most of the studied parameters were qualitative and, consequently, were analyzed in terms of absolute presence rather than by the number available.

3. RESULTS

During the study period, 88 patients with burns were hospitalized in AL-Managil Teaching Hospital (MTH). The mean age of patients admitted with burns is 15.1 years. The distribution of patients according to their age is as follows: 63.6% (n= 56) were children under 15. Children under the age of 5 were 73% (n =41) of all pediatric patients, and the rest, 36.4% (n= 32), were adults (Figure 1). Scalds (due to hot water or boiling) were the leading cause in almost all age groups, affecting 60.2% of patients (n=53). Scalding remained the major etiological cause irrespective of rural or urban residence. The second leading cause of burn was flame, affecting 38.6% (n=34), and 1.1% (n=1) presented with flash (Cleaning Products) (Figure 2).

The correlations between age groups and causes (scald, flame, and others) were significantly meaningful, suggesting that younger children are more susceptible to scald injuries, P.value < 0.001 (Table 1), and the home was the area of greatest risk for burn injuries, P.value = 0.031 (Table 2). Patients who presented with partial thickness burn equals 83% (n=73), 16% (n=14) with mixed partial and full thickness burn, and one patient (1.1%) presented with full thickness burn; he was diabetic with paraplegia got burnt due to incents (bakhour) burnt underneath his bed, this patient underwent immediate excision and skin grafting (Figure 3).

Traditional remedies were used by 33% (n=29) of patients. 13.6% (n=12) of them used toothpaste, and the same percentage used flour paste, 2.3% (n=2) used mud to cover the wound surface, and 1.1% (n=1) used either bee honey or urine. Most patients who presented late to the hospital used traditional remedies, with a P value of 0.001 (Table 3). Patients who developed local wound complications were 16 detailed as scar-affected nine patients, skin changes (hypo or hyperpigmentation) in four, contracture in one patient, and two deaths (Figure 4).

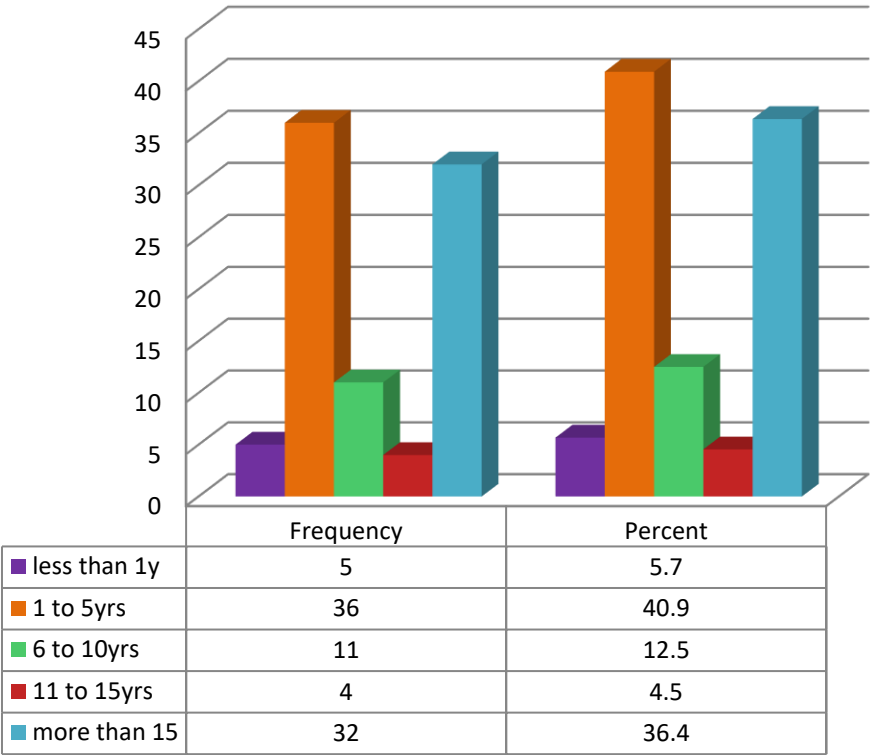


Figure 1 Age distribution of patients admitted with burn in AL-Managil Teaching Hospital MTH (N = 88).

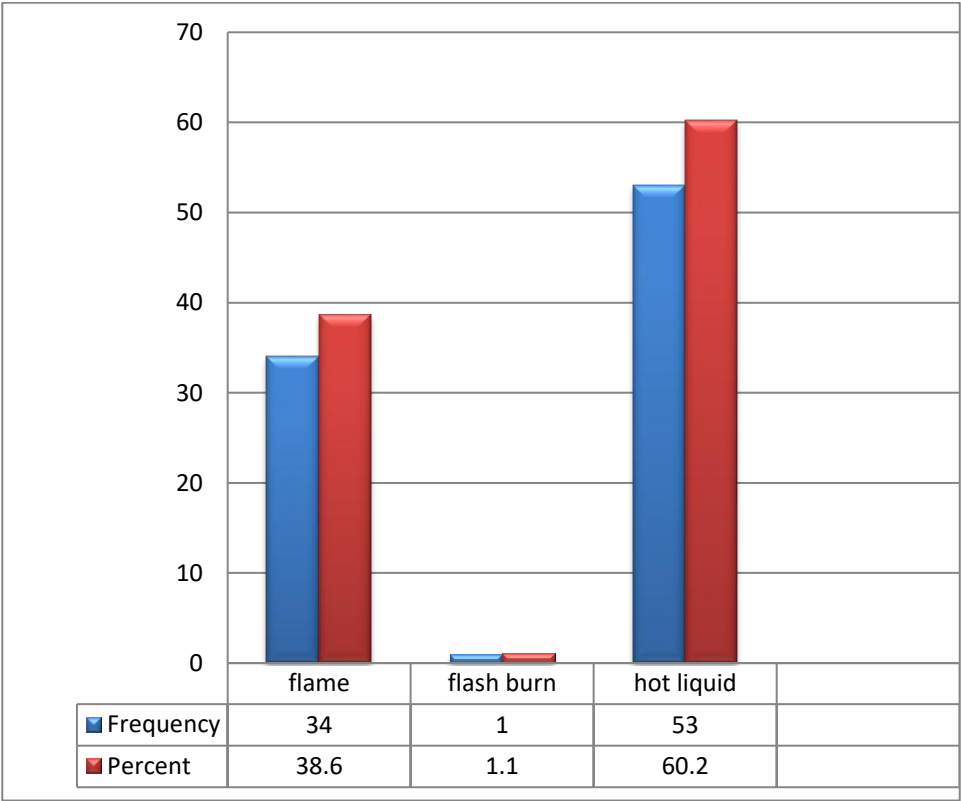


Figure 2 Causes of burn in patients admitted in AL-Managil Teaching Hospital MTH (N= 88).

Table 1 Compares the distribution of burn causes among age groups in patients admitted to AL-Managil Teaching Hospital MTH (N= 88).

		Cause			
		Flame	Flash burn	Hot liquid	
Age	Less than 1 year	1	0	4	5
		20%	0%	80.0%	100%
	1 to 5 years	2	0	36	38
		5.3%	0%	94.7%	100%
	6 to 10 years	3	0	8	11
		27.3%	0%	72.7%	100%
	11 to 15 years	1	0	3	4
		25%	0%	75.0%	100%
	More than 15 years	27	1	2	30
		90%	3.3%	6.7%	100%
Total		34	1	53	88
		38.6%	1.1%	60.2%	100%
P value <0.001 significant for scald is the main cause of burn in all age groups.					

Table 2 Compares the distribution of burn place among age groups in patients admitted to AL-Managil Teaching Hospital MTH (N= 88).

		PLACE		TOTAL
		HOME	WORK	
AGE	Less than 1 year	5	0	5
		100%	0%	100%
	1 to 5 years	38	0	38
		100%	0%	100%
	6 to 10 years	11	0	11
		100%	0%	100%
	11 to 15 years	3	1	4
		75%	25%	100%
More than 15 years	25	5	30	
	83%	17%	100%	
Total		82	6	88
		93%	7%	100%
P value = 0.031 significant for home is the virtual place for burn in all age groups				

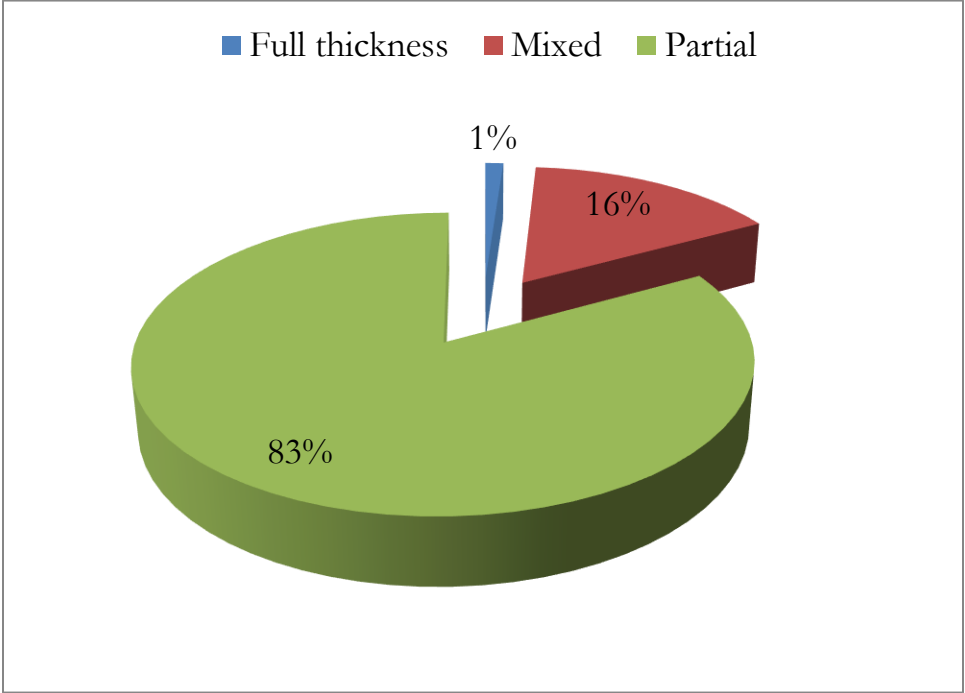


Figure 3 Depth of burn in patients admitted in AL-Managil Teaching Hospital MTH (N= 88).

Table 3 Time of presentation and use of traditional remedies in patients admitted to AL-Managil Teaching Hospital MTH (N= 88).

		Use of Remedies		Total
		No	Yes	
Time Lapse	Less than 6h	79.7%	10.3%	56.8%
	6 to 24h	20.3%	17.2%	19.3%
	24 to 48h	0.0%	41.4%	13.6%
	More than 48h	0.0%	31.0%	10.2%
P value <0.001; Significant for those who presented late used traditional remedies				

Both skin color changes and scars were distributed in the trunk, upper, and lower limbs. Contracture 1.1 % (n=1) affected the left hand and distal forearm, with the wrist in a flecion position. The patient was referred to the plastic unit for further management. The death occurred in 2.2% (n=2); they were female children from rural areas; both had mixed burn depth, one with 25% total body surface area (TBSA) and inhalational injury, while the other had 36% TBSA. Complications statistically correlated to TBSA P < .001 (Table 4).

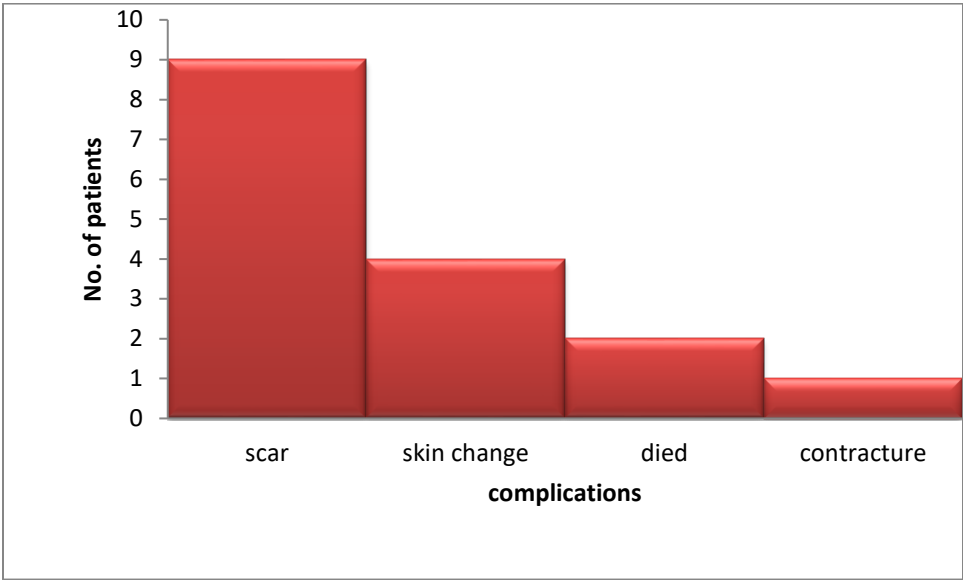


Figure 4 Complications in patients admitted in AL-Managil Teaching Hospital MTH (N= 88).

Table 4 The relation between wound TBSA and the presence of complications in patients admitted in AL-Managil Teaching Hospital MTH (N= 88).

		Complications					
		No complications	Color Change	Scar	Contracture	Death	
TBSA	Less than 10 %	22	0	1	0	0	23
		95.7%	0.0%	4.3%	0.0%	0.0%	
	10 to 15 %	24	0	2	1	0	27
		88.9%	0.0%	7.4%	3.7%	0.0%	
	16 to 20 %	21	2	2	0	0	25
		84.0%	8.0%	8.0%	0.0%	0.0%	
	21 to 30 %	5	2	2	0	1	10
		50.0%	20.0%	20%	0%	10%	
	More than 30 %	0	0	2	0	1	3
		0%	0%	67%	0.0%	33%	
Total		72	4	9	1	2	88
		82.%	5%	10%	1%	2%	100%
Complications significantly associated with increased TBSA; P value <0.001							

4. DISCUSSION

This study was conducted on all hospitalized burn patients at Al-Managil Teaching Hospital in Sudan. Children below the age of five years were the most burn victims, which is consistent with local and regional studies Istre et al., (2002), Forjuoh, (2006) but contrasted to a study in Egypt where the elderly represented the greater group (Hemeda et al., 2003; Dissanaïke and Rahimi, 2009). Children at this age bear the greatest burns burden. This is probably due to their speedy motor development with relatively slower cognitive growth, as well as their interest and longing to reach out, which do not go side by side with their ability to appreciate danger or respond to it. In Sudan and other regional countries, families tend to have more children. Supervision is often left to grandmothers or older siblings who lack appropriate safety education and knowledge of first aid, thus increasing their vulnerability to burns.

Not to mention that children often play near where the mother works in an insecure fireplace. Comparable to Egypt, India, and Ethiopia, we found that females have more burns than males. This contradicts what was reported in Angola, Bangladesh, China, Côte d'Ivoire, Kenya, and Angola, where males predominate (Forjuoh et al., 1995; Ghosh and Bharat, 2000; Mabrouk et al., 2003; Samie and Mohamed, 2007; Yongqiang et al., 2007; Mashreky et al., 2008; Dissanaik and Rahimi, 2009). Women in our community do the whole kitchen job, preparing meals and handling gas cookers. Cooking in the villages and suburbs is done in the customary kitchens where exposed fires from fire-logs with only basic utilities and utensils are used. Most women find themselves involved in multiple tasks while preparing meals.

Rural areas were found to be associated with a higher risk of burn injuries, according to data from Sudan, Ethiopia, Egypt, and many other similar studies (Sawhney, 1989; Lari et al., 2000; Mohammad et al., 2012; Taylor et al., 2013). The household environment constituted the most typical site of occurrence of burns for women and paediatrics, while adult males sustained burns in workplaces. These findings were consistent with those of similar studies (Hemeda et al., 2003; Forjuoh, 2006; Samie and Mohamed, 2007; Mohammad et al., 2012). Scald, followed by flame, were the predominant causes of burn in pediatrics especially in younger age groups, going with national, regional, and local findings (Lari et al., 2000; Mohammad et al., 2012; Golshan et al., 2013). The flame was predominating in the adult age group, consistent with similar studies (Mabrouk et al., 2003; Forjuoh, 2006; Peck et al., 2008).

The use of traditional remedies resulted in wound infection and the development of local wound complications. The same findings were reported in Ghana, Angola, and Ethiopia (Adamo et al., 1995; Forjuoh et al., 1995; Nega and Lindtjørn, 2017). The total mortality rate in this study (2.2%) was lower than that seen in previous local studies (Mohammad et al., 2012), below Saudi Arabia, Yemen, Pakistan, and Ecuador (Fadaak, 2002; Al-Shehri, 2004; Falder et al., 2009; Mohammad et al., 2012). However, it is higher than Ethiopia (Nega and Lindtjørn, 2017). The mean LOS (Length of Hospital Stay) in our study is 14 days, and it's related to increased TBSA, depth of wound, and flame. These findings are similar to Iraq and Pakistan (Atiyeh et al., 2010; Khaliq et al., 2013). Previous local studies did not report the exact LOS, but they reported a greater percentage of patients who managed for a longer duration. Perhaps this may be attributed to the flame type of injury and the greater TBSA that their patient had.

5. CONCLUSION

Children under the age of five years constituted the highest risk group in our community for burns, which makes them a target for prevention. The house is the chief place for burns injuries. Scald, followed by flame, are the most common causes of burn. Most of the burns were of partial thickness type, which, if appropriate management, will end in cosmetically and psychologically acceptable results.

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Author Contributions

Author 1 conducted the study under the supervision of authors 2 and 3. Author 4 participated in the manuscript writing and revision.

Ethics approval

The protocol was approved by the Ethical Review Committee of AL-Managil Teaching Hospital, the Institutional Review Board (IRB), and the College of Medicine at Gezira University.

Informed Consent

Oral consent was obtained from all participants included in the study.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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