

## Review Article

# Epidemiology of Burns: A Decade Experience

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Submitted: 06 October 2018

Accepted: 26 October 2018

Published: 31 October 2018

ISSN: 2475-9406

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**Abstract**

**Introduction:** One of the most important causes of morbidity, disability and death in the developing world is Burn injury that also affects psychosocial and functional aspects of patients. Burn injury is an important yet under-researched area in Pakistan. The present study is designed to document the prevalent epidemiological pattern and outcome of burn injuries over a decade period at country first national Burn Care Centre established at Islamabad to generate evidence based strategies to address the issue in national perspective.

**Methodology:** This study includes retrospective data analysis of patients conducted over a 10 year period from 1<sup>st</sup> January 2008- 1<sup>st</sup> October 2017 at Burn Care Centre (BCC) Pakistan Institute of Medical Sciences (PIMS), Islamabad. Total patients managed in the burn care centre were 94664. Study includes all the cases presented primarily and managed at the centre. The data were subjected to statistical analysis using SPSS version 20. Descriptive statistical tests were conducted. Ethical approval for the study was provided by Hospital Ethical Committee of Pakistan Institute of Medical Sciences (PIMS), Islamabad.

**Results:** Total patients managed in the burn care centre were 94664. Out of the total 54% were males and 46 were females. Children of age group 2-12 year were the most affected group with 51.29% patients. Flame burns were the commonest type 51.1% among all age group and both gender. The household environment constitutes the commonest site of burn 71.3%. The mean total body surface area (TBSA) for children managed on outdoor basis was  $5.1 \pm 5\%$  and for adults  $10.64 \pm 8\%$  overall, while for the admitted patients the mean TBSA was  $36.5 \pm 18\%$ . Most of the burns were partial thickness mixed superficial and deep 63%. The frequency of burn increased by 20% in winter seasons. Most patients belonged to low socioeconomic status. All indoor as well as outdoor patients were treated free of cost. Among the hospitalized patients the mortality rate was 26%. The overall mortality rate was 2.8% when projected to the entire study sample.

**Conclusion:** Our data provides the epidemiological pattern of burn injuries in Pakistan and highlights the gravity of this major public health issue. More tertiary care regional burn centres in cities, and burn units and burn wards in rural areas should be established. More research and advancement as well as a survey at national level in this neglected field is mandatory to decrease morbidity and mortality in our population.

**Keywords**

- Epidemiology
- Burns
- Burn Injuries
- Burn care center
- Pakistan institute of medical sciences
- Islamabad
- Pakistan

**INTRODUCTION**

It is important to study epidemiology to analyze the cause, magnitude and profile of burn in a particular region and population. Epidemiological study is the first step in planning preventive and management strategies; hence, any endeavor in this direction is appreciable [1]. One of the most important causes of morbidity, disability and death in the developing world is Burn injury that also affects psychosocial and functional aspects of patients. Nowadays, great advances have been made in the treatment and care of burn injuries globally and have resulted in increases in survival and quality of life (QOL) of burn patients [2]. Burn injuries are unique traumas that are recognized as serious

public health problems both in low and high income countries [3]. They account for 1% of the global burden of diseases and are ranked fourth among all injuries [4,5]. The burn is not only fatal for patients themselves, but also poses burden to health system by taking up the available healthcare resources. Risk factors include low socioeconomic conditions, poor living conditions, illiteracy, and overcrowding and floor level cooking [6,7]. It is associated with long hospital stay and mortality [8,9]. Burn injury is an important yet under-researched area in Pakistan. The Global Burden of Disease 2010 study estimates that the age-standardized mortality rate for injury caused by fire, heat, and hot substances is 5.8 per 100,000 population in Pakistan [10]. The World Health Organization estimates that the lifetime incidence

of severe burns is 1% and that more than 300,000 people die annually from fire-related burns worldwide [11,12]. As the treatment of burn injuries may require months to years, with repeated intervening surgical procedures, it is obvious that burn injuries continue to constitute a notable medical, economical, and social challenge for a developing country [13,14]. The present study is designed to document the prevalent epidemiological pattern and outcome of burn injuries over a decade period at country first national Burn Care Centre established at Islamabad to generate evidence based strategies to address the issue in national perspective. Study includes all the cases presented primarily and managed at the centre.

## METHODOLOGY

This study includes retrospective data analysis of patients conducted over a 10 year period from 1<sup>st</sup> January 2008- 1<sup>st</sup> October 2017 at Burn Care Centre (BCC) Pakistan Institute of Medical Sciences (PIMS), Islamabad. BCC is a 20 bed tertiary care burn referral hospital and is the only public sector specialist facility in the region, receiving all burn cases from a large catchment area encompassing the twin cities of Islamabad and Rawalpindi and the adjoining territories. Study includes all the cases presented primarily and managed at the centre. Patients presented more than 24 hour after injury or managed at some other hospital are excluded. Informed consent was taken from the patients for inclusion in the study. Initial assessment and diagnosis were made by thorough history and, physical examination and necessary investigations. Total body surface area (TBSA) burnt was calculated in adults using Rule of Nines in adults and Lund and Browder chart in children. Patients with major burns, high voltage electric burns and those needing any surgical interventions were admitted for indoor management. Patient with minor burns were discharged home after necessary emergency management, home medication and follow up advice. The socio-demographic profile of the patients, place of burn injury, TBSA burnt, depth burnt and outcome in terms of survival and mortality were all recorded on the proforma. As per protocol of our centre, we initially managed all the burn victims according to standard Advance Burn Life Support (ATLS) protocols of American Burn Association. Wound cleansing, topical antibiotics and occlusive dressings were applied after assessment. Adequate analgesia and prophylaxis against tetanus were ensured. A central venous line was established in all patients needing intravenous fluid resuscitation. Fluid resuscitation was guided by the Parkland formula. Fresh frozen plasma and blood were transfused where indicated. Early tangential excisions and skin grafting were performed. In addition, patients needing other surgical interventions such as flap coverage, fasciotomies, were managed accordingly. The data were subjected to statistical analysis using Statistical Package for the Social Sciences (SPSS) version 20. Descriptive statistical tests were conducted. Ethical approval for the study was provided by Hospital Ethical Committee of Pakistan Institute of Medical Sciences (PIMS), Islamabad.

## RESULTS

The total patients managed in the burn care centre were 94664. Out of the total 51118(54%) were males and 43545(46%) were females as shown in Bar Graph (1).

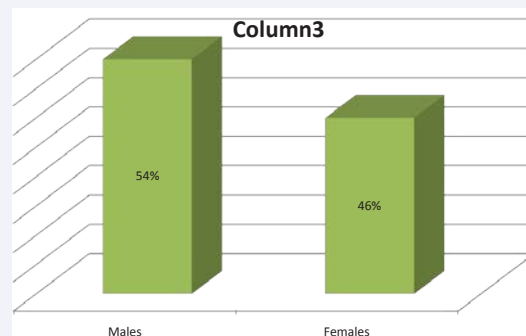
Children of age group 2-12 year were the most affected group with 38842 (51.29%) patients. Adults among different age groups were the second commonly affected constituting 36350 patients (48.5%). Infants 1514(0.2 %) and neonates 75(0.001%) were the least affected. Table (1) shows the age distribution of patients.

Flame burns were the commonest type (51.1%) among all age group and both gender, followed by scalds (28.5), electric (7.7%), contact with hot objects (6%), firework and blast (6.5%) and chemical burn (0.2%) as shown in Table (2).

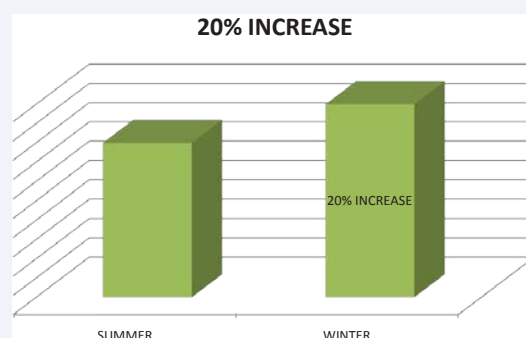
The household environment constitutes the commonest site of burn (71.3%). Table (3) shows the site of occurrence of burns among patients.

The mean total body surface area (TBSA) for children managed on outdoor basis was  $5.1 \pm 5\%$  and for adults  $10.64 \pm 8\%$  overall, while for the admitted patients the mean TBSA was  $36.5 \pm 18\%$ . Most of the burns were partial thickness mixed superficial and deep (63%). Table (4,5) shows the TBSA affected and the degree of burns in patients. 98.7% burns were accidental while 0.9% self inflicted and 0.4% burns were assault based.

*Pseudomonas spp.* predominates the swab culture isolates of our setup 41.9%. MDR (Multi-Drug Resistant) and MRSA (Methicilin Resistant Staphylococcus Aureus) cases are on the lower side due to strict practices of regularly updated antibiogram



**Figure 1** The total patients managed in the burn care centre were 94664. Out of the total 51118(54%) were males and 43545(46%) were females as shown in Bar Graph 1.



**Figure 2** The frequency of burns increased by 20% in winter seasons, while it remains the same with little variation throughout the years, as shown in Bar graph 2.

and specialized care of wounds and advance techniques of patient management at BCC. Klebsiellapneumoniae is on second with 23.2% prevalence among patients. Klebsiella and Pseudomonas was present combine in 10.1% culture reports. Staphylococcus aureus (MRSA) in our patients was 11.6%. The prevalence of swab culture isolates of our setup is shown in Table (6).

The frequency of burns increased by 20% in winter seasons, while it remains the same with little variation throughout the years, as shown in Bar graph (2). 60% of patients belonged to low socioeconomic status, 30% middle class and 10% high socioeconomic status.

A total of 8330 (11%) patients were admitted while 67401(89%) patients were managed on outdoor basis. The mean hospital stay among hospitalized patients was  $14.3 \pm 8.15$  days (range 4-65 days). All admitted as well as all patients managed on outdoor basis were treated free of cost. There were 2165 deaths among the hospitalized patients constituting the mortality rate of 26%. The overall mortality rate was 2.8% when projected to the entire study sample. The mortality rate with different TBSA burnt among hospitalized patients is shown in Table (7).

## DISCUSSION

This study provides the largest data of burn injuries from Pakistan. Therefore our study data provides the best epidemiological pattern of burn injuries in Pakistani population. In our study male population was mostly affected, this finding is also predominant in other studies [15-17]. Children were most common victims among all age groups, which was common

**Table 1:** Age distribution of the patients (n=94664).

	Age	Total Percentage (%)
Neonate	0-28 days	0.001
Infant	1month- 1year	0.2
Children	1-12 Years	51.29
Adults	13-20 Years	12.2
	21-30 Years	15.3
	31-40 Years	10.1
	41-50 Years	6.2
	51-60 Years	4.2
	61-70 Years	0.5
	71-80 Years	0.009
	Total	100

**Table 2:** Overall distribution of the causes of burns (n=94664).

S. No	Causes	Total Percentage (%)
1	Flame burns	51.1
2	Scalds, hot vapors	28.5
3	Electrical burns	7.7
4	Contact with hot objects	6
5	Fireworks, blasts etc.	6.5
6	Chemical burns	0.2
	Total	100

**Table 3:** Place where burn injury was sustained (n=94664).

S. No	Place	Total Percentage (%)
1	Home	71.3
2	Workplace	17.5
3	Street / Bazaar	8.2
4	Road	2
5	Others/Undisclosed	1
	Total	100

**Table 4:** TBSA of Burn in Patients (n=94664).

S. No	TBSA burnt %	Total Percentage (%)
1	0-10 %	46.4
2	11-20 %	22.7
3	21-30 %	10.2
4	31-40 %	9.5
5	41-50 %	6.3
6	51-60 %	2.1
7	61-70 %	1.6
8	70-80 %	0.8
9	80-90%	0.239
10	90-100%	0.161
	Total	100

**Table 5:** Degree of Burn in Patients (n=94664).

Degree of burn	Total Percentage (%)
• First degree ( Superficial)	19.5
• Second degree (Partial thickness)	63%
α. Superficial	
β. Deep	
γ. Mixed	
• Third Degree ( Full thickness)	16.9
• Fourth Degree	0.6
Total	100

**Table 6:** Prevalence of Swab Culture Isolates of Bcc (n=94664).

Pseudomonasauroginosa	41.9%
Klebsiellapneumoniae	23.2%
Klebsiella and Pseudomonas combine	10.1%
Staphylococcusaureus, MRSA	11.6%
Proteus species	7.4%
Candida	5.4%
Acinetobacter	2.7%
No growth	18.2%
Total	100

observation among developing countries and in other studies [18-21]. Flame burns were predominant in our population followed by scald burns, this finding is unique to our population as scalds were the most common burns in epidemiological studies of other populations [21-24]. Flame burns were in majority in hospitalized

**Table 7:** Mortalities among the patients with different TBSA burnt. (n=94664).

	TBSA burnt %	Mortalities (%)
1	0-10 %	0
2	11-20 %	0
3	21-30 %	3.46
4	31-40 %	7.5
5	41-50 %	39
6	51-60 %	78.7
7	61-70 %	92.4
8	>70 %	98.6
9	Electrical Burns:	
	1- Low Voltage	0
	2- High Voltage	1.86
Total Mortalities		26

subsets of patients, followed by scald and electric burns in our population. Scald burns were predominant in patients managed on outdoor basis in our study. Home environment was the most frequent site where burn injuries are sustained in our population [21-25]. Housewives and children were the groups affected at household environment the most. This happening was common in our population as children easily become victims of scald burns due to low level cooking at most of our homes and housewives become victims of flame burns due to their common engagement in cooking activities [26-28]. Awareness and education programs should be established to reduce the incidence of household burns among women and children. The mean total body surface area (TBSA) for children managed on outdoor basis was  $5.1 \pm 5\%$  and for adults  $10.64 \pm 8\%$  overall, while for the admitted patients the mean TBSA was  $36.5 \pm 18\%$ . Most of the burns were partial thickness mixed superficial and deep (63%), this finding is also in conformity with several other studies [29-31]. In our population family and marital conflicts, failed love affairs, emotional traumas and psychiatric issues were the main reasons for self inflicted burns [31,32]. Self inflicted are major social and medical problem and account for 2 - 30% of all burn injury admissions worldwide and suffered more morbidity and mortality [21,33]. The prevalence of electric burn in our population is 7.7% of total and mostly being high voltage, which is quite high comparable to what is reported from developed countries [21,33,34]. This is due low safety protocols followed while designing building, open electrical wires on poles, in residential areas, linemen working on electrical poles and transformers and no proper check or follow up by government officials to ensure safety from these hazards. In our series the frequency of burns increased by 20% in winter seasons comparable to other seasons throughout the years which is also unique to our population owing to increased use of heaters, gas cylinders and boiling of water in winter [21,35-37]. Majority of our patients belonged to low socioeconomic status; this is due to lack of awareness toward safety measures and lack of educational and preventive programs in our population [21]. Mean hospital stay among our hospitalized patients was  $14.3 \pm 8.15$  days<sup>38</sup>. All admitted as well as all patients managed on outdoor basis were

treated free of cost this is most wonderful aspect of management for patients managed at Burn Care Centre, PIMS, Islamabad as despite being in a developing country and not being funded to the full extent all personnel involved in managing have worked hard and dedicated their priority first towards patients. *Pseudomonas spp.* predominates the swab culture isolates of our setup followed by *Klebsiellapneumoniae* species [38-40]. The mortality rate among our hospitalized patients was 26% and the overall mortality rate was 2.8% when projected to the entire study sample. Mortality rate was higher in children, flame burns, full thickness burns and burns greater than 50% TBSA [41-45]. This increased mortality in our population is due to lack of interest of government officials in making standard operating protocols and prevention programs toward this epidemic. In Pakistan there is shortage of burn care centers and even being the state of the art facility our centre has 20 beds that make it difficult for us to select patients for admission as no centre in Pakistan accepts burns greater than 60 % TBSA due to their poor prognosis. As all major burns needs hospital admission the authorities must realize that along with establishing such facilities equally important is the public awareness from dangerous practices at home and work places and introduction of strict safety protocols for all gas and electric appliances.

## CONCLUSION

Our data the most authentic epidemiological pattern of burn injuries in Pakistan and highlights the gravity of this major public health issue. To overcome these epidemic collaborative efforts at national level between doctors, public health authorities and non government organizations should be established. Educational, prevention and rehabilitation programs at national level should be started. Financial assistance of affected victims should be ensured. Planned designing of residential, commercial and industrial projects should be done and proper check and follow up of old areas especially electrical lines, gas lines, gas cylinder factories, oil tankers should be made to ensure safety of public. Women and children being the most affected population and home environment being the most common site of occurrence makes them primary targets for preventive programs. More tertiary care regional burn centers in cities, and burn units and burn wards in rural areas should be established. More research and advancement as well as a survey at national level in this neglected field are mandatory to decrease morbidity and mortality in our population.

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Khan MS, Rehan M, Ali U, Iqbal T (2018) Epidemiology of Burns: A Decade Experience. *JSM Burns Trauma* 3(2): 1042.