

## ORIGINAL ARTICLE

# BURNS: EPIDEMIOLOGY AND DISTRIBUTION PATTERN IN KARACHI - A ONE-YEAR SURVEY

**Qudsia Hassan<sup>1</sup>, Mohd Ikram Ali<sup>2</sup>, Farhat Mirza<sup>3</sup>**

<sup>1</sup>Department of Forensic Medicine & Toxicology, Ziauddin Medical College Clifton, Karachi

<sup>2</sup>Forensic Sciences, Sahara Medical College, Narowal

<sup>3</sup>Department of Forensic Medicine, Jinnah Sindh Medical University, Karachi

### ABSTRACT

**Background:** Burns are associated with morbidity and mortality and have greatly affected mankind. They form the fourth most type of trauma encountered worldwide, preceded by traffic accidents and homicidal violence. In the south Asian region the deaths associated with burns are considered second to accidents.

**Objectives:** The objective of this study was to find the epidemiology and distribution of burns in the city of Karachi and to identify the most vulnerable population in this part of country.

**Design:** Cross sectional study

**Place and Duration:** This is a one-year cross-sectional study from January 2016 to December 2016 conducted on patients reported with burn injuries in medico legal section, in a tertiary care hospital, Karachi

**Methods:** Total number of cases reported during one year was 453. Data was collected regarding age and divided into various sub categories, gender, causative factor of the burn injury, total surface areas of burns, manner of causation of burns, and time of arrival in medico legal section. The estimation of extent of burn was calculated in terms of total body surface area according to Wallace's rule of nine and in cases of children Lund and Browder charts were used. Victims were brought dead too that are included in this data. Data was collected and analyzed using SPSS version 20.

**Results:** Our sample comprised of n=453 participants with burns. Of total participants majority n=256(56.5%) were males and n=197(43.5%) were females. In nature of burns, n=347(76.6%) were due to dry flame heat, n=78(17.2%) were due to Scalds (moist burns), n=17(3.8%) were due to electrical burns whereas n=11(2.4%) caused due to chemical burns. Majority of the cases were reported in autumn season and majority of the reporting time n=151(33.3%) were between noon to evening. In patients with < 20% burns majority were n=22(23.7%) children whereas in burns with ≥20% body surface area majority were n=232(64.6%) adults. Children and old age individuals are the most vulnerable population

**Conclusion:** In metropolitan city of Karachi burns are suffered in majority by males. The manner of causation of burn is accidental and caused by dry flame burns at work place. There is no association of burns with gas stoves or heating places and majority of cases were reported in autumn between noon and evening time.

**KEYWORDS:** Burn, Disability Adjusted Life Years, Surface Area

### Corresponding Author

**Qudsia Hassan**

Ziauddin University Main Building,  
Clifton Campus, 4/B Shahrah-e-Ghalib,  
Clifton Block 6, Karachi  
Qudsia.hassan@zu.edu.pk

## INTRODUCTION

A burn is a thermal injury caused by biological, chemical, electrical and physical agents with local and systemic repercussions. Burns are extensively associated with morbidity and mortality and have affected humanity since time immemorial.<sup>1</sup> They are the fourth most form of trauma encountered worldwide, preceded by traffic accidents and acts of homicidal violence.<sup>2</sup> In middle and low-income countries, such injuries present one of the leading causes of disability adjusted life in years.<sup>3</sup> In the south Asian region this problem is observed with a greater frequency especially in underdeveloped parts of this region, the deaths associated with burns are considered second only to road traffic accidents.<sup>4</sup>

Heat is the most common source of origin of thermal injuries; other sources include chemicals, electrical current and radiations. Burns are acute, unpredictable and devastating injuries that leave the survivor in physical and psychological trauma. A decline in deaths due to burn injuries has been observed in past few decades due to advancement in wound care and plastic surgery field. The disabilities and deaths in association with burns are dependent on multiple factors such as their percentage, age of the victim, thickness of the skin involved, airway injuries due to smoke inhalation and other pre-existing co-morbid conditions of the victim. Multi organ failure secondary to septicemia and hypovolemic shock seem to be the most commonly encountered cause of death. Burn injuries are also a leading cause of disability, disfigurement, multiple surgeries, multiple and prolonged hospital stay and psychological trauma, which pose a high economic burden on the individual as well as on the hospital.<sup>5</sup> The objective of this study was to find the epidemiology and distribution of burns in the city of Karachi and to identify the most vulnerable population in this part of country.

## METHOD

This is a one-year cross-sectional study from January 2016 to December 2016, based on the cases that were reported to the medico legal section of a tertiary care government hospital in Karachi where most of the cases of burns are reported as it is furnished with a fully functional public sector burns facility.

Data was collected regarding age, sex, causative factor of the burn injury, and manner of causation of burns. The estimation of extent of burn was calculated in terms of total body surface area according to Wallace's rule of nine and in cases of children Lund and Browder charts were used. Victims were brought dead too that are included in this data. For the purpose of analysis time of admission was divid-

ed into four slots with midnight from 12am till 6am, Morning from 6am till just before 12 pm, noon starting at 12pm and till just before 6 pm and evening beginning at 6pm till just before 12am. Age groups were classified as less than 10 as children, 10-19 as Adolescents, above 19 years and less than 60 years as adults and 60 years or greater as Old age. Burns were classified into two categories as less than 20% of body surface area and 20% or more. Months were classified into four categories as winter from 1st December to end of February, spring from 1st March to end of May, summer from 1st of June till end of August and autumn from 1st September till end of November. Data was collected and analyzed using SPSS version 20. Total number of cases reported during one year was 453.

## RESULTS

Our sample comprised of n=453 participants with burns. Of total participants majority n=256(56.5%) were males and n=197(43.5%) were females. When nature of burn was assessed it was seen that most reports n=347(76.6%) were due to dry flame heat, n=78(17.2%) were due to Scalds (moist burns), n=17(3.8%) had been exposed to electrical burns whereas least common observed were n=11(2.4%) caused due to chemical burns.

With regards to reporting time n=100(22.1%) cases came up between midnight to Morning, n=78(17.2%) were reported between morning to noon, n=151(33.3%) were brought to hospital between noon to evening and n=105(23.2%) arrived between evening and midnight. Majority of the cases were reported in autumn season n=144(31.8%) followed by winter season where n=118(26%) cases were admitted and 111(24.5%) cases were brought to the hospital in summer season. Least number of cases were reported in spring with only n= 80(17.7%) cases.

When data was analyzed in terms of surface area majority n=359(79.2%) had burns over more than 20% of their body surface area compared to n=93(20.5%) sample having burns less than 20% of their body surface area.

According to age grouping between different age groups n=72(15.9%) cases were children, n=77(17%) cases belonged to adolescent group, n=281(62%) were adults and n=23(5.1%) of sample belonged to old age population. When association between age groups and gender were seen among males n=34(13.3%) cases were children, n= 49(19.1%) were adolescents, majority n=160(62.5%) were adults and n=13(5.1%) belonged to old age group. Among females n=38(19.3%) were children, n=28(14.2%) were adolescents, n=121(61.4%) were adults and only n=10(5.7%) belonged to old age group.

When association between type of burn and age groups was assessed it was seen that dry heat cases comprised of n=27(7.8%) children, n=62(17.9%) adolescents, majority n=236(68%) were adults and n=22(6.3%) comprised of old age group. When Scald (moist heat) was observed majority n=42(53.8%) were children, n=9(11.5%) were adolescents, n=26(33.3%) were adults, and only n=1(1.3%) were old age groups. When chemical burns were observed n=2(18.2%) were adolescents and n=9(81.8%) were adults. There were no cases of chemical burns in children and old age groups. Among electrical burns n=3(17.6%) were children, n=4(23.5%) were adolescents and n=10(58.8%) were adults while there were no cases of electrical burns from old age group (p value 0.000). Our data displayed that all types of burns were seen more commonly among adult age group except for scald (moist heat) which was more commonly seen in children. Association of gender, season of admission and percentage of body surface area burn with types of burn has been shown in Table 1. When admission was associated with season of the year it was observed that in winter season n=11(9.3%)

children were admitted, n=23(19.5%) were adolescents, majority n=80(67.8%) were adults and n=4(3.4%) were old age groups. In spring season among children n=10(12.5%) cases were admitted, n=12(15%) cases of adolescents were admitted, majority n=70(63.1%) were adults and n=5(4.5%) belonged to old age. In summer season n=21(18.9%) children, n=15(13.5%) adolescents, majority n=70(63.1%) adults and n=5(4.5%) old age groups arrived in hospital. When autumn was considered for admissions it comprised of n=30(20.8%) children, n=27(18.8%) adolescents, n=75(52.1%) adults and n=12(8.3%) old age patients (p value 0.051). When percentage of body surface area burn was seen it was observed that those patients with < 20% burns included n=22(23.7%) children, n=19(20.4%) adolescents, n=48(51.6%) adults and n=4(4.3%) old age group. When cases with burns ≥20% body surface area were observed it comprised of n=50(13.9%) children, n=58(16.2%) adolescents, n=232(64.6%) adults and n=19(5.3%) old age patients (p value 0.241). Association of gender with reporting season and reporting time has been displayed in Table 2.

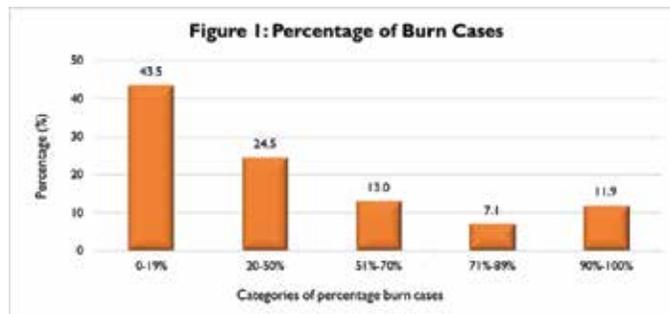


TABLE 1

		BURN (DRY HEAT)		SCALD (MOIST HEAT)		CHEMICAL BURN		ELECTRICAL BURN		P VALUE
		N	%	N	%	N	%	N	%	
GENDER	MALE	185	72.3	48	18.8	7	2.7	16	6.2	
	FEMALE	162	82.2	30	15.2	4	2	1	0.5	
SEASON	WINTER	101	85.6	12	10.2	3	2.5	2	1.7	0.001
	SPRING	65	81.2	9	11.2	4	5	2	2.5	
	SUMMER	79	71.2	20	18	2	1.8	10	9	
	AUTUMN	102	70.8	37	25.7	2	1.4	3	2.1	

PERCENTAGE OF BURN	<20% BODY SURFACE AREA	54	58.1	25	26.9	7	7.5	7	7.5	0.000
	≥20% BODY SURFACE AREA	293	81.6	52	14.5	4	1.1	10	2.8	

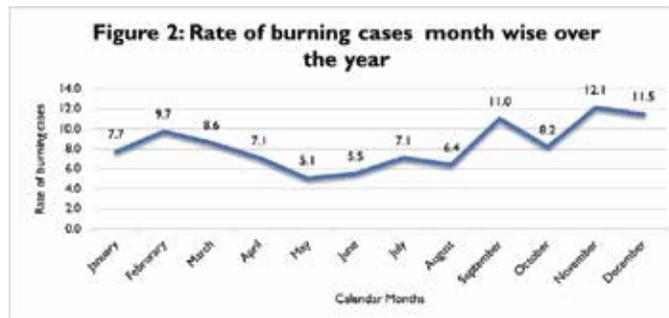


TABLE 2

		MALES		FEMALES		P VALUE
		N	%	N	%	
ADMISSION SEASON	WINTER	61	23.8	57	28.9	<b>0.476</b>
	SPRING	46	18	34	17.3	
	SUMMER	61	23.8	50	25.4	
	AUTUMN	88	34.4	56	28.4	
REPORTING TIME	MIDNIGHT TO MORNING	67	26.1	52	26.3	<b>0.849</b>
	MORNING TO NOON	43	16.8	35	17.8	
	NOON TO EVENING	89	34.8	62	31.5	
	EVENING TO MIDNIGHT	57	22.3	48	24.4	

**DISCUSSION**

Burn injuries form one of the leading causes of trauma to the mankind. There are different severities of burns ranging from small to large surface areas, and their management directly depends upon their

severity in terms of physiological, anatomical, functional and psychological damages.<sup>6</sup> In last fifty years revolutionary advancement in terms of burn care has taken place in terms of plastic and reconstructive surgery. Victims suffering from deep to extensive burns, elderly burns victims and inhalation burns pose a great challenge to the Medical

Science even with such advancements.<sup>7</sup>

The results of our research showed a male preponderance with male= 56.5% and female = 43.5% which is quite contradictory to the researches done in Bhutan, Bangladesh, India, Nepal and Sri Lanka. In all those studies there was female predominance.<sup>8,9</sup>The reason for this contradiction in gender preponderance may be due to the fact that our study comprised of urban population where mostly females are educated and do not use liquid fuel for domestic use. While in all the above mentioned South Asian countries the data comprised of rural population where there are lack of life skills, lack of first aid facilities and unequipped health system. Even if first aid facilities are available, the health-care providers are unskilled.<sup>7,8,10</sup>A surveillance study conducted by Pakistan National Emergency Department data results are exactly in accordance with the results of our research showing a male preponderance ratio of 2:1.<sup>11</sup>A similar study was conducted on mortality ratio in Burns Ward of Civil Hospital, Karachi from period 2010 – 2011, which reported a male preponderance to female death ratio of 53.1% and 46.9% respectively.<sup>12</sup> A similar type of results were seen in a study conducted in Rawalpindi, where 40 % of the reported cases were of females and rest were males.<sup>13</sup>

Results of our study revealed majority of the victims falling under the categories of adults n=28 (62%) followed by adolescents 17% and then children and elderly >15%.In African regions females are the most common victims within age range of 16-35 years.<sup>14</sup> One study conducted in Pakistan showed age preponderance of 10-29 years of age.<sup>6</sup> Similar studies conducted in Karachi, Rawalpindi showed suffers belonging to age group 16 – 30 years and < 46 years respectively.<sup>7,8</sup> Studies conducted in Iran are in accordance with our study where mean age was 22.3± 19 years in female victims and 13.6± 17 years in male victims respectively.<sup>15</sup>

Majority of the studies showed injuries and death related to burns occurring at home. <sup>8, 13, 14, 15</sup> In one study at Rawalpindi 79.2% of the cases reported occurred at home. Results of our research showed that majority of the burns were caused by dry flame burns 76.6% followed by scalds (17.2%) and electrical burns (3.8%). Among this category least common was observed due to chemical burns.<sup>8</sup>This is in complete concordance to other researches in South Asia, America and Africa, where most common cause of injury due to burns are due to dry flame burns. <sup>8,9, 10, 14</sup> United states treat approximately 50,000 patients of burn every year. According to a study conducted in United States 46% of the burns are caused by flame burns, which support results of our study.<sup>1</sup> However study in Iran and India showed two third of the burns were caused by hot liquids or steam. When association between type of burn and age groups was assessed it was seen that dry heat

cases comprised of n=236(68%) adults followed by n=62(17.9%) adolescents, n=27(7.8%) children and n=22(6.3%) old age group respectively. Scald (moist heat burns) was observed in majority in children n=42(53.8%) followed by n=26(33.3%) adults, n=9(11.5%) in adolescents, and only n=1(1.3%) in old age groups. These differences are due to different heating devices like Samovar, valor or picnic gas stoves employed in those parts of the world or due to overturning and spilling of hot liquids.<sup>15, 16</sup> In case of chemical burns n=2(18.2%) were adolescents and n=9(81.8%) adults were observed. There were no cases of chemical burns in children and old age groups. Among electrical burns n=3(17.6%) were children, n=4(23.5%) were adolescents and n=10(58.8%) were adults while there were no cases of electrical burns from old age group (p value 0.000). Our data displayed that all types of burns were seen more commonly among adult age group except for scald (moist heat) which was more commonly seen in children, which are most commonly accidental in nature.

World over burns comprise 5% of mortality. United State spends approximately \$ 500 billion per year on suffers of burns. <sup>17</sup> In terms of surface area majority n=359(79.2%) had burns over more than 20% of their body surface area compared to n=93(20.5%) sample having burns less than 20% of their body surface area (Table 2 & Figure 1). This result is supported by other researches around the world. In a study in India having similar results showed maximum number of patients had 21 – 50 % burns.<sup>4</sup> However a ten year study conducted in Fauji Foundation; Rawalpindi, Pakistan revealed results showing seventy seven (31.04%) patients with 10% and 55 (22.17%) patients having 11-20% total body surface area burns respectively.<sup>18</sup>

Researchers have shown that mortality rate is higher if burn area is more than 40% as seen in various studies in India.<sup>9, 14</sup>However study in Karachi showed highest mortality when surface area was more than 60%.<sup>12</sup>In our research with victims having ≤ 20% maximum number of cases were seen in adults 63.1%. Maximum numbers of cases were reported between midnight to evening 33.3 %. Reason being maximum exposure to flame occurs at home while cooking and during work at this time. The association of season with number of victims showed maximum reporting in autumn season (31.8%) followed by winter & summer season (28%). Maximum number of cases were reported in months of November 12.1% followed by December 11.5 % and September 11 % as shown in Figure 2. The association of burns with seasonal variation cannot be established with factors explained as above.

## CONCLUSION

Burns are multi centric entity which requires a multi-

disciplinary aggressive approach toward treatment. It involves patient, family, doctors and paramedics simultaneously which becomes a challenging task.<sup>19</sup> A study conducted in Lahore in 2015 showed that low social support is being provided to the burns patients which affects their treatment and recovery outcomes with physiological and psychological sequel.<sup>6, 20, 21, 22</sup> In one study it was found that no association was observed between burn patients and post traumatic stress disorder (PTSD). Female burn patients have more symptoms of PTSD and lower resilience compared to male. Resilience may be a protective factor of PTSD.<sup>23, 24</sup> Safety can be ensured by educating the masses about causes, hazards, first aid at home and safety measures. Kerosene oil based stoves usage be discouraged and LPG gas may be encouraged. Children and elderly individuals should be given limited access to kitchen. According to WHO, burn causes 18 million disability adjusted life years.<sup>14</sup> A multidisciplinary approach and team care proves a best option for treating these patients.<sup>25</sup>

## REFERENCES

- Garcia Espinoza. Burns: Definition, Classification, Pathophysiology and Initial Approach. *General Medicine: Open Access* 2017; 5(5).
- World Health Organization. The Global Burden of Disease: 2004 Update. Geneva: World Health Organization; 2008.
- Peck M. Epidemiology of burns throughout the world: Distribution and risk factors. *Burns* 2011;37(7):1087-100
- Subrahmanyam M. Epidemiology of burns in a district hospital in Western India *Burns* 1996;22(6):439-42.
- Goudar BV. The problem of burns (Bhimanagouda V. Goudar, 2017). *Int Surg J* 2017; 4(2):500-5.
- Cheng JZ, Farrokhi A, Ghahary A, Jalili RB. Therapeutic Use of Stem Cells in Treatment of Burn Injuries. *J Burn Care Res.* 2018;39(2):175-82.
- Burd A. Research in burns - Present and future. *India J Plastic Surg* 2010; 43(Suppl): S11-S14.
- Syed Moniruzzaman, PhD Centre For Public Safety. Epidemiology of burns in South Asian countries, Lecture presented in conference 2017.
- Goudar BV, Agarwal S, Yamanur P. Lamani, Gururaj S, Gouda V. The Problems of Burns. *Int Surg J* 2017;4(2):500-5.
- Golshan A, Patel C, Hyder AA. A systematic review of the epidemiology of unintentional burn injuries in South Asia. *J Pub Health* 2013;35(3):384-96.
- Siddiqui E, Zia N, Feroze A, Awan S, Ali AL, Razzak JA, et al. Burn injury characteristics: findings from Pakistan National Emergency Department Surveillance Study. *BMC Emerg Med* 2015; 15(Suppl 2): S5.
- Ibran E al, Mirza FH, Memon AA, Farooq M Z, Hassan M. Mortality associated with burn injury- a cross sectional study from Karachi, Pakistan. *BioMed Central research notes.* 2013;6:545.
- Farooq U, Nasrullah M, Bhatti JA, Majeed M, Hanif M, Khan JS, et al. Incidence of burns and factors associated with their hospitalisation in Rawalpindi, Pakistan. *Burns* 2011 May;37(3):535-40.
- Rybarczyk MM, Schafer JM, Elm CM, Sarvepalli S, Vaswani PA, Balhara KS, et al. A systematic review of burn injuries in low- and middle-income countries: Epidemiology in the WHO-defined African Region. *Afr J Emerg Med* 2017;7(1):30.
- Iran S. Arshi, H. Sadeghi-Bazargani, R. Mohammadi, R. Ekman, D. Hudson, H. Djafarzadeh, Delavari A, et al. Prevention oriented epidemiologic study of accidental burns in rural areas of Ardabil. *Burns* 2006;32 :366-371
- Ganesamoni S, Kate V, Sadasivan J. Epidemiology of hospitalized burn patients in a tertiary care hospital in South India. *Burns* 2010;36(3):422-9.
- Nordberg E. Injuries as a public health problem in Sub-Saharan Africa: epidemiology and prospect for control. *East Afr Med J* 2000;6:1-4.
- Chaudhry IA. Burns: frequency and mortality related to various age groups. *J Surg Pak* 2009; 14 (2): 67-71.
- Atiyeh BS, Gunn SW, Hayek SN. State of the art in burn treatment. *World J Surg* 2005;29(2):131-48.
- Waqas A, Naveed S, Bhuiyan MM, Usman J, Inam-Ul-Haq A, Cheema SS. Social Support and Resilience Among Patients with Burn Injury in Lahore, Pakistan. *Cureus.* 2016; 8(11): e867.
- Martin L, Byrnes M, McGarry S, Rea S, Wood F. Social challenges of visible scarring after severe burn: a qualitative analysis. *Burns* 2016, S0305-4179(16):30263-7.
- Kornhaber R, Wilson A, Abu-Qamar M, McLean L, Vandervord J. Inpatient peer support for adult burn survivors —a valuable resource: a phenomenological analysis of the Australian experience. *Burns* 2015, 41:110-117.
- Bibi A, Kalim S, Khalid MA. Post-traumatic stress disorder and resilience among adult burn patients in Pakistan: a cross-sectional study. *Burns Trauma* 2018 6:8. Yanga Z, Wangb JQ, Zhanga BZ, Zengc Y, Mac HP. Factors influencing resilience in patients with burns during rehabilitation period. *Int J Nurs Sci.* 2014;1:97.
- Su Win T, Nizamoglu M, Maharaj R, Smailes S, et al. Relationship between multidisciplinary critical care and burn patients survival: A propensity-matched national cohort analysis. *Burns* 2018; 44: 57-64.