

## Epidemiological Analysis and Cost of Hospitalization Associated with Pediatric Burns in Kermanshah, Iran

Behzad Karami Matin<sup>1</sup>, \*Satar Rezaei<sup>1</sup>

<sup>1</sup> Faculty of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.

### Abstract

#### Introduction

Burn injuries are a major public health problem all over the world, especially in developing countries. The aim of this study was investigate to the epidemiological data and cost of hospitalization due to burn in children in Kermanshah provinces from 2011 to 2013.

#### Methods and Materials

This was a retrospective cross- sectional study. The study subject was all of patient lee than 15 years who admitted in Burns Center in Imam Khomeini Hospital in Kermanshah, Iran, from 21 March 2011 to March 2013 (two years). The data including age, gender, cause of burn, burn degree, place of burn, Length of stay (LOS), Burned body surface (BBS) and cost of hospitalization was obtained from hospital data and analyzed by SPSS version 18.

#### Results

The overall mean age was  $5.27 \pm 4.52$  years; the ages ranged from less than 1 year to 15 years. The mean BBS % and LOS was 22.8 % and 7.48 day, respectively. The mean cost per patient, per hospitalization day and per % BBS were 15,000,000 IRR, 657,981 IRR and 20045348 IRR, respectively.

#### Conclusion

The current study showed the main cause of burn and mortality in the pediatric population was hot liquids and flame, respectively. An important point is that most of burn injuries in pediatric population are preventable and avoidable if the necessary training about cause of these burns provides for their parent.

**Keywords:** Cost of hospitalization, Iran, Epidemiology, Pediatric burns.

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#### \*Corresponding Author:

Faculty of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran.

Email: [satarrezaei@gmail.com](mailto:satarrezaei@gmail.com)

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## Introduction

Burns injuries are a major issue on public health in terms of mortality, morbidity and cost of treatment in the both developing and developed countries and the burns in pediatric range from minor to severe injuries (1, 2). The previous studies also have shown the more than 5 % of total admission in hospital and 1 % of global burden of diseases are related to the burns injuries (3, 4). Also, in Iran burn injuries, especially among pediatric, cause significant mortality and morbidity and the second cause of death, after traffic accident, in population under the age of 15 years (5, 6).

To many reasons such as less perception of dangerous situation, recklessness and less ability to react properly in dangerous situation, the risk of burn injuries in children is higher in compared with adults. The burns injuries is most expensive and its treatment requires to specialized personnel and medical equipment and technologies (1). The objective of current study was to investigate the epidemiology, etiology and cost of hospitalization of pediatrics burn injuries in west of Iran, Kermanshah. We hope the results of this study will be used as a basis for developing targeted preventive programs to protect children from burns.

## Materials and methods

The study subjects included all those aged 15 years and under who admitted at the Imam Khomeini Hospital Burn Center, Kermanshah, Iran, between 21 March 2011 to March 2013. This burn center is the only referrals center for the all burns in the province. The Kermanshah province consists of 14 counties with an area of 24,461 square kilometers and a population of 1947225 people, of whom 121586 (6.25%) of people are between the ages of 0 – 15 years

(according to the census 2011), which is located in the middle of the western part of Iran. All patient information including age, gender, season of burns, causes of burn, Burned body surface (BBS), degree of burn, outcomes of burn, place of burn, Length of stay (LOS), and hospital costs (including drug and other consumable items, nursing services, diagnostic services, visits, hotel accommodation, blood banks, surgery, etc.) were collected by reviewing medical records. The children were divided to four groups based on their ages: 0-4 years, 5-8 years, 9-12 years and 12-15 years. The extent of burns was divided to five groups based on burns: 0-20 %, 20-40 %, 41-60 %, 61-80 % and 81-100 %. Also, the cause of burns was divided to three groups based on burn cause: flame, hot liquids (water, milk and etc.) and others (electricity and explosion).

Differences between various groups were assessed using the Chi-square test, independent t-test and one way ANOVA test. The P-value less than 0.05 was considered to be statistically significant. The statistical analysis was performed using SPSS Version 18.

## Results

Among the 1005 hospitalized patients due to burns at the Imam Khomeini Hospital Burn Center, during the two years period, 252 (25 %) of those were the children  $\leq$  15 years of age. The mean age was  $5.27 \pm 4.52$  years; the ages ranged from less than 1 year to 15 years. There were not significant different between the mean ages of boys and girls (p-value= 0.321). The 9-12 years age group had the highest proportion of patients (27.7 % of all patients). The distribution of patient by age and gender is shown (Table.1).

**Table 1:** Distribution of age and gender of pediatric burn in Kermanshah

Age groups	Total number		Male		Female	
	n	%	n	%	n	%
0-4	65	25.7	32	22	32	31
5-8	60	23.8	35	23.7	26	23.8
9-12	70	27.7	47	32.2	23	21.4
13-15	57	22.8	33	22	24	23.8
Total	252	100	147	100	105	100
*Mean age $\pm$ SD	5.27 $\pm$ 4.52		4.86 $\pm$ 3.84		5.88 $\pm$ 5.33	

\*Age vs. gender, p- value = 0.321

The current study showed the commonest cause of burns is hot liquids which accounting for 60.7 % of all burns injuries, followed by flam (35 % of all patient) and 4.3 % of all burn injuries is related to the electricity and explosion. In all age groups except in the "13-15 years", the hot liquids were the most common cause of burns.

The distribution of patient by age groups, BBS, LOS, cause of burn and the

commonest cause of burn are shown in (Table. 2). The mean LOS and BBS were  $7.48 \pm 7.72$  days and  $22.8 \pm 18.6$  %, respectively. The LOS days ranged from less than 1 day to 42 days and the BBS % ranged from less than 1 % and 100 %. Also, there were a significant association between age of patient with LOS (0.015) and extent of burns (0.001).

**Table 2:** Distribution of pediatric burns by age groups, BBS % and Cause of burn in Kermanshah

Age groups	LOS (days) Mean $\pm$ SD	Extent burns (%) Mean $\pm$ SD	Cause of burn,		Commonest Cause (%)
			Flame	Hot liquids	
1-4	6.27 $\pm$ 5.25	17.5 $\pm$ 7.25	10	50	Hot liquids(77)
5-8	4.88 $\pm$ 3.11	21.25 $\pm$ 16.94	13	45	Hot liquids(75)
9-12	9 $\pm$ 10	23 $\pm$ 20.5	30	40	Hot liquids(57)
13-15	9.5 $\pm$ 9.3	30 $\pm$ 24.6	35	18	Flame (61)
Total	7.48 $\pm$ 7.72	22.8 $\pm$ 18.6	88	153	Hot liquids (60.7 %)
P_value	0.015 <sup>a</sup>	P=0.001 <sup>a</sup>	P=0.04 <sup>b</sup>		

<sup>a</sup> One-way ANOVA was used,

<sup>b</sup> chi-square test was used df=1

The epidemiological characteristics of pediatric burns in Kermanshah are shown in (Table.3). 58.4 % (147) of study sample were boys and 41.6 % (105) were girls. Also, the male to female ratio was 1.4. The most frequency burn injuries had occurred at the winter which accounting for 27.7 % of

all study sample, followed by autumn (26.7 %), spring (23.8 %) and summer (21.8 %). The mean cost per patient, per hospitalization day and per % BBS were 15,000,000 IRR, 657981 IRR and 20,045,348 IRR, respectively.

**Table 3:** Characteristic of pediatric burns in Kermanshah (n=252)

Variables	n	Percent
<b>Gender</b>		
Male	147	58.4
Female	105	41.6
<b>Place of burns</b>		
Indoor	188	74.3
Outdoor	64	25.6
<b>Cause of burn</b>		
Hot liquids	153	60.4
Flame	88	34.6
Others	11	5
<b>Site of burns</b>		
Head and neck	125	49.5
Upper limb	168	66.3
Lower limb	128	50.5
Trunk	185	73.3
Perineum	25	9.9
<b>Season of burn</b>		
Spring	60	23.8
Summer	55	21.8
Winter	70	27.7
Autumn	67	26.7
<b>Cost of parameters</b>		
Mean cost per patient		15,000,000
Mean Cost per hospitalization day		657,981
Mean Cost per burn percent		2,005,348
Mean LOS (days)		7.48 ± 7.72
Mean extent of burn (%)		22.8 ± 18.6
<b>Extent of burn %</b>		
0-20	159	63.1
21-40	74	29.4
41-60	5	1.96
61-80	7	2.77
81-100	7	2.77
<b>Burn degree</b>		
1	3	1.2
2	127	50.4
3	72	28.5
1&2	3	1.2
2&3	47	18.7
<b>Outcome of burns</b>		
Survival	227	90
Death	25	10

The extent of the burn was <40% of the BBS in 92.5 % (233) of the patients and 50.4 % of patient had a third degree of burn. The 10 % (25) of all patients died during the period study; on the other hands, the overall fatality rate among study sample was 11 %.

The distribution of study sample by cause of burn is shown in (Table.4). The fatality rate on flame and hot liquids was 20.4 % and 4.5 %, respectively. The mean age, LOS, BBS and cost hospitalization for burns occurred by Flame is higher than the others cause.

The mean cost of hospitalization for flame and hot liquids was 15,124,010 and 14,830,521 IRR, respectively ( $p=0.115$ ). Also, the mean LOS and BBS of burns by Flame were 10.16 days and 30 %, respectively. The male to female ratio for burns by Flame and hot liquids was 1.63 and

1.2 respectively. There is not significant association between cause of burn and gender ( $p= 0.091$ ). The fatality rate of burn by flame and hot liquids was 20.5 and 4.5 %, respectively ( $p= 0.001$ ). Also, the mean BBS of burn by Flame was 1.5 higher than to the hot liquids ( $p= 0.014$ ).

**Table 4:** Distribution of pediatric burns by cause of burn in Kermanshah

Variables	Gender		Outcome		Mean $\pm$ SD			
	Male	Female	Death	survival	Age	LOS (days)	Extent burns (%)	Cost (IRR)
Flame	48	40	18	70	8.69 $\pm$ 4.96	10.16 $\pm$ 10.28	30 $\pm$ 26.6	15124010
Hot liquids	95	58	7	146	3.51 $\pm$ 2.99	6.3 $\pm$ 6.14	20.07 $\pm$ 12.44	14830521
Others	4	7	0	11	7.67 $\pm$ 5.5	8.67 $\pm$ 3.5	20.7 $\pm$ 12.7	13199593
P_value	0.091 <sup>a</sup>		0.001 <sup>a</sup>		-	0.023 <sup>b</sup>	0.014 <sup>b</sup>	0.115 <sup>b</sup>

<sup>a</sup> chi-square test was used d.f=1

<sup>b</sup> independent t test for two means was used

There were 158 (63 %) patients with BBS less than 21 % and only 17 (6.7 %) patients had BBS burned over 40 %. Also, about 68 % of deaths occurred in patients with BBS over 40 %. The mean BBS, Age and cost in patient with BBS over 40 % was higher in

compared to BBS less 40 %. The distribution of pediatric burn by BBS and degree of burn is shown in (Table.5). Also, the analysis of hospital profiles showed 50.8 % of pediatric had a second degree burn, as is shown in (Table. 5).

**Table 5:** Distribution of pediatric burn by BBS and degree of pediatric burn in Kermanshah

Variables	Gender		Outcome		Mean $\pm$ SD			
	Male	Female	Death	survival	Age	LOS (days)	Extent burns (%)	Cost (IRR)
<b>Burn %</b>								
0-20	103	55	1	157	4.4 $\pm$ 3.8	5.13 $\pm$ 4.25	13.14 $\pm$ 4.8	1327102
21-40	35	40	7	68	5.63 $\pm$ 4.8	11.9 $\pm$ 10.2	28.8 $\pm$ 5.05	1670646
41-60	0	5	3	2	13 $\pm$ 2.8	27 $\pm$ 1.5	51.8 $\pm$ 0.5	1743925
61-80	7	0	7	0	5.3 $\pm$ 2.5	4.3 $\pm$ 2.9	72.7 $\pm$ 10	1994350
81-100	2	5	7	0	14 $\pm$ 1.7	2.67 $\pm$ 2.9	96 $\pm$ 5.3	2267432
<b>Burn degree</b>								
1	3	0	0	3	1	9	16	
2	68	60	3	125	4.07 $\pm$ 3.5	5.67 $\pm$ 4.2	17.7 $\pm$ 8.5	
3	47	25	12	60	6 $\pm$ 5.2	8.8 $\pm$ 9.6	26.5 $\pm$ 27.4	
1&2	3	0	0	3	3	1	5	
2&3	26	20	10	36	7.8 $\pm$ 4.99	10.68 $\pm$ 10.7	32 $\pm$ 18.6	

## Discussion

Burn injuries, especially pediatric burns, are imposing the high mortality, morbidity

and economic burden on patients, their family and society in general. This study showed about 25 % of patient were admitted due to burns had the ages less than 15 years

old, while according to census 2011 about 6.25% of total population of Kermanshah province are to the this age groups (7). The mean age of patient was  $5.27 \pm 4.52$  years which is similar to the finding of studies conducted in Tehran, Iran (5), Isfahan, Iran (6) and Pakistan (8), But it is not similar to the results of studies conducted in Kuwait (9) and Istanbul, Turkey (10). The male to female ratio was 1.4. The increased number of male in compared with the female is common in studies conducted in Istanbul, Turkey (10), Pakistan (8), Kuwait (9) and Mosul, Iraq(1). This finding may contribute to the nature boys that they are have a tendency toward to being more active and jumbles in compared to the he female.

The most common cause of burn in pediatric was hot liquids in our study. This finding is similar to the results of previous studies (1, 6, 8, 9, 11-13). This can be attributed to this fact that the younger are vibrant and they are a lot of time in the inside home. But it is important and should be mentioned that the most of these burns occurred due to carelessness or mistake parent and approximately all of these burns are preventive. The results of our study showed as the age of children is increased the main cause of burns, especially among males, changed from hot liquids to Flame, which this finding is similar to the others study in Iraq, Kuwait and Turkey (1, 9, 12, 14).

The overall mean BBS in our study was 23 % and about 68 % of patient who died had a BBS over 40 %. One of the main factors affecting on LOS, BBS % and cost of hospitalization is the cause of burn. Hot liquids usually cause lightly burn rather than to the flame and so need to fewer operations and a shorter LOS. The results showed the mean BBS in burns occurred by Flame is higher than to the burns by hot liquids in our study and there were a significant

correlation between cause of burn and BBS % ( $p=0.014$ ). This finding is consistence with the results of other studies (1, 15-17). The overall mean LOS in study subject was 7.47 days which is higher in burns by Flame (10.16 days) in compared to the hot liquids (6.3 days) ( $p=0.023$ ). The significant association between cause of burns and length of stay is founded in studies conducted in (1, 18). Also, although when the BBS % of patient is increasing, the mean cost per patient was increased but there was not a significant correlation between BBS % and cost ( $p=0.984$ ) which is consistence with result of study conducted by Sahin et al. in Turkey (3). The LOS per 1 % of BBS was 3 days which was 1 days and 2 days in studies conducted by Sahin et al. (3) and Gillespie et al. (19), respectively.

The overall fatality rate of hospitalized children due to burns in our study was 11 %. This finding is similar to the results of study conducted in Tanzania (16) but was lesser than in Mosul, Iraq (1) and higher than in Kuwait (9). An important point is that this burn center is a referral centers and the patients from the other provinces such as Kurdistan, Lorestan and Ilam received. Also, in the current study only patients who hospitalized was considered and patients with minor burns treated as outpatient were excluded. The fatality rate of burn by flame was 5 time higher than to the hot liquids and there was a significant association between cause of burn and mortality rate ( $p= 0.001$ ) which in consistence with other studies in Iraq(1) and Kuwait (9).

Several studies have been conducted about cost of burns in Turkey(3), Iran (20), Welsh(21) and especially among pediatric population (22, 23). The mean cost per hospitalization day and one percent of BBS was 65,7981 and 20,045,348 IRR, respectively. Sahin et al. (3) and Griffiths et

al. (24) founded a cost \$US15,125 and £1850 per burns patient, respectively. This results in contrast with the mean cost of burn in our study which was 15,000,000 IRR. In the current study the cost of hospitalization in burns of patient was estimated from provider perspective and this makes the actual cost of burns patient was underestimated. Also, an important point is that the study population could also have an impact on the average cost. In our study the study subject was a pediatrics population (0-15 years old) while in studies conducted by Sahin et al (3) and Griffiths et al. (24) all of patients included and there is no age limit. Both the previous studies and current study have been showed the main cause of burn in pediatrics and total population were hot liquids and flame, respectively (6, 20, 25-27). Also, these studies showed the mean of BBS% and LOS in burns by Flame is higher than the hot liquids. Shields et al. founded the main factors are affecting on cost of burns including length of stay, percentage of total body surface area burned, child's age, region of the United States, hospital location, and hospital type (22).

### Conclusion

The current study provides useful information about characteristics of pediatric burns in Kermanshah, Iran. Our study showed the hot liquids were the main cause of burn in pediatric population, although flame was the most common fatality in study subjects. An important point is that the approximately of burns injuries in pediatrics are preventable and we hope this study could be helps to policy makers about eliminating or reducing burn injuries.

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### Authors' Contribution

Satar Rezaei had a substantial role in content, design and data analysis. Behzad Karami Matin participated in the finalizing the analysis and writing the initial version of the manuscript.

**Conflict of interests:** None

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