

# The Epidemiological Data and Cost of Hospitalization in Patients Dying Due to Burn Injuries in the West of Iran: A Four Year Review

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## Abstract

**Background and Objectives:** The burn injuries are one of the serious public health problems which impose a high economic burden on patients and their family, health sector and community in general. This study aimed to explore epidemiological data of burn patients and factors influencing costs of hospitalization due to burn injuries in Kermanshah Province situated in Western Iran.

**Methods:** The study surveyed 625 burn patients who were admitted and died in the Imam Khomeini Hospital's Burn Center in Kermanshah Province from 21 March 2009 to 20 March 2012. The data about demographics, cause of burn, burned body surface (BBS), length of stay (LOS), and cost of hospitalization were collected from hospital documentations. Descriptive analytical methods were used for data analysis.

**Findings:** The mean and median age was 32.5 and 27 years respectively. The female/male ratio was 2.45 (181 male and 444 female). Flame was found as the most common cause of death due to burn (~93 % of all deaths). The mean cost of hospitalization per one day stay and per one percent of BBS was 2897062.5 and 234897 IRR, respectively.

**Conclusions:** This study provides detailed provincial data on demographic characteristics cost of hospitalization of patients died due to burn injuries in. Our results showed that the cost of hospitalization of in burn-injury patients are related to their LOS, % BBS, and the cause of burns. These data may help hospital managers and health policy-makers in developing strategies to decrease the rate of death due to burn injury and reduce hospitalization cost of burn-injury patients.

**Keywords:** Burn injury, Epidemiology, Hospitalization cost, Epidemiology, Length of stay, Burned body surface.

## Background and Objectives

Burn injuries are one of the most important health problems, which can produce high mortality and morbidity in the world, especially in low- and middle-income countries [1]. In 2004, about 11 million people have been burned in the world; almost all of them need medical attention. Also around 195,000 deaths are occurring due to burns, which the majority (95%) of them are related to low- and middle-income countries [2]. The factors associated with burn injuries vary widely from one region to another; therefore, a successful preventive program should be

designed according to the needs of each region. Furthermore, burn care is an expensive care because the treatment of a burn patient needs special care, modern equipment and trained personnel [3-4]. In the USA, the cost of primary care per day for one patient with burns varies from \$3000 to \$5000. The average costs of hospitalization for burn patients were found to be twice more than others diseases [5]. More than 2000 Iranian people die due to burns each year; about 1.5 % of them occur in Kermanshah province [6].

Kermanshah province with an area of 24,461 square kilometers and with a population of around 2 millions, is located in the middle of the western part of Iran. This province from the east is limited to the Hamadan province, from the north to Kurdistan province, from the west to Iraq, and from the south to Ilam and Lorestan provinces. Imam Khomeini Hospital is the

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main referral center for burn injuries not only for Kermanshah province, but also in the neighboring provinces. It means that approximately all patients with burn injuries in Kermanshah province are referred to this burn center. In designing a programme to burn injury prevention, the magnitude of the economic and epidemiological data of burn injuries must be determined. This study would provide a holistic view about economic and epidemiological data for patients, hospital managers and health policy makers. The aim of this study was to investigate the cost of hospitalization and epidemiological data of 625 burn patients who were admitted and died in Imam Khomeini Hospital's Burn Center in Kermanshah province from 21 March 2009 to 20 March 2012.

## Methods

This study was a cross-sectional descriptive study. At the time of this study (between 21 March 2009 and 20 March 2012), 625 patients who died due to burn injuries were admitted in the burn center at Imam Khomeini Hospital in Kermanshah province. The clinical and hospitalization data of these patients were obtained from the hospital records and statistics:

- Age, gender, season of burns, causes of burn, burned body surface (BBS), place of burns, length of stay (LOS);
- Hospital costs (including drug and other consumable items, nursing care, diagnostic tests, visits, hotelling, and other costs).

The statistical analysis was performed using SPSS Version Software.

## Ethics

The approval for conducting this study was obtained from Kermanshah University of Medical Sciences' Ethics Committee.

## Results

The mean and median age of the study population were 32.5 and 27 years, respectively (the range of age varied from less than 1 to 96 years). The female/male ratio was 2.45 (181 males and 444 females). The distribution of 625 patients, who died due to burns by age groups and gender, is shown in Table 1 and 2, respectively.

In all age groups except in the "*less than 10 years*", flame was the most common cause of death due to burns. The mean LOS and %BBS for the "*20-30*" age group were 8.9 days and 80%, which were more than

in other age groups. The mean cost of hospitalization for this age group was 21506689 IRR, which is greater compared with others.

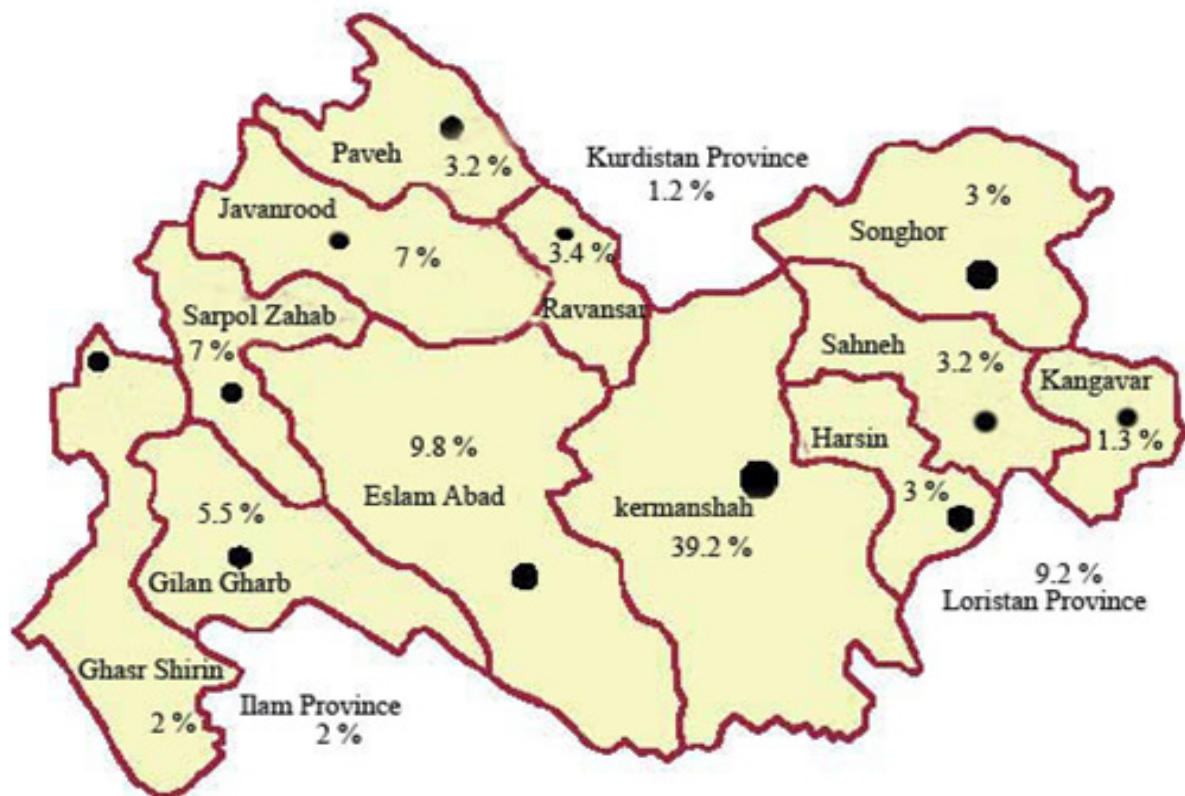
The mean LOS, BBS and cost of hospitalization were 6.3 days, 77.7% and 18251493.6 IRR respectively. The majority of deaths (71.04%) belonged to females. Also the mean LOS, %BBS and cost of hospitalization in the females were 77.7%, 7.02 days and 20030839 IRR, respectively. The reviewing of medical records showed that the most common cause of death due to burns was flame (approximately 93% of all deaths). The distribution of death due to burns by cause is shown in Table 3.

The death due to burns by electricity was more common in the males, and no death due to burns by electricity occurred in the females. The mean LOS and %BBS in deaths due to burns by flame were greater than by other causes. The distribution of all patients by %BBS is shown Table 4.

The mean LOS and cost of hospitalization of death with 61-80% BBS were 9.27 days and 31950613 IRR, which was higher than other groups. The mean cost per one day hospitalization and per 1% BBS was 2897062.5 and 234897 IRR, respectively. The mean cost per one day hospitalization for males was 3018846 IRR, and for females was 2853396 IRR. Also the mean cost per 1% burns for males and females was 185156 and 258462.5 IRR, respectively. The distribution of cost drivers for males, females and all deaths is shown in Table 5. The distribution of cost drivers for males, females and all deaths is similar.

In all patients, the main cost drivers were associated with drugs and other consumable items (60% of total costs), hotelling (30%), and visits (3.7%). The highest number of deaths due to burns occurred in the summer months (28%), followed by autumn months (27%), winter months (24%), and spring months (21%). The mean cost per patient in summer was 20323041 IRR, which is higher than in the other seasons. The mean LOS and BBS % in deaths in the summer months were 78.6% and 6.8 days, respectively that are higher than in the others seasons. The highest number of burns occurred at home (70%), followed by work places (25%) and unknown places (5%). In Table 6, the deaths are categorized in terms of the tissues/organs of body involved in burning. The commonest tissues involved in burns were upper limbs (98.5%), followed by the lower limbs (97.5%) and trunk (94%). Also about 61% of all deaths belonged to burning in all tissues.

The distribution of deaths due to burns at the time of our study (2009-2012) by geographic regions is shown in Figure 1.



**Figure 1** The distribution of patients died due to burn injuries over the Provincial geographic region

With regard to the distribution of deaths due to burns by geographic regions, most of the deaths was occurred in the Kermanshah city (39.2 %), followed by Eslam Abad (9.8 %) and Lorestan Province (9.2 %). About 12.4 % of all deaths came from the neighboring provinces such as Kurdistan, Ilam and Lorestan provinces.

## Discussion

Factors associated with burn injuries vary among different regions; therefore, in each region, before designing and performing an effective preventive program, the epidemiological studies about burn injuries are necessary. The costs related to care of burn injuries are high. Also

**Table 1** Classification of burn-injury-related data of patients died due to burn injuries based on their age groups

Age group (year)	Gender		Mean LOS (day)	Mean BBS (%)	Mean cost (IRR)	The most frequent causes (%)
	Male	Female				
0-10	14	15	6.2	54.9	13257995	Scald (45)
10-20	20	102	6.3	79	16355747	Flame (97.5)
20-30	62	165	8.9	80	21506689	Flame (96)
30-40	33	64	9.8	81	18607136	Flame (95.5)
40-50	20	37	8.5	70.2	17000000	Flame (89.5)
50-60	4	23	9.7	67.3	20504734	Flame (88)
>60	28	38	9	69.2	12356984	Flame (96)

**Table 2** Classification of burn-injury-related data of patients died due to burn injuries based on their gender

Gender	Frequency of deaths	Mean age (year)	Mean LOS (day)	Mean BBS (%)	Mean Cost (IRR)	The most common cause (%)
Male	181	35	4.6	75.5	13886690	Flame (89.5 %)
Female	444	31.4	7.02	77.7	20030839	Flame (94 %)
Total	625	32.5	6.3	77.07	18251494	Flame (92.8 %)

the previous studies in high income countries have shown that the cost of burn injuries in comparison with other health problems such as stroke and AIDS is more [7-9]. However, the review of literature at the time of this study indicated that there are few studies on the cost of burns injuries in Iran [1]. In this study, we sought to identify the epidemiological data and cost of hospitalization in deaths due to burns in the burn center at Imam Khomeini Hospital in Kermanshah Province (Iran) from 2009 to 2012.

The current study showed that the mean age of deaths was 32.5 years. The highest frequency of deaths due to burns was occurred in 20-30 years age group, which is consistent with other studies [1, 10]. The male/female ratio was 2.45. The results showed the frequency of death due to burns in the females was higher than in the males, which is similar to other studies [1, 10-11]. The study by Qader in Iraq showed the female/male ratio was 6.02, and the study by Panjeshahin *et al.* in the South West of Iran showed the female/male ratio was 3.34 [11,12]. Although there is self-immolation in the regions, but since there is no insurance coverage for the costs of hospitalization, the review of hospital data revealed that no self-immolation was recorded in the medical records, and all of the patients expressed that burn was an unintentional event. The most common cause of deaths due to burns in all age groups except for "*less than 10 years*" was flame, which is in consistent with other studies (Scald was the most common cause of deaths

in "*less than 10 years*" group). In burns due to flame, the mean LOS, the cost of hospitalization and %BBS were greater as compared with other causes of burn. For all deaths, the mean LOS, %BBS and cost of hospitalization were 6.3 days, 77.7 % and 18251493.6 IRR, respectively.

There was a significant association between % BBS and the cause of burns, LOS and cost of hospitalization ( $P<0.0001$ ), which is inconsistent with the findings of other studies [1, 13]. The mean cost of hospitalization for males and females was 13,886,690 and 20,030,839 IRR, respectively. The average cost for females was higher than that for males, which could be due to the longer LOS and the higher average of %BBS for females as in the other studies. Also the longer LOS increases the cost of treatment, causes numerous huge economic burden on the patients, and inhibits the earnings of other family members. Karami Matin *et al.* found the the mean cost of hospitalization for males and females was 19,113,198 and 22,007,182, respectively. In all deaths, the mean cost per 1%BBS and one day hospitalization was 234,897 and 2,897,062 IRR, respectively. In other studies, the mean cost of burns per patient was 20,463,227 IRR [1], \$15,250 [9] and \$46,069 [14]. Usually the admission and discharge policies, the quantity and quality of health care services, the prices of services and drugs, the wages of personnel and the cost calculation are different between countries; therefore, the

**Table 3** Classification of burn-injury-related data of patients died due to burn injuries based on cause of the injury

Cause	Gender		Mean LOS (day)	Mean BBS (%)	Mean cost (IRR)
	Male	Female			
Flame	162	418	8	83	18068295
Scald	10	6	7.3	57.6	20700000
Electricity	2	0	0.5	47	235899
Explosion	7	18	6.9	58	22014772
Others*	0	2	6.3	78.5	22966095

\*Acid and alcohol

**Table 4** Classification of burn-injury-related data of patients died due to burn injuries based on their BBS intensity

BBS intensity	Gender		Cause of burns					Mean LOS (day)	Mean cost (IRR)
	Male	Female	Flame	Scald	Electricity	Explosion	Others		
0-20	3	0	2	0	1	0	0	1.6	3545230
21-40	13	17	21	2	0	7	0	8.9	22082354
41-60	32	76	95	9	0	4	0	8.95	25493610
61-80	37	125	145	3	1	13	0	9.27	31950613
81-100	96	226	317	2	0	1	2	3.77	8710459

**Table 5** Distribution of cost drivers burn-injury patients' hospitalization

Gender	Nursing care	Visit	Drug, and others consumable items	Diagnostic tests	Hoteling	Other
Male	1.7	4.3	59.5	2	29.7	2.8
Female	1.7	3.5	59.9	1.5	30.2	3.2
Total	1.7	3.7	59.9	1.6	30	3.1

estimated costs of treatment in burn injuries and other diseases varied greatly from country to country. This study had some limitations. First, it was conducted in a single burn center in one province, and therefore, one should be cautious in generalizing the results to other parts of the country and the world. Second, due to the adoption of the perspective of the provider (hospital) in this study, some costs such as informal costs, productivity loss, transportation, food, etc. are not considered, and therefore, the actual costs might be higher than what calculated in the current study.

## Conclusions

This study provided a holistic view for hospital managers and health policy makers about the demographic characteristics and cost of hospitalization about deaths due to burns in Kermanshah province. Also the results showed that the main factors relevant to cost of hospitalization in burn injuries are LOS, %BBS and the cause of burns. The authors hope that the results of the current study could help to policymakers in designing preventive programs for reducing the burden of burn injuries. In addition, as we are aware, this is the first study about the cost of hospitalization in deaths due to burns in Iran. Therefore, the results will add

to our knowledge regarding the cost of treatment in deaths due to burns in Iran.

### Abbreviations

(LOS): length of stay; (BBS): body burned surface

### Competing Interests

The authors declare no competing interests.

### Authors' Contributions

KMB conceived, designed and coordinated the study and

**Table 6** Frequency of burn injuries based on patients' organs

Region	N	%
Head and neck	567	90.7
Upper limbs	616	98.5
Trunk	588	94
Lower limbs	609	97.5
Perineum	410	65.5
All regions	382	61



participated in revising the manuscript. RS made the major contribution in collecting, analyzing and interpreting the data, and drafting and revising the manuscript. MJ was involved in analyzing and interpreting the data and revision of the manuscript. All authors read and approved the final manuscript.

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