

## Epidemiology and Burn out Consequences in a Large Therapeutic Center in Iran (2010-2015)

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ARTICLE INFO	ABSTRACT
<p><i>Article type:</i> Original article</p> <hr/> <p><i>Article History:</i> Received: 14-May-2019 Accepted: 16-May-2019</p> <hr/> <p><i>Key words:</i> Burn Epidemiology Infection Injury</p>	<p><b>Introduction:</b> Burns have impacts including medical, psychological, economic and social that involve patients and health care system. Epidemiologic factors of burns vary in different societies. While the effects of some burn variables on mortality rate, in similar circumstances, are expected to be universal. The present study was carried out to analyze the epidemiology, mortality, and current etiological factors of burn injuries.</p> <p><b>Materials and Methods:</b> This cross-sectional study was conducted during a period of 6 years (from 2010 to 2015). Data were obtained by the analysis of medical records of patients hospitalized in the Imam Reza Burn Center in Mashhad, Iran. The data were recorded by the nurses and staffs in the burn ward.</p> <p><b>Results:</b> In our study, 1334 in-hospital burn patients were recorded. The mean age was <math>27 \pm 5.67</math> years. The most common mechanism of burn was flame. The multivariable logistic regression modeling revealed, that the most important risk factors of patient mortality were length of stay (LOS) (OR=2.53(95% CI: 1.75-3.66), percentage of burn regarding body surface (BBS) OR=10.64(95% CI: 7.58-14.43), degree of burns OR=6.39(95% CI: 1.46-27.99).</p> <p><b>Conclusion:</b> The results of our study revealed a high incidence of burns. Prevention plans should be made in this regard.</p>
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### Introduction

Burns continue to constitute a major problem threatening public health. Burns have impacts including medical, psychological, economic and social that involve patients and health care system (1).

Data from the National Center for Injury Prevention and Control in the United States show

that approximately 2 million fires are reported each year resulting in 1.2 million burn injuries. Moderate to severe burns requiring hospitalization account for approximately 100,000 of these cases and about 5000 patients die annually from burn-related complications (2).

As a result of improvements in intensive care

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management in specialized burn wards, burn-related death has decreased in the recent years. Improved consequences have been attributed to advances in the care of these patients, such as fluid resuscitation, nutritional support, pulmonary care, burn wound care, infection control practices and other nursing cares (2, 3).

Epidemiologic studies have identified environmental characteristics of burn injuries together with high-risk groups in the population and have provided a valuable basis for prevention programs in the community. However, after the burns, they still are associated with high rates of multiple-organ failure and complications or infections (4, 5).

Following a burn injury, the most common cause of death is an infection. These victims are at high risk for acquiring additional nosocomial infections because of their impaired immune function and they need many invasive therapeutic and diagnostic procedures. (4) Wound infections are common in severe burns, which are due to the destructed skin that provides a suitable environment for microbial growth and invasion (5, 6). Epidemiologic factors of burns vary in different societies. While the effects of some burn variables on mortality rate, in similar circumstances, are expected to be universal (1).

Thus, the present study was carried out to analyze the epidemiology, mortality, and current etiological factors of burn injuries in the Imam Reza Burn Center in Mashhad, Iran.

## Methods

### Study design

This cross-sectional study was conducted during a period of 6 years (from March 2010 to September 2015) in Mashhad, Iran. Mashhad is the second largest city in Iran and is located in the north-east of country. Imam Reza Hospital is one of the largest hospitals in Iran and has thousands of active beds. All patients who were hospitalized for diagnosis from March 2010 to September 2015 were included in the study.

### Data collection

Data were obtained by analysis of the medical records of patients hospitalized in the Imam Reza Burn Center in Mashhad, Iran. This center is the only burns center in the north-east of Iran. The data were recorded by the nurses and staffs in the burn ward. Data were collected in check list that included demographic information, the degree and percentage of burn regarding body surface (BBS), cause of burn, length of stay (LOS), death rate and distribution of burn patients by suicide & addiction & HBsAg. The percentage of burned body surface (BBS) was assessed by the method of Nine's

Role.

We used the registered form of burn patient information that was available in the burn unit.

After the initial control, data entered into the statistical software.

### Statistical Analysis

Results were analyzed by using SPSS 16 software, and statistical analysis was performed using descriptive (frequency percent) and chi-square tests. Non parametric test, Mann-Whitney U test was used for variables abnormal distribution. Potential confounder was adjusted. Univariate and Multivariate analysis was used to identify significant risk factors from candidate variables. Then, multivariable logistic regression modeling was used to calculate the crude and adjusted odds ratios and 95% confidence interval (CI), P value of <0.05 was considered statistically significant.

## Results

In a 6 year period (2010-2015), a total of 1334 in-hospital burn patients were recorded in Imam Reza teaching hospital of Mashhad University of Medical Sciences. Among burn patients, 49.7% were men. The mean age was  $27 \pm 5.67$  years. Table 1 shows demographics and burn characteristics among burn patients. The most common age group was 21-40 years (45.5%). The mean length of stay was 17.7 days. From all of patients, 719 discharged, deaths 216 (females) and 171 (males), 228(17%) were transferred to the intensive care unit (ICU) due to the severity of the burn injury.

The most common Mechanism of burn was the flame. The mean of BBS was 45.8%. Table 2

**Table1.** Distribution of Demographics and burn characteristics among burn patients admitted to hospital in 2010-2015

Patient characteristics	N (%)
Age group(years)	
0-20	465(33.9)
21-40	625(45.5)
41-60	190(13.8)
>60	78(5.7)
Un known	15(1.1)
Sex	
Male	682(49.7)
Female	691(50.3)
Mechanism of burns	
Flame	111(8.1)
Scald	43(3.1)
Electrical	15(1.1)
Explosion	39(2.8)
Others	25(1.8)
Un known	1140(83.1)
Degree of Burns	
2	122(9)
2,3	120(9)
2,3,4	611(46)
Un known	481(36)

**Table2.** Distribution of burn patients by BBS& sex (Mann-Whitney U test)

BBS%	Female N (%)	Male N (%)	Survival N (%)	Death N (%)	P Value
<9	19(3)	7(1)	22(85)	4(15)	<0.001
10-19	73(10)	29(4)	100(98)	2(2)	
20-29	98(15)	48(7)	141(97)	5(3)	
30-39	100(15)	146(22)	228(93)	18(7)	
40-49	98(15)	105(16)	167(87)	36(18)	
50-59	52(8)	86(14)	102(74)	36(26)	
60-69	72(10)	69(10)	85(60)	56(40)	
70-79	54(8)	52(8)	39(37)	67(63)	
80-89	40(6)	47(7)	25(29)	62(71)	
90-100	44(7)	51(8)	12(7)	88(93)	
Unknown	22(3)	22(3)	87(70)	13(30)	
Total	672	662	983	351	

**Table3.** Distribution of burn patients by sex and suicide& Addiction& HBsAg(chi-square test)

Factor	Yes	No	P value
	N (%)	N (%)	
Suicide			>0.05
Male	2(0.3)	660(99.7)	
Female	6(0.9)	666(99.1)	
Addiction			<0.001
Male	6(0.8)	657(99.2)	
Female	25(3.7)	646(96.3)	
HBs Ag			>0.05
Male	2(0.3)	680(99.7)	
Female	8(1.2)	683(98.8)	

**Table4.** Odds Ratio and 95% Confidence Interval derived from Multiple Logistic Regression Model

Factor	Univariate	P value	Multivariate	P value
	OR(95% CI)		OR(95% CI)	
Sex	1.40(1.10-1.77)	0.005		
Age	3.54(1.25-10.03)	0.01		
length of stay(LOS)	1.61(1.17-2.22)	0.003	2.53(1.75-3.66)	<0.001
BBS	10.67(8.03-14.17)	<0.001	10.64(7.58-14.43)	<0.001
degree of burns	19.78(4.81-81.19)	<0.001	6.39(1.46-27.99)	<0.001

presents the distribution of patient based on the BBS and sex, with increase of BBS, survival were decreased. Also, Table 3 shows information about suicide, addiction, and HBsAg in burn patients. Impact of individual factors on patient mortality is reviewed in table 4. Univariate regression logistic analysis was performed to identify the most important factors affecting on patient mortality. To track the non-important variables, the first significant level for  $\alpha$  error was set 0.1. The results showed that sex, age, length of stay (LOS), percentage of burn regarding body surface (BBS), mechanism of burns have a significant impact on patient mortality ( $p < 0.1$ ). In the multiple logistic regressions, using stepwise method (forward LR) and after adjusting for the confounding variables, significant associations were found between length of stay (LOS) OR=2.35 (95% CI: 1.75-3.66), percentage of burn regarding body surface (BBS) OR=10.64(95% CI: 7.58-14.43), degree of burn OR=6.39(95% CI: 1.46-27.99) and patient mortality (Table 4). The results showed, the most important risk factor for patient mortality was length of stay (LOS) ( $p < 0.05$ ). The others risk factors were, percentage of burn regarding body

surface (BBS), degree of burn. (Table 4).

### Discussion

In present study, epidemiology, mortality, and current etiological factors of burn injuries, during six years, were investigated.

This study showed that length of stay (LOS) was the most important risk factor for patient mortality (perhaps due to infections), and other risk factors were: The others risk factors were age, sex, percentage of burn regarding body surface (BBS), and degree of burn.

The length of stay (LOS) was due to severity of burns and the most important causes were BBS and degree of burn. The length of stay (LOS) increased the cost and mortality in burn patients.

The gender and age distributions of burn patients considerably differ between studies. Female to male ratio in our study was 1.01. Some studies have reported a female preponderance (7-9) . However, other studies have reported a male preponderance (10, 11). Korean study showed a male predominance (3327/ 4481, 74.2%) (12).

In our study, the mean age of patients was 27 years, and the majority (79.1%) of burn patients

were aged between 0 - 40 years. The average age of our patients was greater than Agbenorku et al. study that reported a mean age of 15.8 years (13). In the present study, the average age was 27, which indicated that the most of burns occurred in patients of working age, as it is a unique tertiary and regional referral center in the north-east of Iran.

This article presented that the most frequent age group of burn patients was 21-40 years old.

In Groohi et al. study, the maximum burn incidence rates were observed in age groups <5 and 16-25 years (14).

In Penjeshahin study, the maximum burn incidence rates were in the age groups  $\geq 80$  and 20-29 years.(15)

This age group represents the productive period of life when people are more exposed to the hazards of burn, both at home and at work environments.

In our study, the mortality rate in the females was higher than males. Moreover, in our study, from all the hospitalized patients, 12.8% of males and 16.1% of females died.

Overall death rates due to burn injuries were 4.5 per 100,000 patients in a year in Kurdistan (14), in this respect, Panjeshahin et al. reported the mortality rates of 4.6 per 100,000 patients in a year in Fars province, Iran (15).

The female patients had a greater mean size of burns and higher mortality rate, reflected in a female to male risk of death ratio of 4 which is higher than other studies (14), similar to what Veeravagu et al. found (25).

In a study that was conducted in Kurdistan, female patients had a greater mortality rate due to the traditional style of Kurdish women's clothing, which help accidental burn. Their clothes are high volume, and most of the material of their clothes is highly flammable like nylon or silk (1).

In our study the most common known cause of burn in patients was flame and then scald (Both men and women).

The flame was the most common cause of burns, followed by scalds, and the same findings reported by other authors (1, 15-17).

In another study conducted in Iran, flame was the most common cause of burn in adults, followed by scalds (5, 14).

In the study conducted in Kurdistan the most common cause of burn in female patients was flame while male patients burned more with scalds (14).

In a study conducted in Shiraz, the flame was the most common cause of injuries (15), followed by scalding, which agrees with some of the studies (1, 15, 17, 18).

This may be explained by this fact that

flammable liquids are nearly the most frequently used domestic fuels in Iran.

Korean study revealed that flames were the most frequent cause of burns among adults in working age (which is considered to be 21-60 years), and scalds were the most common cause in younger patients. Flame injuries usually occur at work and scalds happen at home. Although scald burns were the most frequent etiological type in some studies [45.8% in Haik et al. and 57.4% in Agbenorku et al.] (7, 13). These differences in studies may be due to differences in the developmental grade of the countries that were examined (12).

In our study, the mortality rate increased with age. In the recent study, the mortality rate among females was higher than males.

In Kurdistan study, the death rate among females was significantly higher than males, because the females had a large number of fuel and fire burns and BBS involvement was higher than the males (14). This was due to Cultural differences in various areas, as well as differences in registration of data or wrong data.

In the present study, we demonstrated that the greater BBS and degree of burn were associated with increased mortality and increased hospital LOS. Veeravagu et al study, also, confirmed this. An important consideration is that, LOS, not only increased the cost of burn injuries and hospitalization, but also associated with disability and productivity loss (25).

In the present study, suicide was higher in women. Some literatures have reported a tendency towards increased frequencies of self-inflicted burns among men and women (19) Kurdistan study has reported one of the highest values (14, 20, and 21).

The high rate of suicide by burning among women may be explained by the various factors like, no perspective solution for individual problems. For example, they cannot find a way to solve their family problems such as lack of understanding with by the spouse, addiction of the spouse, the difference of age and polygyny, Low socioeconomic class, easy availability of inflammable factors and etc.

The overall mortality rate of our study was 26.3%. The overall mortality rate in the Fars province study was 34.4% and the overall fatality rate in the Kurdistan region was 33.4%, which are higher than many reports (15, 17, 22-24). The high mortality in burn patients in Iran could be due to a considerable number of patients with high BBS who were admitted to our burn units, the absence of effective barrier nursing of the patients, each room of the ward contained three to four patients which resulted in cross-infection, High resistance of microorganisms to

many available antimicrobial agents and also unavailability of preferred antibiotic choices (15).

## Conclusion

The results of the present epidemiological study showed that the highest incidence rates of burns were in younger age groups. Burn injuries were more frequent and larger with higher mortality in females than in males. The greater BBS and degree of burn were associated with increased mortality and increased hospital LOS. Flame was the primary cause of burns. Self-inflicted burns were noted mainly in young women and resulted in a great number of mortality. It is necessary to implement strategies for health education relating to the prevention of burn accidents.

The results of our study revealed a high incidence of burns among <20 years old. In this respect, implementing prevention programs should be designed for focusing chiefly on the domestic environment and the kinds of risks to which children are exposed in their everyday routine and parents, should also be educated about how to supply entertainment that would keep children away from risks, such as when they are playing in hazardous places involving fire and inflammable substances. In this respect, school teachers should be trained, so that they could guide children about avoiding risks.

This study attempted to determine the epidemiological aspect in major burns. Further analysis of epidemiological factors combined with another factor is required to improve the quality of life and decrease the mortality rate of major burn patients.

Our study limitation included that this study was retrospective and was performed at a single center, because our burn center is the largest and the only tertiary referral facility affiliated with a university medical center in the north-east of Iran, and the possibility of collaboration with local burn centers, it's possible that there were errors in data entry and limit on analysis that we tried as much as possible to control and correct data. Further studies are recommended in this area.

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## Conflicts of Interest

There are no conflicts of interest.

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