



Demographic Assessment of Burn Injuries in Iranian Patients

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► ABSTRACT

Objective: This study investigated the demographic characteristics and factors influencing burn injuries, primarily in low socioeconomic societies where such incidents are prevalent due to factors such as illiteracy and poverty.

Methods: This cross-sectional study included all burn patients admitted to Shahid Mottahari Hospital in Tehran, Iran. Demographic data such as age, sex, occupation, education level, and residence as well as detailed information about the burn incidents such as date, time, location, number of people present at the scene, and referral place was collected. Additionally, comprehensive burn details such as cause, extent, severity, previous history, and need for hospitalization directly at the emergency department were documented.

Results: The study included 2213 patients (mean age 34.98±19.41 years; range 1-96), with a men predominance (60.6%). The majority of burns (64.4%) occurred at home, primarily due to accidents (99.6%), with boiling water being the most common cause (39.2%). The most frequent burns were second-degree burns (91.8%), with an average injured body area of 6.31±6.67%. There were significant correlations between burn severity and demographic factors such as age, sex, occupation, cause of burn, hospital admission, outcome, and length of stay. Remarkably, the extent of burns was negatively correlated with the distance to the hospital, while positively correlated with the length of hospital stay.

Conclusion: Burn injuries were significantly influenced by demographic factors. Enhancing treatment facilities and reducing the time and distance to medical care could be crucial in high-risk cases.

Keywords: Demographic variables; Burn; Emergency.

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Introduction

Injuries are an urgent public health concern worldwide, affecting entire communities significantly [1-4]. Burn injuries are notably debilitating and sometimes disregarded. They are associated with severe morbidity, death, economic costs, and profound psychological effects, with long-term systemic consequences [5, 6]. Burn injuries, which rank fourth among unintentional injuries following car accidents and interpersonal violence, cause dramatic changes in homeostatic mechanisms, including circulation, metabolism, immune response, and inflammation, potentially resulting in multiple organ failure [1, 2, 7-9]. Burn injuries present a major global health issue, exacerbated by variables such as ignorance, poverty, and complications from other conditions [10, 11]. Accurate epidemiological statistics are essential for effective intervention. These injuries occur at varying rates across different demographics, with socioeconomic variables playing a significant role [12-15]. Unfortunately, the majority of data was extracted from high-income countries, with low-income nations frequently underrepresented due to healthcare disparities [16-18].

Annually, nearly 486,000 people in the United States seek treatment for burns, resulting in 40,000 hospitalizations and 3,400 deaths [19, 20]. In Iran, burn injuries were reported at an annual rate of 100,000 to 150,000 incidents, with a 6% hospitalization rate and a 10% fatality rate [21]. The World Health Organization (WHO) estimated about 11 million cases each year, resulting in 180,000 fatalities, representing a significant recovery challenge [22]. WHO classifies burns based on their etiology, which includes exposure to fire, smoke, flames, hot objects, electricity, and lightning [23, 24]. Various factors, such as direct contact with high temperatures, electricity, friction, radiation, or chemicals, contribute to burns, emphasizing the importance of prevention and improved patient outcomes [25, 26].

Burns are especially prevalent in developing and low- to middle-income countries, such as Iran [27-29]. They are ranked as the seventh leading cause of injuries in Iran, accounting for approximately 100,000 cases per year [30, 31].

Effective management of burn patients requires diverse medical care approaches, including expertise and interdisciplinary monitoring, with a major part being managed on an outpatient basis [22]. Remarkably, more than 90% of burn injuries are treated as outpatients [32]. In Iran, hot liquids are the predominant cause of burns, occurring mainly at home as a result of an accident [33-37]. Variables such as lifestyle, socioeconomic status, and energy sources significantly affect fatality rates and risk factors associated with burns in various countries [38]. Psychopathological consequences, such as

depression and anxiety, are typical after a burn, and they are frequently associated with a lack of social support. Reduced social support is a critical predictor of post-traumatic stress disorder (PTSD) in burn patients and is associated with an increased risk of mortality, particularly during the intensive resuscitative phase [39]. Despite advancements and public health initiatives targeting burn prevention, there is still a gap in comprehensive research, particularly for patients in emergency room settings [3, 40-42]. This study focused on emergency room presentations and aimed at filling this gap in burn injury research in Iran. Burn injuries, which are recognized as a major public health issue, lead to extensive morbidity, mortality, and socio-economic burdens, particularly in countries such as Iran. The present research enhanced the understanding of burn injury epidemiology, aiding in resource allocation and prevention strategies. It also helped to identify high-risk groups by providing insights into the epidemiology and risk factors of burns in various demographics and regions.

Materials and Methods

This cross-sectional study was conducted in 2020 at Shahid Motahari Hospital (Tehran, Iran). All the patients with burn injuries, who were admitted to the emergency room, were included in this study. Patients whose profiles were incomplete were excluded.

A checklist was used to collect the patient's demographic and medical history, including age, sex, occupation, education, and place of residence. This task was carried out by emergency staff by interviewing and monitoring the patients on a regular basis. The required information regarding the injury, including the date, time, number of people at the accident scene, accident location, referral source, means of transportation to the hospital, and time of emergency department visit, were all recorded. Furthermore, information on the burn, such as its source, extent, severity, necessity for hospitalization, historical background, and length of emergency department stay, was documented.

The data was gathered and analyzed using SPSS statistical software (version 24). Qualitative variables were presented as frequency and percentages. Quantitative variables were expressed as mean±SD. Relationships between variables were examined using Spearman's non-parametric test. The Chi-square test was used to compare categorical qualitative data. The independent sample T-test and Mann-Whitney U test were utilized to compare non-parametric variables. A p -value of ≤ 0.05 was considered statistically significant.

Results

A total of 2213 burn patients, with 1342 (60.6%) men

and 871 (39.4%) women, were examined at Shahid Motahari Hospital (Tehran, Iran). The mean age of the patients was 19.41±34.98 years, with men averaging 34.77±18.59 years, and women 35.31±20.62 years. The

age category of 20 to 39 was the most represented, accounting for 41.8% of the sample. Although a significant association between age groups and sex was noted ($p=0.028$), there was no significant

Table 1. Demographic characteristics of burn patients

Demographic features	Number (%)	Demographic features	Number (%)	
Age groups		Occupation		
1-19	441 (19.9)	Unemployed	44 (2.00)	
20-39	924 (41.8)	Self-employment	902 (40.8)	
40-59	592 (26.8)	Governmental	418 (18.9)	
79-60	231 (10.4)	Housewife	419 (18.9)	
80-99	25 (1.10)	Urban areas of burn accidents		
Sex		1	63 (2.80)	
1-19	Male	247 (56.0)	2	106 (4.80)
	Female	194 (44.0)	3	45 (2.00)
20-39	Male	594 (64.2)	4	88 (4.00)
	Female	330 (35.7)	5	105 (4.70)
40-59	Male	356 (60.1)	6	52 (2.30)
	Female	236 (39.8)	7	58 (2.60)
79-60	Male	131 (56.7)	8	53 (2.40)
	Female	100 (46.2)	9	18 (0.80)
80-99	Male	14 (56.0)	10	34 (1.50)
	Female	11 (44.0)	11	32 (1.40)
Education		12	26 (1.20)	
Elementary	159 (7.20)	13	29 (1.30)	
Middle School	94 (4.20)	14	46 (2.10)	
High school	224 (10.1)	15	40 (1.80)	
Diploma	603 (27.2)	16	24 (1.10)	
Associate Degree	92 (4.20)	17	23 (1.00)	
Bachelor's Degree	375 (16.9)	18	30 (1.40)	
Master's Degree	101 (4.60)	19	18 (0.80)	
Doctorate	22 (1.00)	20	23 (1.00)	
Location		21	12 (0.50)	
Tehran	1712 (77.4)	22	25 (1.10)	
Other Cities	501 (22.6)	Place of burn incident		
Vehicle type		Home	1426 (64.4)	
Personal	1719 (77.7)	Workplace	471 (21.3)	
Ambulance	91 (4.10)	Other	316 (14.3)	
Rental Car	409 (18.2)	Cause of the burn		
Cause of the burn (etiology)		Flame	2 (0.10)	
Accident	1886 (85.2)	Boiling Water	868 (39.2)	
Forgiveness	320 (14.4)	Acid	59 (2.70)	
Suicide	1 (<0.1)	Explosion	20 (0.90)	
Other	6 (0.3)	Steam	43 (1.90)	
Previous history of burns		Electricity	55 (2.50)	
Yes	87 (3.9)	Hot Body	468 (21.1)	
No	2126 (96.1)	Wound	5 (0.20)	
Type of hospital admission		The Cold	8 (0.40)	
Hospitalization	98 (4.4)	Flame	465 (21.0)	
Outpatient	2115 (95.6)	Laser Therapy	5 (0.20)	
Degree of burn		Hot liquid (hot oil, thermal glue, paraffin, bitumen)	165 (7.5)	
I	80 (3.6)	Molten material	50 (2.30)	
II	2031(91.8)	Patients' admission		
III	102 (4.6)	Discharge	2125 (96.0)	
		Hospitalization	84 (3.80)	
		Transfer to another center	2 (0.10)	
		Died in the emergency room	2 (0.10)	

age difference between sexes ($p>0.05$). Total Body Surface Area (TBSA) was critical in determining burn severity, particularly in understanding third-degree burns in terms of length of hospitalization. The majority of patients were from Tehran (77.4%), specifically the second and fifth districts. The home was identified as the primary accident site (64.4%), with boiling water (39.2%), hot materials (21.1%), and flames (21%) being the most common burn causes. Accidents accounted for 99.6% of burns. 3.9% of patients reported a previous burn history, and 4.4% had past hospital admissions.

The majority of patients (91.8%) suffered from superficial second-degree burns. Such burns are often accompanied by skin redness, pain, and swelling. A significant majority (96%) were discharged after treatment. The demographic information of the studied patients is shown in Table 1.

The analysis of third-degree burns in relation to TBSA revealed that larger burn areas typically require longer hospital stays. This emphasizes the strong correlation between the severity of the burn and the length of hospitalization. In addition, the burn incident lasted an average of 14.5 ± 5.27 hours, and the average distance from the accident site to the hospital was 36.73 ± 75.86 Km. Incidents reported from 1 to 7 burn victims, with an average emergency room stay of 24.82 ± 16.92 min. The mean burn percentage was 3.67 ± 6.31 , ranging from 1 to 100%. Comprehensive details are presented in Table 2.

There were significant correlations between burn severity and several patient demographics and clinical features. A significant association was found between the degree of burns and patient age, with a majority of first to third-degree burns occurring in the 20-39 age range, accounting for 924 cases ($p=0.012$). The length of hospitalization for third-degree burns was significantly influenced by the affected Total Body Surface Area (TBSA).

In terms of sex differences, males predominantly suffered from first to third-degree burns (1342 cases). The average burn percentage was significantly higher in men (7.44 ± 4.22). Moreover, there was a significant correlation between burn degree and sex ($p<0.05$).

Occupationally, 902 of the burn victims were unemployed, while 1632 employed individuals had a significant number of second-degree burns, indicating a significant association between burn degree and occupation ($p<0.05$).

Concerning educational level, individuals with a diploma level of education were significantly

affected (603 cases reported). Although there was no significant association between burn degree and education level, a correlation with burn percentage was found.

Following analyzing the causes of burns, accidents were the predominant cause of burns, accounting for 2205 cases. The majority of these incidents occurred at home (1426 cases), with second-degree burns being the most common (2031 cases). The degree of burns had a significant relationship with the cause ($p<0.05$), but not with the location of the incident.

Distance to the hospital was also a factor, with second-degree burn patients having the longest average distance from the accident site to the hospital (146.88 ± 195.68 km). There was a negative significant relationship between burn degree and distance to the hospital (Pearson correlation= -0.068 , $p=0.005$).

In terms of hospitalization, the majority of patients, especially those with first to second-degree burns, were treated as outpatients, with a total of 2115 cases. There was a direct significant relationship between burn degree and the length of hospital stay (Pearson Correlation= 0.238 , $p=0.001$). Remarkably, a large proportion of patients (2125 cases) were discharged, highlighting the effectiveness of the treatment.

Our findings provided detailed insights into the relationships between burn degrees and patients' demographic characteristics, as well as sex-based variations in burn percentage. These associations, along with their implications, are comprehensively presented in Tables 3-5.

Discussion

Burn injuries with an annual estimated 180,000 deaths have been considered a serious public health concern worldwide [1]. The purpose of the present study was to provide a better understanding of the etiological, demographic, and clinicopathological patterns of burn injuries in Iran to help healthcare providers and researchers in the future. We were mainly focused on the burn patients' characteristics, including age, sex distribution, employment, marital and educational status, cause of burn, place of burn accident, length of hospital stay, and outcomes. The main findings revealed a significant association between the degree and percentage of burns and demographic variables such as age, sex, occupation, and level of education. Moreover, a significant relationship was found between the variables related to burns, such as the cause and location of the burn

Table 2. The average time and distance from the accident site to the hospital and patients' visit to the emergency room

Patients' demographics in the emergency room	Minimum	Maximum	Mean \pm SD
Time of occurrence	1	24	14.5 \pm 5.27
Time of patient's visit	1	24	12.4 \pm 4.41
Distance from the accident site to the hospital (Km)	1	161.4	75.8 \pm 36.7
Number of burn patients	1	7	1.05 \pm 0.33
Burn percentage	1	100	3.67 \pm 6.31
Length of hospitalization (min.)	2	201	24.8 \pm 16.9

Table 3. The degree of burns according to the status of the patient's demographic characteristics

Demographic features	Degree of burn			Total	
	1 st	2 nd	3 rd		
Age groups	1-19	17	412	12	441
	20-39	42	837	45	924
	40-59	14	552	26	592
	60-79	6	208	17	231
	80-99	1	22	2	25
	Total	80	2031	102	2213
Sex	Male	39	1233	70	1342
	Female	41	798	32	871
	Total	80	2031	102	2213
Occupation	Unemployed	3	35	6	44
	Self-employment	23	836	43	902
	Governmental	15	382	21	418
	Housewife	22	379	18	419
	Total	63	1632	88	1783
Education	Elementary	1	151	7	159
	Middle School	3	91	0	94
	High school	7	200	17	224
	Diploma	26	548	29	603
	Associate Degree	3	84	5	92
	Bachelor's Degree	17	349	9	375
	Master's Degree	5	93	3	101
	Doctorate	0	21	1	22
Total	62	1537	71	1670	
Etiology	Accident	79	2026	100	2205
	Forgiveness	0	1	0	1
	Suicide	0	1	0	1
	Other	1	3	2	6
	Total	80	2031	102	2213
Place of burn	Home	54	1314	58	1426
	Workplace	15	432	24	471
	Other	11	285	20	316
	Total	80	2031	102	2213
Type of hospital admission	Hospitalization	1	69	28	98
	Outpatient	79	1962	74	2115
	Total	80	2031	102	2213
Patients' admission	Discharge	77	1972	76	2125
	Hospitalization	2	58	24	84
	Transfer to another center	0	0	2	2
	Death in the emergency room	1	1	0	2
	Total	80	2031	102	2213

Table 4. The percentage of burns in each sex

Burn patients' status	Sex	N	Mean	SD	SEM
Percentage of burn	Male	1016	4.22	7.44900	0.234
	Female	676	2.84	3.92700	0.151

incident, the status of the patient's admission to the hospital, and the patient's outcomes. Besides, the distance from the place of the burn accident to the hospital was also an important factor in increasing the degree of burn. The severity of the burn significantly increased the length of the patient's stay in the hospital. It was reported that there was a correlation between the place of living and working and burn traumas. According to a comprehensive systematic review, the majority of burn traumas occurred at

home (75.05%), in the workplace (14.67%), and in other places (9.88%), respectively [1]. Similar to the findings of a previous systematic review, the findings of the present study indicated that the most common place of burn occurrence was at home in 64.4% of cases, at the workplace in 21.3% of cases, and 14.3% at other places [1]. According to the findings of the present study, the most common cause of burns was accidents (85.5%), in comparison to other causes of burns such as forgiveness and suicide.

Table 5. The association between the degree of burn with patient's etiological, clinicopathological, and demographic characteristics

Demographic features	Degree of burn	1 st	2 nd	3 rd
Place of burn incident	N	80	2031	102
	Minimum	1	1	1
	Maximum	3588	16142	979
	Mean	94.69	71.56	146.88
	SD	404.213	372.183	195.682
Duration of Hospitalization	N	80	2031	102
	Minimum	5	2	10
	Maximum	180	180	201
	Mean	21.94	24.05	42.47
	SD	19.511	14.211	39.826

It is essential to comprehend the main causes of burns to develop preventative strategies. While boiling water was a prevalent cause, a broader spectrum of etiological factors, such as electricity, friction, radiation, and chemicals was also mentioned in the literature. It's crucial to recognize that while some causes, such as boiling water in domestic environments, are more common in particular locations, other causes, such as chemical and electrical burns, might be more prevalent in industrial or occupational settings. The variety of these factors emphasizes the necessity for focused preventative interventions across various environments [25].

Mobayen *et al.*, reported that burn injuries were frequently caused by flames, indoors, and in adolescents with a low educational state [1]. However, the findings of the present study indicated that the most prevalent cause of burns was boiling water (39.2%), followed by a hot material (21.1%), and the flame was observed only in 21% of cases. However, in a retrospective cohort study conducted specifically on women in Baghdad, fire (64.8%) was reported as the leading cause of burns among females [41]. In a survey of socio-demographic and quality of life status post-burn, 94% of the injuries claimed by the respondents were accidental, most of which occurred as a result of catastrophes of flame, electrical, or scald burns, mainly in patients with synthetic material cloths (39%), mixed (35%), and cotton/other material (26%) at the time of the occurrence [43].

Since burn cases have the highest hospital bed occupancy rate, it imposes a high financial burden on both the family and the hospital [43]. Given that burn traumatic injury is a very overwhelming occurrence that has short- and long-term consequences such as prolonged recovery and extended rehabilitation periods, it requires immediate management by a specialized healthcare team [43]. As a result, the World Health Organization (WHO) has identified burn injuries as one of the leading causes of disability-related life years (DALYs), especially in the South East Asia Region (SEAR) [43]. In the present research, 4.4% of patients who were admitted to the hospital had the highest superficial second-degree burn (91.8%). These burns, primarily affecting the outer layer of the skin, are frequently

accompanied by redness, pain, and swelling. Despite the severity of these burns, as indicated by an average burn percentage of 6.31 ± 3.67 , the mortality rate was significantly low, with only 0.1% of deaths recorded in the emergency department. This emphasizes the necessity of prompt medical intervention in improving burn patient outcomes. A 10-year epidemiological survey of 92,333 hospitalized burn patients in Romania found a significant correlation between the increase in mortality rate and the year of study, which was accompanied by a drastic reduction in the annual number of burns from 10,547 (47 cases per 100,000) in 2006 to 7313 (36.93 per 100,000) in 2015 [44]. In addition, about 3,194 deaths (1/100,000 cases) in the United States were caused by fire and burn injuries, accounting for only 1.3% [42]. Out of 450,000 annual cases of burn patients in the United States, only 40,000 required hospitalization, and 3,400 died as a result of burn complications [45]. In the present study, the ratio of mortality to hospitalization was lower than in the previous studies, which could be attributed to the larger sample size and other risk factors in the American population. In a cohort study of the burn registry program, risk factors for mortality and lethal area fifty percent (LA50) of the Iranian population were evaluated over two years. Burn causes had little effect on the mortality of patients, and age (median age of 25), female sex, and burn size were the most important predictors of mortality [46]. They found that the mean length of hospital stay for burn patients was 14.41 days, which was twice as long in suicide cases. In the present study, the main demographic features of patients that could affect burn intention, degree, and size were evaluated. The findings indicated that age was related to the degree of burn, and most cases were between 20 and 39 years old. In a study conducted in Turkey, the average age of burned cases was 27.9 years, with a 15.8% hospitalization rate [47]. In other Iranian and Chinese studies, the mean age of burn patients was reported to be 30 [48], 16-25 [49], and 25-27 (80% under 40) years old [50], respectively. According to these figures, people in this age range are more likely to have burns as a result of occupational risk factors. Therefore, it is essential to maintain safety for patients in this age group. The findings of a previous

study indicated that females of reproductive age are frequently at risk of intentional burning because of their low socioeconomic status and unsafe cooking appliances [51]. As a result, it showed that sex might be an important risk factor in the degree of burn. Gatea *et al.*, found that the mean age of burn females was 27.1 with 64.8% fire exposure, and that there was a significant relationship between clinical outcomes and length of stay, causes of burn, and educational level [41]. According to the findings of the present research, men were significantly involved with the higher degrees and average percentage of burns than women. Findings of other studies showed that men had twice the risk of women (68% vs. 31.9%, or a ratio of 2.2-2.4 to 1) [48, 50, 52, 53]. As well, the findings of these studies showed that the higher rate of burns in men could be related to their hazardous occupational status compared to women. Therefore, in addition to the proper culture of society, sufficient safety equipment should be provided for both sexes, especially men, in more dangerous circumstances. The decline in burn admissions, incidence, and severity in several countries could be attributed to a variety of factors, including governmental policies, preventive curricula, and improved workplace safety [54-56]. However, burn mortality rates must be considered more cautiously, as most studies have only reported inpatient mortality, while a certain proportion of patients died at the scene of injury [56-59]. Similar to the findings of other studies, the present research found a significant correlation between the degree of burn and the accident location, with the majority of burns occurring at home [48, 49]. Furthermore, the hospitalization rate of burn patients in this study was 4.4%, with mean lengths of 21.9, 24.0, and 42.4 in the 1st, 2nd, and 3rd degrees of burn, respectively. It showed that this amount could be increased with the degree of burn of the patients, as we observed that patients with higher burn degrees were hospitalized with a longer hospital stay, had poor outcomes, and a poor prognosis leading to transplantation or death. Previous research confirmed our findings, indicating that a lower percentage of burns led to more outpatient management and faster discharge. Therefore, after the occurrence of a burn, patients should be transferred to medical centers as soon as possible to prevent infection and even organ failure due to a lack of follow-up and early referral. Enhanced treatment facilities play a crucial role in not only providing immediate and effective care for burn injuries but also in preventing future occurrences. These facilities frequently serve as centers for education and awareness, disseminating crucial information about burn prevention and safety measures to patients, their families, and the community. By educating the public on the common causes and risk factors associated with burns, particularly in high-risk groups and settings, treatment centers can foster a more informed and cautious approach to activities that pose burn risks.

Furthermore, advanced treatment facilities should be equipped to conduct comprehensive post-burn assessments and provide rehabilitation services. These services include counseling and guidance on avoiding circumstances that caused the initial injury, thereby reducing the likelihood of repeated incidents. The presence of well-equipped facilities also signifies a strong healthcare system, which can inhibit risky behaviors that lead to burns, as individuals become more aware of the consequences and the seriousness with which such injuries are treated [60-62].

In summary, while the primary function of treatment facilities is to provide medical care, their potential impact extends to preventive measures by raising awareness, educating the public, and preventing the recurrence of burn injuries through comprehensive post-treatment assistance.

According to the persuasive results found in the present study, it is recommended to identify significant risk factors in more population-based studies to help administrators and policymakers pay more attention and prioritize accident injuries based on sex, especially younger men, the improvement of pre-hospital and hospital services, and the safety of medical and emergency care equipment.

In conclusion, the findings of the present study highlighted the impact of demographic factors such as sex, education, occupation, and the accessibility of treatment facilities on burn injuries. Recognizing these factors could contribute to the development of effective prevention strategies and improve healthcare services. This study recommended policymakers and administrators prioritize accident injury prevention, particularly for younger men, enhance pre-hospital and hospital services, and ensure the availability of safe medical and emergency care equipment. This allows us to reduce the burden of burn injuries and improve outcomes for affected individuals.

Declaration

Ethics approval and consent to participate: This study was approved by the Ethics Committee of the Iran University of Medical Sciences, Tehran, Iran (code: IR.IUMS.FMD.REC.1399.780).

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