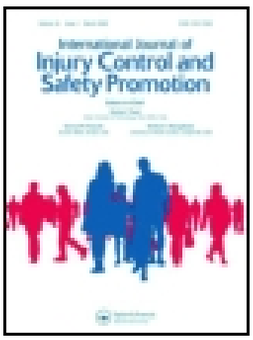

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Incidence and cost of non-fatal burns in Iran: a nationwide population-based study

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ABSTRACT

To determine the incidence and cost of non-fatal burns in Iran; this cross-sectional household survey of a nationally representative sample of 15–64 years old was conducted. Through face-to-face interviews and telephone calls, the data on the demographics, history and cost of burns were collected. The annual incidence rate of burns was estimated 129.85 per 1000 population. Burns occurred higher in younger age, female gender and urban residency. The most common burn description was as follows: unpaid work (activity during burn), home (place of burn), heat and hot substances (mechanism of burn) and upper limb (site of burn). The average total cost of burn includes victims seeking medical care was US$124 per case. The main findings of this study suggest that burns are a major public health concern in Iran. To stop this important health issue, a national program for burn prevention and education must be developed.

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Burn; incidence; epidemiology; cost; Iran

Introduction

Injuries are among the leading global causes of death and disability. Worldwide burden of injuries is expected to rise in the next decade (Murray et al., 2012). Burns are one of the common type of injuries, and a major public health issue, at least in terms of long-term disability and morbidity worldwide, particularly in developing countries (Heimbach, 1999).

> A burn is an injury to the skin or other organic tissue primarily caused by heat or due to radiation, radioactivity, electricity, friction or contact with chemicals. Thermal (heat) burns occur when some or all of the cells in the skin or other tissues are destroyed by hot liquids (scalds), hot solids (contact burns), or flames (flame burns). (3 WHO: Burns Fact sheet N°365, 2014)

According to the World Health Organization, 268,000 persons (0.5%of total deaths) globally died of fire, heat and hot substances in 2012. The majority of these occur in low-income and middle-income countries. This figure is more concerning in the Eastern Mediterranean Region where 0.7% of the total deaths are related to fire, heat and hot substances (WHO: Burns Fact sheet N°365, 2014; WHO: Global health estimates 2014 summary tables: deaths by cause, age, & sex, by WHO region, 2000-2012, 2014).

Based on available information about the incidence and mortality of burns, this should be considered as a major public health problem in Iran. The mortality rate of burns reported by different studies in Iran varies from 1.4/100,000 to 9.7/100,000 and case-fatalities have been reported in the range of 2%–98% (Aghakhani, Rahbar, & Feizi, 2009; Alaghehbandan, MacKay Rossignol, & Rastegar Lari, 2001; Arshi et al., 2007; Groohi, Alaghehbandan, & Lari, 2002; Hasani, Aghamolei, Boushehri, & Sabili, 2009; Lari, Joghataei, Adli, Zadeh, & Alaghehbandan, 2007; Maghsoudi & Gabraely, 2008; Maghsoudi et al., 2004; Mohammadi, Ekman, Svanström, & Gooya, 2005; Panjeshahin, Lari, Talei, Shamsnia, & Alaghehbandan, 2001; Saadat, 2005; Sadeghi-Bazargani & Mohammadi, 2012; Sheikhazadi, Garadaghi, & Ghadyani, 2005; Zarghami & Khalilian, 2002). The overall case-fatality in Iranian burn cases is substantially high when compared to developed countries (Sadeghi-Bazargani & Mohammadi, 2012). On the other hand, non-fatal burns are a leading cause of morbidity, including prolonged hospitalization, defacement and disability, often with resulting stigma and refusal (WHO: Burns Fact sheet N°365, 2014).

Published literatures demonstrated that small amount of burned patients were treated in hospitals (Chen, Chen, Chen, & Ma, 2014). Although many studies have shown epidemiology of burns in Iran, but due to paucity of sufficient community-based information available for minor burns, reliable estimation of the true incidence of all burns in Iran seems to be unknown (Sadeghi-Bazargani & Mohammadi, 2012). In order to evaluate the true incidence of burns and its related factors in Iran, more attention should be paid to the community-based studies.

The aim of this study was to investigate the incidence, characteristics and cost of non-fatal burns at a national level in a random sample of Iran's 15–64 year old residents, in 2011.

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Methods

Study design and setting

We used a cross-sectional design to estimate the incidence of non-fatal burns and its related factors in Iran. This study was a part of the Iranian Mental Health Survey (IranMHS) that was performed using a population-based method in 2011 and included detailed assessment of injury (Rahimi-Movaghar et al., 2014).

Target population and sampling

We included non-institutionalized people ranging from 15 to 64 years old residing in Iran. A three-stage sampling was conducted. In the first stage, 1525 clusters as primary sampling units (PSUs) were selected from the whole country. PSUs were selected randomly according to the national census of the Iranian Statistical Centre in 2006. PSUs were selected with probability in proportional to size regarding the number of households and population of each province. The full addresses of the selected clusters were given to the interviewers. At the second stage, all households living in each PSU were enumerated and six households in each PSU were selected by systematic random sampling. And finally, one member of each household was chosen using Kish Grid tables (Kish, 1949). A total number of 9150 subjects were approached. The sample size was computed based on the objectives of IranMHS. Previous reports have investigated the study's power for the calculated, and the finally interviewed, sample sizes (Hafezi-Nejad et al., 2014).

Study variables and measurement

Through face-to-face interviews, the variables including age, gender (male vs. female), location (urban vs. rural), insurance (having medical insurance, having complementary insurance) and personal history (head of household, marital status, retired, unemployed and suicide history) were evaluated. The above-mentioned determinants of injury were selected in line to our previous explorations (Hafezi-Nejad et al., 2015).

We asked subjects about the occurrence of burns in the past three months. We included any injuries to tissues caused by heat, electricity, radiation, friction or chemicals. For each event, activity, place, mechanism and site of injury were described and were coded to match the International Classification of Diseases, 10th revision 2012 (ICD10-2012) classifications. Details on specific coding and definitions have been described previously (Hafezi-Nejad et al., 2014).

The instrument that was used for this aim was Short Form Injury Questionnaire 7 that its face and content validity were examined based on expert opinions and its reliability was confirmed in a pilot study (Sharif-Alhoseini et al., 2012)

The study was administered at all provinces in Iran from January to June 2011. For each of the 42 participants (7 clusters), one interviewer was assigned. Interviewers were chosen based on the following criteria: having at least a bachelor's degree in psychology or consultation, being native or at least residing in the geographical area of the related university and being fluent in the local language of the area under study. For interviewers' training, a one-week educational seminar and workshop was held from 17 to 23 December 2010. During this course, interviewers were trained on how to use the questionnaire and their responsibilities were explained.

To inform and encourage the local residents for better cooperation certain procedures were utilized, including: providing information using different local media, installing posters and showing brochures of the project.

After the first part of the survey (including the household interviews), the second part was designed to investigate the cost of injuries. Subjects with positive history of injuries seeking medical care were telephoned and asked regarding the total and the out of pocket costs. Incidence and cost of non-fatal injuries has been previously investigated in Iran (Hafezi-Nejad et al., 2015).

Statistical analysis

One-way Kolmogorov–Smirnov (KS) test was used to explore the distribution of the age variable. Since the KS test values violated the assumption of normality for age variable, we used Mann–Whitney-*U* test for the numerical data analysis and Chi-Square tests for categorical data analysis along with odds ratio and 95% confidence interval. A *P* value of less than 5% was considered statistically significant. We used SPSS (v. 22, Chicago, IL) as our analytical software.

Costs are estimated per case of burn in US-dollars, for Iran 2011. Exchange rates were obtained from the Central Bank of Iran's average rate for the year of the study (http://www.cbi.ir/exrates/rates_en.aspx). Out-of-pocket cost and out-of-pocket per cent of the total cost were calculated separately.

Ethical approval

The Ethical Boards of Sina Trauma and Surgery Research Center, Tehran University of Medical Sciences and Iran National Institute for Health Research approved the study.

Results

In total, 9150 subjects were approached in this survey; 835 participants declined to cooperate in the study, we could not contact 328 participants and 17 participants were excluded during the interviews. In addition, the 84 completed questionnaires were excluded due to their unacceptable quality. Therefore, 7886 subjects responded to the survey (response rate 82.6%). Table 1 shows the distribution of the study population and annual incidence rates of burns per 1000 persons by participant characteristic.

Two hundred and forty-seven subjects reported that they had experienced burn injury in the preceding three months (3.1%). Of these 242 participants had experienced one, 3 participants had experienced two, 1 participant had experienced three and 1 participant had experienced five episodes of non-fatal burn injuries over the past three months. Therefore, the frequency of burn among 7886 subjects was 256 during the

Table 1 . Distribution of the study sample and annual incidence rates of burns across population study.

Variables	No. in the sample	% of total sample	History of burn		Incidence rate of burns[a]
			Yes	No	
Age group (years)					
15–24	2221	28.2	82	2139	147.68 (132.13–164.56)
25–34	2565	32.5	95	2470	148.15 (133.63–163.82)
35–44	1657	21.0	37	1620	89.32 (75.51–104.92)
45–54	890	11.3	21	869	94.38 (75.28–116.85)
55–64	553	7.0	12	541	86.80 (64.00–115.08)
Gender					
Female	4499	57.1	188	4311	167.15 (155.41–179.53)*
Male	3387	42.9	59	3328	69.68 (61.07–79.16)
Location					
Urban	4386	55.6	166	4220	151.39 (140.09–163.36)*
Rural	3500	44.4	81	3419	92.57 (82.76-103.22)
Province					
Azarbaijan-e-Sharqi	419	5.3	6	413	57.28 (36.7–85.23)
Azarbaijan-e-Gharbi	349	4.4	4	345	45.85 (26.20–74.45)
Ardabil	132	1.7	0	132	NA
Isfahan	582	7.4	19	563	130.58 (102.89–163.45)
Alborz	195	2.5	9	186	184.62 (129.30–255.59)
Ilam	60	0.8	1	59	66.67 (18.16–170.69)
Bushehr	113	1.4	1	112	35.40 (9.64–90.63)
Tehran	893	11.3	48	845	215.01 (185.67–247.66)
Chaharmahal-va-Bakhtiari	114	1.4	3	111	105.26 (54.39–183.87)
Khorasan-e-Razavi	623	7.9	19	604	121.99 (96.11–152.69)
Khorasan-e-Jonubi	78	1.0	2	76	102.56 (96.11–152.69)
Khorasan-e-Shomali	91	1.2	2	89	87.91 (37.95–173.22)
Khuzestan	496	6.3	13	483	104.84 (78.30–137.48)
Zanjan	123	1.6	2	121	65.04(28.08–128.16)
Semnan	69	0.9	2	67	115.94 (50.06–228.45)
Sistan-o-Baluchestan	310	3.9	11	299	141.94 (103.13–190.54)
Fars	534	6.8	16	518	119.85 (92.30–153.05)
Qazvin	138	1.7	8	130	231.88 (158.61–327.35)
Qom	135	1.7	5	130	148.15 (90.49–228.80)
Kurdistan	173	2.2	2	171	46.24 (19.96–91.12)
Kerman	323	4.1	10	313	123.84 (88.47–168.63)
Kermanshah	228	2.9	4	224	70.18 (40.11–113.96)
Kohgiluyeh-va-BoyerAhmad	80	1.0	4	76	200.00 (114.32–324.79)
Golestan	178	2.3	2	176	44.94 (19.40–88.56)
Guilan	276	3.5	16	260	231.88 (178.58–296.11)
Lorestan	219	2.8	5	214	91.32 (55.78–141.04)
Mazandaran	337	4.3	8	329	94.96 (64.95–134.05)
Markazi	160	2.0	9	151	325.00 (242.73–426.19)
Hormozgan	176	2.2	9	167	204.55 (143.26–283.18)
Hamadan	161	2.0	2	159	49.69 (21.45–97.91)
Yazd	121	1.5	5	116	165.22 (100.96–255.28)
Total	7886	100.0	247	7639	129.85 (122.02–138.05)

Note: NA: not applicable.
[a]Annual incidence rate of burns (95% confidence interval).
*$P < 0.0001$; P values were obtained for the incidence rates between categories of gender and location variables.

past three months (12.8% of all injuries) and the annual incidence rate of burns was estimated 129.85 per 1000 population in Iran, 2011.

The incidence rate of burns was higher in younger age groups especially those aged 25–34 and 15–24 years (159.06 and 151.28 per 1000 population, respectively). Women had significantly higher incidence of burns in comparison to men (171.59 vs. 74.40 per 1000 population; $P < 0.0001$). Incidence rate of burns was significantly higher for subjects living in urban areas (159.60 vs. 92.75; $P < 0.0001$). Markazi Province had the highest incidence of burns in Iran in 2011 (325 per 1000 population).

We also evaluated burn based on age, gender, location, insurance and personal history (Table 2).

The median (interquartile range) age of the participants with and without a history of burn was 28 (13) and 31 (17) years, respectively. 4.2% of females had a history of burn while 1.7% of males reported that they had a history of burn during the past three months. 3.8% of subjects living in urban areas and 2.3% of rural residents reported occurrence of burn during the three months interval.

Burns occurred higher in younger age (P value = 0.002), female gender (OR = 2.46, 95% CI: 1.83–3.31), urban residency (OR = 1.66, 95% CI: 1.27–2.17) and not being head of the family (OR = 2.20, 95% CI: 1.58–3.07).

In addition, we evaluated burn patients according to receiving medical care that presented in Table 3.

Among subjects who had a history of burn, 27 persons received medical care for burns. 22.0% of males, who had history of burn during the past three months, received medical care whereas 7.4% of females reported that they had received medical care for burns (OR = 3.51, 95% CI: 1.54–7.99). The most common type of treatment was dressing (58.6% of all treatments) followed by non-injectable medication (34.5% of

Table 2. Association between different characteristics and history of burn in the past three months among participants.

Variables	History of burn[a] Yes	No	OR (95% CI)	*P* value
Demographics				
Age (years)	28 (13)[b]	31 (17)[b]		0.002
Gender			OR = 2.46 (1.83–3.31, baseline: male)	<0.001
Female	188 (4.2%)	4311 (95.8%)		
Male	59 (1.7%)	3328 (98.3%)		
Location			OR = 1.66 (1.27–2.17, baseline: rural)	<0.001
Urban	166 (3.8%)	4220 (96.2%)		
Rural	81 (2.3%)	3419 (97.7%)		
Insurance				
Insurance			OR = 1.10 (0.79–1.53, baseline: yes)	0.587
No	44 (3.4%)	1261 (96.6%)		
Yes	203 (3.1%)	6378 (96.9%)		
Complementary insurance			OR = 0.89 (0.65–1.22, baseline: yes)	0.473
No	198 (3.1%)	6260 (96.9%)		
Yes	49 (3.4%)	1379 (96.6%)		
Personal history				
Head of family			OR = 2.20 (1.58–3.07, baseline: yes)	<0.001
No	204 (3.8%)	5219 (96.2%)		
Yes	43 (1.7%)	2420 (98.3%)		
Married			OR = 1.02 (0.78–1.35, baseline: yes)	0.875
No	75 (3.2%)	2284 (96.8%)		
Yes	172 (3.1%)	5355 (96.9%)		
Retired			OR = 2.13 (0.68–6.71, baseline: yes)	0.186
No	244 (3.2%)	7444 (96.8%)		
Yes	3 (1.5%)	195 (98.5%)		
Unemployed			OR = 2.45 (0.91–6.62, baseline: yes)	0.068
No	243 (3.2%)	7343 (96.8%)		
Yes	4 (1.3%)	296 (98.7%)		
Suicide history			OR = 0.77 (0.28–2.12, baseline: yes)	0.557
No	243 (3.1%)	7543 (96.9%)		
Yes	4 (4.0%)	96 (96.0%)		

Note: OR (95% CI): odds ratio (95% confidence interval).
[a]Number (per cent).
[b]Median (interquartile range).

Table 3. Association between different characteristics and history of receiving medical care among burn victims.

Variables	Receiving medical care[a] Yes	No	OR (95% CI)	*P* value
Demographics				
Age (years)	31 (13)[b]	28 (13)[b]		0.729
Gender			OR = 3.51 (1.54–7.99, baseline: female)	0.002
Male	13 (22.0%)	46 (78.0%)		
Female	14 (7.4%)	174 (92.6%)		
Location			OR = 0.97 (0.42–2.27, baseline: rural)	0.950
Urban	18 (10.8%)	148 (89.2%)		
Rural	9 (11.1%)	72 (88.9%)		
Insurance				
Insurance			OR = 0.78 (0.26–2.39, baseline: yes)	0.795
No	4 (9.1%)	40 (90.9%)		
Yes	23 (11.3%)	180 (88.7%)		
Complementary insurance			OR = 0.54 (0.22–1.33, baseline: yes)	0.176
No	19 (9.6%)	179 (90.4%)		
Yes	8 (16.3%)	41 (83.7%)		
Personal history				
Head of family			OR = 0.56 (0.22–1.42, baseline: yes)	0.278
No	20 (9.8%)	184 (90.2%)		
Yes	7 (16.3%)	36 (83.7%)		
Married			OR = 1.17 (0.50–2.73, baseline: yes)	0.722
No	9 (12.0%)	66 (88.0%)		
Yes	18 (10.5%)	154 (89.5%)		
Retired			OR = NA (baseline: yes)	1.000
No	27 (11.1%)	217 (88.9%)		
Yes	0 (0%)	3 (100%)		
Unemployed			OR = NA (baseline: yes)	1.000
No	27 (11.1%)	216 (88.9%)		
Yes	0 (0%)	4 (100%)		
Suicide history			OR = NA (baseline: yes)	1.000
No	27 (11.1%)	216 (88.9%)		
Yes	0 (0%)	4 (100%)		

Note: OR (95% CI): odds ratio (95% confidence interval); NA: not applicable.
[a]Number (per cent).
[b]Median (interquartile range).

Table 4. Number of studied people by activity during burn, place of burn, mechanism of burn and injured organ.

Variables	Frequency	Per cent
Activity during burn		
Unpaid work	193	75.4
Paid work	39	15.2
Recreation/rest	12	4.7
Unspecified	6	2.3
Driving	3	1.2
Walking	3	1.2
Place of burn		
Home	214	83.6
Trade and service area	17	6.6
Industrial and construction area	14	5.5
Street and highway	8	3.1
Public administrative area	2	0.8
Farm and natural environment	1	0.4
Mechanism of burn		
Heat and hot substances	245	95.7
Electricity, radiation and ambient air	7	2.7
Non-living mechanical force	3	1.2
Unspecified	1	0.4
Injured organ		
Upper limb	218	85.2
Lower limb	25	9.8
Head, neck and face	7	2.7
Abdomen, spine and pelvis	3	1.2
Multiple regions	3	1.2

all treatments). Location and having insurance were not associated with risk of treatment.

The total cost of burn includes victims seeking medical care ranges from US$5 to US$769 with the average of US$124 per case. The average out-of-pocket cost and out-of-pocket per cent of burn per case were US$33 (with the range of US$0–US$191) and 26.61%, respectively.

Data were presented for burns based on activity during burn, place of burn, mechanism of burn and injured organ (Table 4).

We found that the most frequent activity during burn was unpaid work (75.4% of all burns). Home was the most common place of burn (83.6% of all burns). 95.7% and 2.7% of all burns occurred because of heat and hot substances and electricity, radiation and ambient air, respectively. The most prevalent injured organ was upper limb (85.2% of all burns).

Discussion

The importance of burns

According to Murray and his colleagues' study, disability-adjusted life years for fire, heat and hot substances in 2010 was 276 (95% CI: 193–350) per 100,000 (Murray et al., 2012). Fire, heat and hot substances were in the 34th position in global ranking of the leading causes of disability-adjusted life years in 2010 (Murray et al., 2012). Also according to a systematic analysis for the Global Burden of Disease Study 2013, fire and heat ranked 34th causes of global years of life lost (YLL) in 2013 (Collaborators, 2015). Nevertheless, in the national Iranian study on burden of disease and injuries in 2003, burns came in the 13th position in ranking of the leading causes with the highest burden. Moreover in Iran, burns came in the eighth position ranked by YLL in 2003 (162 in 100,000) (Naghavi et al., 2009).

In different studies in Iran, the mortality rate of burns reported in the range of 1.4–9.7 per 100,000 persons (Aghakhani et al., 2009; Alaghehbandan et al., 2001; Arshi et al., 2007; Groohi et al., 2002; Hasani et al., 2009; Lari et al., 2007; Maghsoudi & Gabraely, 2008; Maghsoudi et al., 2004; Mohammadi et al., 2005; Panjeshahin et al., 2001; Saadat, 2005; Sadeghi-Bazargani & Mohammadi, 2012; Sheikhazadi et al., 2005; Zarghami & Khalilian, 2002), whereas age-standardized death rate of fire, heat and hot substances was 3.5 (95% CI: 2.9–4.1) per 100,000 in 2013 globally (Collaborators, 2015). However, 90% of burn deaths occur in low-income and middle-income countries, where prevention programs are uncommon and the quality of acute care is inconsistent (Peck, 2011).

Incidence of non-fatal burns

In 2011 (year of our study), there were 298,014 non-fatal burns in people aged between 15 and 64 years in the US, resulting in a crude rate of 142.56 per 100,000 each year (Centers for Disease Control & Prevention. Web-based Injury Statistics Query & Reporting System (WISQARS), 2003). A population-based survey with a total sample size of 819,429 subjects during 2003 in Bangladesh revealed that the overall incidence of non-fatal burns was 166.3 per 100,000 (Mashreky et al., 2009). We found that the annual incidence of non-fatal burns in Iran is 129.85 per 1000 persons in 2011 which is very high in comparison to incidence rate of non-fatal burns in the US and Bangladesh. In the United States in 2001–2013, only 1.5% of all injuries of people ranging from 15 to 64 years were related to unintentional burns (ranked in 13th position of all injuries) (Centers for Disease Control & Prevention. Web-based Injury Statistics Query & Reporting System (WISQARS), 2003), whereas this value in our study was 12.8% of all injuries. In addition, burns are the second most common type of injury in Iran (Hafezi-Nejad et al., 2015). Based on these information, burns must be considered as a major public health issue in Iran.

Community-based studies to estimate the incidence of burns in the country is insufficient (Sadeghi-Bazargani & Mohammadi, 2012). This study was conducted to provide more information about the incidence of burns at the national level in people aged between 15 and 64 years.

Age distribution in burns

We found that the median (interquartile range) age of the participants with a history of burn was 28 (13) years. Published literatures regarding burns in Iran during the years 2000–2010 reported a mean age varying from 19 to 35 years. The average age of a burn patient has been reported between 21 and 23 years in most studies. Also about half of the burn patients in most studies during the years 2000–2010 were children or fewer than 20 years old. Nevertheless, electrical, chemical and suicidal burns occur at higher age (Sadeghi-Bazargani & Mohammadi, 2012). In a study of national injury surveillance system over the period 2000–2002, the mean age among burn patients was 19.18 years. The age-adjusted incidence showed that children had a much higher incidence of domestic burns (Sadeghi-Bazargani & Mohammadi, 2013). Burns are the 11th leading cause of death of children aged 1–9 years and are the fifth most

common cause of non-fatal childhood injuries (WHO: Burns Fact sheet N°365, 2014). In low-income and middle-income countries, children under the age of five years have a disproportionately higher rate of burns than is the case in high-income countries (Mashreky et al., 2009; WHO: World report on child injury prevention, 2008).

The target population of our study was people ranging from 15 to 64 years old. Therefore, these differences are justifiable.

Gender distribution in burns

In our study, burns occurred higher in female gender (4.2% vs 1.7%, OR = 2.46, 95% CI: 1.83-3.31), while males reported more seeking medical care (22.0% vs 7.4%, OR = 3.51, 95% CI: 1.54-7.99). The higher rate of medical seeking in male can be due to different case definition (i.e. male have reported only severe cases of burns, while females have reported mild cases as well). Based on a population-based survey during 2003 in Bangladesh, the incidence rate of non-fatal burns was higher in females than in males (RR = 1.15, 95% CI: 1.03–1.27) (Mashreky et al., 2009). In addition, in low-income countries, rates of death by fire are 2.3 times as high in females as in males in the 15–59 year age group (Peck, 2011). The crude rate of non-fatal burns in people aged between 15 and 64 years in the US in 2011 was 148.57 per 100,000 in men, higher than the rate of 136.60 per 100,000 seen in women (Centers for Disease Control & Prevention. Web-based Injury Statistics Query & Reporting System (WISQARS), 2003). According to a number of previous experiences, in most studies that published around burns in Iran, the prevalence of burns was higher among men, however Rasouli and his colleagues showed that fatal burns were more common in females. In all of these studies, women were dominant in the gender distribution of self-immolations (Rasouli et al., 2011; Sadeghi-Bazargani & Mohammadi, 2012, Sharif-Alhoseini et al., 2012). Due to the majority of hospital-based studies and lack of community-based studies, results of previous studies could not be extrapolated to the community-dwelling subjects.

Location distribution in burns

Most of the previous studies regarding burns in Iran, have not examined location distribution differences in prevalence of the burns in the urban and rural areas. A few hospital-based studies have demonstrated location distribution in burns. Due to rural–urban population variation in different provinces, such demonstrations cannot be an accurate comparison of location distribution in burns between rural and urban areas (Sadeghi-Bazargani & Mohammadi, 2012). In our study in the urban areas, 3.8% of the people interviewed reported burns while in the rural areas 2.3% reported burns (OR = 1.66, 95% CI: 1.27–2.17). In opposite, rural Bangladeshi people were at more than three times higher risk of burn (Mashreky et al., 2009). The lower rate of burn reported in rural residents may be due to different case definition in rural vs. urban population, rather than a real difference in incidence.

Place and mechanism of burns

In our study as well as in the previous studies, in Iran home was the most common place of burn (Sadeghi-Bazargani & Mohammadi, 2012). In addition, the most prevalent injured organ was upper limb (85.2% of all burns) followed by the lower limb (9.8% of all burns). In a study of national injury surveillance system over the period 2000–2002, the upper limbs and lower limbs were injured in 43.6% and 37.6% of all burns, respectively (Sadeghi-Bazargani & Mohammadi, 2013). Also, 95.7% of all burns in our study occurred because of heat and hot substances and most frequency activity during burn was unpaid work (75.4% of all burns). Flame burns were most common type of burns in the previous hospital-based studies but in minor burns, scalds were more common than flames. Based on analysis of 125,000 cases from a national register, scalds were the most common type of burns (77.7% of all burns). All over the world, scalds are usually related to cooking or bathing activity, but in our country, bathing activity is not a major cause of scalds (Sadeghi-Bazargani & Mohammadi, 2012; Sadeghi-Bazargani & Mohammadi, 2013).

We also found that seven persons (2.7% of all burns) had the history of burn due to electricity, radiation and ambient air. Six (85.7%) of them were male and all of these seven burns occurred outside the home (four, two and one of them occurred at trade and service areas, industrial and construction areas and street and highway, respectively). Mohammadi and his colleagues showed that 4.73% of all burns were due to electrical burns and 95.3% of the victims were male. They also demonstrated that half of the patients were employees and 59.3% of the electrical burns occurred at their work place (Mohammadi, Amini, Mehrabani, Kiani, & Seddigh, 2008).

The similar results were revealed by a systematic review of the epidemiology of unintentional burn injuries in South Asia. In that study, flame burns and scalds were the most common type of burns among children and women and electrical burns occurred mostly among men. Also in that study, home was the most common place of burns occurring (Golshan, Patel, & Hyder, 2013).

Treatment and cost of burns

In this study, among subjects who had a history of burn, 27 persons received medical care for burns. We showed that males had 3.51 times more major burns that requiring treatment than females (OR = 3.51, 95%CI: 1.54–7.99).

There has been a consensus that the cost of burns' care is high. A review of 20 Australian adult burn patients reported that the average cost of treatment was US$73,532 (Ahn & Maitz, 2012), In the US the average cost of non-fatal burns for hospitalized and ED-treated and released patients ranging from 15 to 64 years, including medical cost and work loss cost, estimated US$9018 (expressed in 2010 US prices) (Centers for Disease Control & Prevention. Web-based Injury Statistics Query & Reporting System (WISQARS), 2003) In Iran, this amount is much less. Burns are among the least expensive injuries in Iran (Hafezi-Nejad et al., 2015). According to our findings, in Iran the average total cost of burn was US$124 per case and the average out-of-pocket cost of burn was US$33 per

case. Costs of burns were obtained for burns that needed medical care. The total cost of burns consisted of all costs remembered by the victims, including direct cost (the money paid directly for medical and non-medical issues) and indirect cost (daily loss of money and time because of the absence from work). Based on the existing information, the value of lost quality of life was the largest proportion of the cost of injuries; larger than the medical costs and indirect costs (Zaloshnja, Miller, Lawrence, & Romano, 2005).

> Burns are preventable. High-income countries have made considerable progress in lowering rates of burn deaths, through a combination of prevention strategies and improvements in the care of people affected by burns. Most of these advances in prevention and care have been incompletely applied in low-and middle-income countries. (WHO: Burns Fact sheet N°365, 2014)

Low socio-economic status and low maternal education are among the risk factors of burns in low-income and middle-income countries (Forjuoh, 2006; Golshan et al., 2013). According to existing evidences for burns, expenditure for prevention and education programs is lower than the costs of treatment (Ahn & Maitz, 2012). To stop this major health issue, a national strategy and program for burn prevention and education must be developed.

Limitations

Based on available information, children have significant proportion in burn occurrence (Mashreky et al., 2009; WHO: World report on child injury prevention, 2008; Sadeghi-Bazargani & Mohammadi, 2012; Sadeghi-Bazargani & Mohammadi, 2013). Nevertheless, our study did not evaluate the incidence of burns in paediatric populations. Another limitation of our study was related to its population-based design; recall bias may have resulted in an underestimation of the appropriate incidence of the burns. In addition, three-month recall period in this survey may lead to underestimation of the incidence for minor burns, especially for minor burns that not seeking medical care. Furthermore, three-month recall period may also affect the patterns of burn occurrence with respect to the season that the question was asked. Nevertheless, this survey has been conducted between January and June 2011 (equivalent to winter and spring) and we asked subjects about the occurrence of any types of burns in the past three months. Therefore, the participated people's answers contain burns in the three seasons (fall, winter and spring) and we can choose no certain season as the time of occurrence of burn. Another limitation of our study was the fact that we did not examine main features of burns such as total body surface area, depth of burns and morbidity. Our study addressed the incidence of non-fatal burn injuries; however, future studies shall examine the mentioned features of burns and appropriate preventive measures that may be implemented in the target populations, which were highlighted in our study.

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