Factors responsible for mortality among burns patients in Islamic Republic of Iran

Mahmood Ghahghai[1], Sahar Sotoodeh Ghorbani[2], Seyed Hoseininejad[1], Abdulreza Sheikhi[1], Mahtab Farhadi[1] and Roozbeh Rahbar

[1]Department of General Surgery, School of Medicine Ahvaz Jundishapur University of Medical Sciences, Ahvaz, Islamic Republic of Iran (Correspondence to R. Rahbar: roozbeh.rahbar@yahoo.com). [2]Department of Epidemiology School of Public Health and Safety, Shahid Beheshti University of Medical Sciences, Tehran, Islamic Republic of Iran.

Abstract

Background: Burns is one of the most important causes of death, and the best way to reduce mortality due to burns is prevention.

Aims: To investigate the factors responsible for mortality due to burns in south-western Islamic Republic of Iran.

Methods: This was a cross-sectional study of 400 burns patients admitted to different wards of Ayatollah Taleghani Trauma and Burns Hospital, Ahvaz, Islamic Republic of Iran, from October 2020 to September 2021. Logistic regression was used to determine the factors responsible for mortality.

Results: The mean age of the patients was 28.47 (19.09) years, and 252 (63.0%) patients were male. There were 257 survivors and 143 deaths (35.75% mortality rate). The multiple logistic regression model showed that age, sex, percentage of total body surface area, burn depth, length of hospital stay, and length of intensive care unit stay were significantly associated with deaths due to burns.

Conclusion: The mortality rate due to burns was high at the Ayatollah Taleghani Trauma and Burns Hospital, Islamic Republic of Iran. Improving the quality of care provided to burns patients at health facilities can help reduce the current high mortality rate.

Keywords: burns, mortality, intensive care, emergency, survivors, risk factors, Iran

Citation: Ghahghai M, Ghorbani SS, Hoseininejad S, Sheikhi A, Farhadi M, Rahbar R. Factors responsible for mortality among burns patients in Islamic Republic of Iran. East Mediterr Health J. 2023;29(8):650–656. https://doi.org/10.26719/emhj.23.092

Received: 03/07/22; Accepted: 13/06/23

Introduction

Burns are the leading cause of disability-adjusted life-years lost in low- and middle-income countries, and treatment of burn injuries imposes a serious financial burden (*1*,*2*). Burns are the fourth most unexpected accident worldwide, followed by road accidents, falls, and collisions among people (*3*). Statistics from WHO suggest that > 300 000 deaths per year are caused by burns and their complications, and > 95% of burn deaths occur in low- and middle-income countries (*3*). In the Islamic Republic of Iran, burns and subsequent injuries are significant causes of death, and adult women and children aged 1–9 years are high-risk groups for burn injuries, in comparison with adult men (*4*).

Burns of varying severity can be caused by fire, combustible materials, chemicals, electricity, and radiation, and can lead to severe complications and death (*5*). Sex, age, total body surface area affected, respiratory injury, and comorbidity (e.g. cardiac, respiratory, and liver disease, and diabetes) are well-known predictors of burn mortality (*6*).

Research in developed countries indicates that prevention is the best way to decrease burn mortality. By identifying the factors that affect burn mortality, it is possible to prevent the occurrence of burns and reduce the number of deaths. The causes and demographic characteristics linked to burn injuries vary among countries; therefore, it is important for each country to carry out its own epidemiological research on burns (*7*). This study aimed to determine burn mortality and its associated factors in south-western Islamic Republic of Iran.

Methods

Study design and data collection

This descriptive, analytical, cross-sectional study was undertaken at Ayatollah Taleghani Trauma and Burn Hospital in Ahvaz, Islamic Republic of Iran from October 2020 to September 2021. Although the hospital is located in the south-western province of Khuzestan, patients are also referred from the neighbouring provinces of Ilam, Bushehr, and Lorestan. The hospital has 5 wards with 240 beds. Four hundred burn patients were admitted to different wards of the hospital [i.e. female, male, and paediatric wards, and intensive care unit (ICU)] during the study period. We included all burn patients who were treated in hospital and as outpatients. Exclusion criteria included: (1) patients with inadequate or incomplete records, such as absence of age, sex, diagnosis, outcome, burn depth, or burn surface area; and (2) patients who

were referred to the emergency department and did not have indications for hospitalization and were treated on an outpatient basis.

We gathered data from patients' medical records. The following variables were analysed: age, sex, marital status, level of education, occupation, economic status, degree of burn, percentage total body surface area affected (Lund and Browder chart), cause of burn, location of burn, length of hospital stay, burn complications, and mortality rate.

Ethical approval

All procedures were performed in accordance with the ethical standards of Ahvaz Jondishapur University of Medical Sciences (ID: IR.AJUMS.HGOLESTAN.REC.1400.033) and with the 1964 Helsinki Declaration and its later amendments, or comparable ethical standards. The medical records were reviewed and patients' names and details were kept confidential.

Statistical analysis

Continuous variables were described as mean (standard deviation), and categorical variables as frequency and percentage. The independent sample *t* test or Mann–Whitney *U* test was used to compare the continuous variables between 2 groups. The χ^2 test and Fisher's exact test were used for categorical variables. Logistic regression was used to determine the factors affecting mortality of burns. We used Stata 14 for data analysis (StataCorp, College Station, TX, USA). The significance level was $P < 0.05$.

Mortality rate was calculated as follows:

$$\text{Mortality rate} = \frac{\text{Number of patients who died from burns}}{\text{Total number of patients}} \times 100$$

Results

There were 252 (63.0%) male and 148 (37.0%) female burn patients, with a mean age of 28.47 (19.09) years (Table 1). The average length of hospital stay was 6.25 (7.59) days. There were 143 deaths, with a mortality rate of 35.75%. Fire injuries (52.63%) followed by electrical injuries (26.67%) accounted for the majority of deaths. The mean age in the nonsurvivor group was higher than in the survivor group [34.77 (18.09) vs 24.96 (18.37) years] ($P < 0.001$). Mortality rates were higher among patients aged ≥ 60 years (70.0%), followed by 51–60 years (50.0%) and 31–40 years (44.83%) ($P < 0.001$). Mortality rates were higher among women than men (43.92% vs 30.95%) ($P < 0.001$) and among married than unmarried people (41.31% vs 29.41%) ($P < 0.001$). For employment and socioeconomic status, the highest mortality rate was among homemakers (53.57%), followed by self-employed people (46.15%), and individuals of lower socioeconomic status (43.83%).

The mortality rate was greater among people who received surgical debridement, as opposed to those who did not (31.04% vs 83.33%) ($P < 0.001$). The mortality rate among patients who received blood transfusion or blood products was higher than among those who did not (47.24% vs 24.38%) ($P < 0.001$). The length of hospital stay was significantly lower for the nonsurvivor group than the survivor group [11.7 (8.12) vs 15.6 (7.6)] ($P < 0.001$). The average percentage of total body surface area affected was 35.98 (26.69)%, and most burns were third degree.

Fire was the most common cause of burns among males and females, and the least common causes were chemicals and contact with hot surfaces (Figure 1). There were 75 burns (18.75%) caused by self-immolation [46 (61.33%) females and 29 (38.66%) males].

Forty-three (39.09%) children aged < 10 years had 1–15% of their total body surface area affected, which indicated no serious injuries among this age range (Table 2). Burn injuries of 70.0–100.0% were more common among patients aged 21–30 years ($n = 13$, 21.23%) and 31–40 years ($n = 20$, 35.71%).

The primary causes of burn mortality were shock (44.0%), followed by acute respiratory distress (26.0%), sepsis (19.0%), acute renal failure (4.0%), anaemia (3.0%), wound infection (3.0%), and unknown (1.0%).

The multiple logistic regression model showed that the following factors were significantly associated with burn mortality (Table 3): age (AOR = 1.03, 95% CI: 1.00–1.06), sex (AOR = 2.73, 95% CI: 1.04–7.18), percentage of total body surface area affected (AOR = 11.74, 95% CI: 1.27–58.65), burn depth (AOR = 1.12, 95% CI: 1.08–1.17), length of hospital stay (AOR = 0.81, 95% CI: 0.75–0.88), and length of ICU stay (AOR = 1.19, 95% CI: 1.11–1.28).

Discussion

We investigated the mortality rate among burn patients in a hospital in south-western Islamic Republic of Iran and the factors affecting it. The mortality rate was 35.76%, and our results suggested that age, sex, percentage of total body surface area affected, depth of burn, length of hospital stay, and length of ICU stay were independent determinants of mortality. In comparison, the burn mortality rate was 0.86% in China (*8*), 3.49% in Spain (*9*), 4.61% in Singapore (*10*), 6.4% in Kuwait (*11*), 9.72% in Nigeria (*12*), 14% in Turkey (*6*), 18.8% in Brazil (*13*), and 23.4% in Cameroon (*1*). The high mortality rate of burn patients admitted to the hospital in our study can be partly attributed to the lack of specialized burn centres in the surrounding provinces and cities. Resuscitation was often delayed because of the long distances patients had to travel. Additionally, patients with large total body surface area affected and with severe burns were referred to our hospital. In the study by Amengle et al. in Cameroon, the mortality rate was 41.2%. The higher rate compared with our study can be attributed to severe burns among children (*14*). Additionally, in the study of Nguema et al. in Gabon, the mortality rate was 54.8% and because the study was conducted in an ICU, the mortality rate was higher than in our study (*15*). The study by Rasouli et al. showed a mortality rate of 33% in Tehran (*16*), which is similar to the rate we reported here. Soltani et al. reported a mortality rate of 59.48% in Tehran and patients with <

40% total body surface area affected accounted for 52.5% of injuries; therefore, the occurrence of severe burns was high (*17*).

In our study, female burn patients had a higher risk of death than male patients had, which agrees with most studies to date (*18*,*19*). This is perhaps because women are more likely than men to be exposed to flammable liquids or combustible substances and may have insufficient information concerning the proper use of petroleum products. However, Rasouli et al. (*16*) and Forbinake et al. (*1*) reported that the mortality rate was higher among men than women.

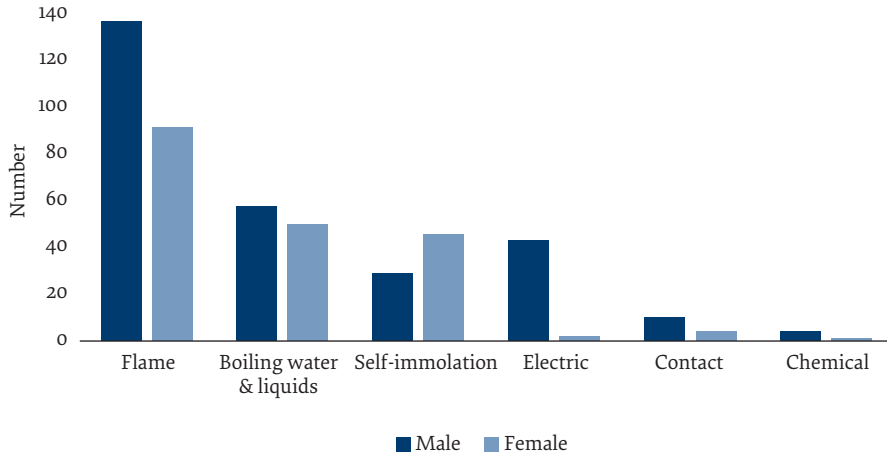
Our results suggest that mortality increased significantly with age, which is consistent with previous

Table 1 Demographic and clinical characteristics of burns patients, Ahvaz, Islamic Republic of Iran, October 2020 to September 2021

Variables		N = 400	Survivors (n= 257)	Nonsurvivors (n= 143)	P value
Age, mean (SD)		28.47 (19.09)	24.96 (18.37)	34.77 (18.9)	<0.001
Age, yrs	<10	100 (25)	83 (83.0)	17 (17.0)	<0.001
	11–20	45 (11.25)	28 (62.22)	17 (37.78)	
	21–30	67 (16.75)	43 (64.18)	24 (35.82)	
	31–40	87 (21.75)	48 (55.17)	39 (44.83)	
	41–50	45 (11.25)	31 (68.89)	14 (31.11)	
	51–60	36 (9.0)	18 (50.0)	18 (50.0)	
	≥61	20 (5.0)	6 (30.0)	14 (70.0)	
Sex	Male	252 (63.0)	174 (69.05)	78 (30.95)	0.009
	Female	148 (37.0)	83 (56.08)	65 (43.92)	
Marital status	Single	187 (46.75)	132 (70.59)	55 (29.41)	
	Married	213 (53.25)	125 (58.69)	88 (41.31)	0.016
Education level	Illiterate	131 (32.75)	94 (71.76)	37 (28.24)	
	Elementary	83 (20.75)	53 (63.86)	30 (36.14)	
	Middle school	66 (16.50)	43 (65.15)	23 (34.85)	0.089
	High school and diplomaAcademic	107 (26.75)	58 (54.21)	49 (45.79)	
		13 (3.25)	9 (69.23)	4 (30.77)	
Employment	Homemaker	84 (21.0)	39 (46.43)	45 (53.57)	
	Employee	73 (18.25)	50 (68.49)	23 (31.51)	
	Manual worker	168 (42.0)	122 (72.62)	46 (27.38)	0.002
	Unemployed	4 (1.0)	4 (100.0)	0 (0.0)	
	Student	17 (4.25)	13 (76.47)	4 (23.53)	
	Self-employed	52 (13.0)	28 (53.85)	24 (46.15)	
	Retired	2 (0.50)	1 (50.0)	1 (50.0)	
Economic status	Poor	235 (58.75)	132 (56.17)	103 (43.83)	<0.001
	Moderate	159 (39.75)	119 (74.84)	40 (25.16)	
	Good	6 (1.50)	6 (100.0)	0 (0.0)	
Burn depth	First degree	0 (0)	0 (0)	0 (0.0)	<0.001
	Second degree	171 (42.75)	170 (99.41)	1 (0.59)	
	Third degree	229 (57.25)	87 (37.99)	142 (62.01)	
Burn agent	Boiling water & liquids	108 (27.0)	98 (90.74)	10 (9.26)	<0.001
	Fire	228 (57.0)	108 (47.37)	120 (52.63)	
	Chemical	5 (1.25)	5 (100.0)	0 (0.0)	
	Electrical	45 (11.25)	33 (73.33)	12 (26.67)	
	Contact with hot surface	14 (3.50)	13 (92.86)	1 (7.14)	
TBSA%		35.98 (26.69)	20.42 (12.15)	63.95 (22.56)	<0.001
TBSA%	≤15%	110 (27.50)	110 (100.0)	0 (0.0)	
	16–30%	112 (28.0)	102 (91.7)	10 (8.93)	
	≥31%	178 (44.50)	45 (25.28)	133 (74.72)	
Cause of burn	Accidental	325 (81.25)	252 (77.54)	73 (22.46)	<0.001
	Intentional	75 (18.75)	5 (6.67)	70 (93.33)	
Location of burn	Workplace	52 (13.0)	37 (71.15)	15 (28.85)	0.536
	Home	324 (81.0)	205 (63.27)	119 (36.73)	
	Outside the home	24 (6.0)	15 (62.50)	9 (37.50)	
Debridement	Yes	364 (91.0)	251 (68.96)	113 (31.04)	<0.001
	No	36 (9.0)	6 (16.67)	30 (83.33)	
Length of hospital stay, d		14.18 (8)	15.59 (7.59)	11.66 (8.12)	<0.001
Length of ICU stay, d		6.25 (7.59)	4.14 (7.06)	10.06 (7.03)	<0.001
Blood transfusion	Yes	199 (49.75)	105 (52.76)	94 (47.24)	<0.001
	No	201 (50.25)	152 (75.62)	49 (24.38)	

ICU = intensive care unit; TBSA% = percentage total body surface area affected.

Figure 1 Causes of burns among males and females, Ahvaz, Islamic Republic of Iran, October 2020 to September 2021



studies (*5,20,21*). Older age is a strong predictor of burn mortality because of the deregulation of immune responses and skin thinning (*22*). Age-related weakening of the immune system means that older burn patients are likely to die from infectious complications during hospitalization or resuscitation (*23*).

We found a significant increase in mortality among patients with third-degree burns compared with second-degree burns, which agrees with previous studies (*16,23*). Temiz et al. found that increases in burn depth and surface area affected resulted in increased mortality (*5*). The study of Kaya et al. on electrical burns suggested that mortality significantly increased for third-degree compared with first- and second-degree burns (*24*). The overall mean percentage of total body surface area affected was 36% in our study, which included 63.9% in the nonsurvivor group and 20.42% in the survivor group; therefore, there was a significant association between the percentage of total body surface area affected and mortality.

There is a consensus that the percentage of total body surface area affected is a risk factor for burn mortality (*25,26*); for example, > 40% is an important predictor of mortality (*16,27*). Likewise, several studies have shown that the mortality rate among patients with > 30% and > 70% total body surface area affected was 44.2% and 100%, respectively (*28–30*). In our study, the mortality rate among patients with ≥ 30% total body surface area affected was 74.7%.

We found that the length of hospital stay had a significant and inverse relationship with burn mortality. This was consistent with the study by Güldoğan et al. who found that total length of hospitalization increased survival (*30*). Length of stay in the ICU was a risk factor for mortality, and many studies showed that increased length of stay in the ICU was linked to increased burn mortality (*31*).

In our study, 22.46% of patients with accidental burns and 93.33% of suicide attempts resulted in death, which was a significant difference. The mortality rate in the study of Güldoğan et al. was lower in accidental burns but higher in suicidal burns (*30*).

There are various causes of burn mortality among patients admitted to hospital. In the study by Olaitan et al., the main cause of death was acute renal failure (*32*), while sepsis was the leading cause in the study by Rasouli et al. (*16*). In a study conducted in Tokyo, the leading cause of premature death within 30 days of admission was shock and inhalation injury (*26*). Likewise, shock was the most common cause of death in a study in Cameroon (*1*). In our study, shock and then acute respiratory distress were the leading causes of death.

Our study had some limitations; therefore, the findings should be interpreted with caution. The first

Table 2 Percentage total body surface area affected according to age, Ahvaz, Islamic Republic of Iran, October 2020 to September 2021

TBSA%	Age, yrs							
	< 10	11–20	21–30	31–40	41–50	51–60	≥61	Total
1–15	43 (39.09)	13 (11.82)	19 (17.27)	18 (16.36)	5 (4.55)	10 (9.09)	2 (1.82)	110 (100)
16–30	25 (22.32)	11 (9.82)	17 (15.18)	24 (21.43)	22 (19.64)	7 (6.25)	6 (5.36)	112 (100)
31–50	25 (32.47)	8 (10.39)	11 (14.29)	16 (20.78)	7 (9.09)	5 (6.49)	5 (6.49)	77 (100)
51–70	4 (8.89)	6 (13.33)	7 (15.56)	9 (20.00)	8 (17.78)	5 (11.11)	6 (13.33)	45 (100)
71–100	3 (5.36)	7 (12.50)	13 (23.21)	20 (35.71)	3 (5.36)	9 (16.07)	1 (1.79)	56 (100)
Total	100 (25.0)	45 (11.25)	67 (16.75)	87 (21.75)	45 (11.25)	36 (9.00)	20 (5.00)	400 (100)

TBSA% = percentage total body surface area affected.

Table 3. Multiple regression analysis to determine the factors affecting in-hospital deaths, Ahvaz, Islamic Republic of Iran, October 2020 to September 2021

Predictors	*P* value	OR	95% CI
Age	0.009	1.03	1.00–1.06
Female	0.042	2.73	1.04–7.18
Third-degree burn	0.030	11.74	1.27–58.65
Burn depth	<0.001	1.12	1.08–1.17
Length of hospital stay	<0.001	0.81	0.75–0.88
Length of ICU stay	<0.001	1.19	1.11–1.28

CI = confidence interval; ICU = intensive care unit; OR = odds ratio.

limitation was the cross-sectional study design. Such studies can only examine whether there is a relationship or not, and the causal relationship between independent factors cannot be examined; therefore, the degree of mortality caused by burns could not be explored. We only investigated a single centre; therefore, future studies need to be conducted in other specialized burn hospitals and clinics. This study was conducted during a period of 12 months without considering the burn season (mainly during holidays and cold times of year); therefore, it is suggested that these issues be taken into consideration in future research. An advantage of this study was that it was conducted in the major centre for burn injuries in south-western Islamic Republic of Iran and many patients with large burns were admitted from the neighbouring provinces and cities. This means that the study sample was diverse, which makes it possible to extrapolate the results beyond the present study.

Conclusion

Mortality due to burns was high in this study at a burns hospital in south-western Islamic Republic of Iran. Improvements in the quality of services at health facilities, especially burns facilities, and improved socioeconomic situation could help reduce the currently high mortality rates due to burns. Greater awareness at the community level on how to prevent burns and training for healthcare workers caring for burns patients could help reduce the high death rate. We found that age, sex, percentage of total body surface area affected, burn depth, length of hospital stay, and length of stay in the ICU were independent determinants of mortality. Therefore, using these parameters, treatment guidelines could be developed to reduce mortality among burns patients.

Acknowledgement

This study was supported by the School of Medicine, Ahvaz Jundishapur University of Medical Sciences grant number 330098714. The authors would like to thank the School of Medicine research affairs of Shahid-Beheshti University of Medical Sciences for technically supporting this study.

Conflict of interest: None declared.

Facteurs responsables de la mortalité chez les patients victimes de brûlures en République islamique d'Iran

Résumé

Contexte : Les brûlures constituent l'une des principales causes de décès. La prévention est le meilleur moyen de réduire le taux de mortalité qui en découle.

Objectif : Étudier les facteurs responsables de la mortalité due aux brûlures dans le sud-ouest de la République islamique d'Iran.

Méthodes : Il s'agissait d'une étude transversale portant sur 400 patients victimes de brûlures admis, entre octobre 2020 et septembre 2021, dans différentes unités de l'Hôpital Ayatollah Taleghani spécialisé en traumatologie et en prise en charge de brûlures, situé à Ahvaz (République islamique d'Iran). Une régression logistique a été utilisée pour déterminer les facteurs responsables de la mortalité.

Résultats : L'âge moyen des patients était de 28,47 (19,09) ans et 252 (63,0 %) étaient des hommes. Il y a eu 257 survivants et 143 décès (taux de mortalité de 35,75 %). Le modèle de régression logistique multiple a montré que l'âge, le genre, le pourcentage de surface corporelle totale brûlée, la profondeur des brûlures, la durée du séjour à l'hôpital et celle du séjour en unité de soins intensifs étaient significativement associés aux décès dus aux brûlures.

Conclusion : Le taux de mortalité dû aux brûlures était élevé à l'Hôpital Ayatollah Taleghani. L'amélioration de la qualité des soins dispensés aux patients victimes de brûlures dans les établissements de santé peut contribuer à réduire le taux de mortalité qui est actuellement élevé.

العوامل المسؤولة عن الوفيات في أوساط مرضى الحروق في جمهورية إيران الإسلامية

محمود قهقايي، سحر ستوده قرباني، سيد حسين نجاد، عبد الرضا شيخي، مهتاب فرهادي، روزبة رهبر

الخلاصة

الخلفية: تُعد الحروق من أهم أسباب الوفاة، وأفضل طريقة للحد من الوفيات الناجمة عن الحروق هي الوقاية.

الأهداف: هدفت هذه الدراسة إلى التحري عن العوامل المسؤولة عن الوفيات الناجمة عن الحروق في جنوب غرب جمهورية إيران الإسلامية.

طرق البحث: أُجريت هذه الدراسة المقطعية على 400 مريض حروق أُدخلوا إلى عنابر مختلفة من مستشفى آية الله تاليغاني للرضوح والحروق، في الأهواز، جمهورية إيران الإسلامية، في المدة من أكتوبر/ تشرين الأول 2020 إلى سبتمبر/ أيلول 2021. واستُخدم الانحدار اللوجستي لتحديد العوامل المسؤولة عن الوفيات.

النتائج: كان متوسط أعمار المرضى 28.47 (19.09) سنة، وكان 252 مريضًا (63.0٪) من الذكور. وكان هناك 257 ناجيًا و143 وفاة (معدل الوفيات 35.75٪). وأظهر نموذج الانحدار اللوجستي المتعدد أن العمر والجنس والنسبة المئوية من إجمالي مساحة سطح الجسم، وعمق الحرق، وطول مدة الإقامة في المستشفى، وطول مدة الإقامة في وحدات العناية المركزة عوامل تقترن بشدة بالوفيات الناجمة عن الحروق.

الاستنتاجات: كان معدل الوفيات الناجمة عن الحروق مرتفعًا في مستشفى آية الله تاليغاني للرضوح والحروق، بجمهورية إيران الإسلامية. وقد يساعد تحسين جودة الرعاية المقدمة لمرضى الحروق في المرافق الصحية على خفض معدل الوفيات المرتفع حاليًّا.

References

1. Forbinake NA, Ohandza CS, Fai KN, Agbor VN, Asonglefac BK, Aroke D, et al. Mortality analysis of burns in a developing country: a CAMEROONIAN experience. BMC Public Health. 2020 Aug 20;20(1):1–6. https://doi.org/10.1186/s12889-020-09372-3 PMID:32819340
2. Mohammadi-Barzelighi H, Alaghehbandan R, Motevallian A, Alinejad F, Soleimanzadeh-Moghadam S, Sattari M, et al. Epidemiology of severe burn injuries in a Tertiary Burn Centre in Tehran, Iran. Ann Burns Fire Disasters. 2011 Jun 30;24(2):59. PMID:22262960
3. Kumar S, Ali W, Verma AK, Pandey A, Rathore S. Epidemiology and mortality of burns in the Lucknow Region, India – a 5 year study. Burns. 2013 Dec;39(8):1599–605. https://doi.org/10.1016/j.burns.2013.04.008 PMID:23663899
4. Maghsoudi H, Pourzand A, Azarmir G. Etiology and outcome of burns in Tabriz, Iran an analysis of 2963 cases. Scand J Surg. 2005; 94(1):77–81. https://doi.org/10.1177/145749690509400118 PMID:15865123
5. Temiz A, Albayrak A, Peksoz R, Dişçi E, Korkut E, Tanrikulu Y, et al. Factors affecting the mortality at patients with burns: single centre results. Turk J Trauma Emerg Surg. 2020 Sep;26(5):777–83. https://doi.org/10.14744/tjtes.2020.37862 PMID:32946089
6. Tarim MA. Factors affecting mortality in burn patients admitted to intensive care unit. East J Med. 2013;18(2):72–5. https://east-jmed.org/jvi.aspx?pdir=ejm&plng=eng&un=EJM-25152
7. Ganesamoni S, Kate V, Sadasivan J. Epidemiology of hospitalized burn patients in a tertiary care hospital in South India. Burns. 2010 May;36(3):422–9. https://doi.org/10.1016/j.burns.2009.06.212 PMID:19782475
8. Jie X, Baoren C. Mortality rates among 5321 patients with burns admitted to a burn unit in China: 1980–1998. Burns. 2003 May;29(3):239–45. https://doi.org/10.1016/s0305-4179(02)00303-0 PMID:12706617
9. Barret JP, Gomez P, Solano I, Gonzalez-Dorrego M, Crisol FJ. Epidemiology and mortality of adult burns in Catalonia. Burns. 1999 Jun;25(4):325–9. https://doi.org/10.1016/s0305-4179(98)00190-9 PMID:10431980
10. Song C, Chua A. Epidemiology of burn injuries in Singapore from 1997 to 2003. Burns. 2005 Jan;31(Suppl 1):S18–26. https://doi.org/10.1016/j.burns.2004.10.005 PMID:15649612
11. Bang RL, Sharma PN, Gang RK, Ghoneim IE, Ebrahim MK. Burn mortality during 1982 to 1997 in Kuwait. Eur J Epidemiol. 2000;16(8):731–9. https://doi.org/10.1023/a:1026702201874 PMID:11142501
12. Dongo AE, Irekpita EE, Oseghale LO, Ogbebor CE, Iyamu CE, Onuminya JE. A five-year review of burn injuries in Irrua. BMC Health Services Res. 2007 Oct 23;7(1):1–5. https://doi.org/10.1186/1472-6963-7-171 PMID:17956614
13. De-Souza DA, Marchesan WG, Greene LJ. Epidemiological data and mortality rate of patients hospitalized with burns in Brazil. Burns. 1998 Aug;24(5):433–8. https://doi.org/10.1016/s0305-4179(98)00043-6 PMID:9725683

14. Amengle LA, Bengono RB, Mbengono JM, Beyiha G, Minkande JZ, Abena MO. [Aspects épidémiologiques et pronostiques des brulures graves chez l'enfant.] Health Sci Dis. 2015;16(1) (in French). https://www.hsd-fmsb.org/index.php/hsd/article/view/474

15. Nguema PN, Matsiegui PB, Nsafu DN. Severe burns patients: epidemiology and treatment (a study of 104 Gabonese cases). Sante. 2000 Jan–Feb;10(1):37–42 (in French). PMID:10827361

16. Rasouli MR, Zarei MR, Dianat S, Eslami V, Harirchi I, Boddouhi N, et al. Factors associated with mortality in adult hospitalized burn patients in Tehran. Turk J Trauma Emerg Surg. 2011 Jan;17(1):61–5. https://doi.org/10.5505/tjtes.2011.22129 PMID:21341137

17. Soltani K, Zand R, Mirghasemi A. Epidemiology and mortality of burns in Tehran, Iran. Burns. 1998 Jun;24(4):325–8. https://doi.org/10.1016/s0305-4179(98)00017-5 PMID:9688197

18. Gomez M, Wong DT, Stewart TE, Redelmeier DA, Fish JS. The FLAMES score accurately predicts mortality risk in burn patients. J Trauma Acute Care Surg. 2008 Sep;65(3):636–45. https://doi.org/10.1097/TA.0b013e3181840c6d PMID:18784578

19. Muller MJ, Pegg SP, Rule MR. Determinants of death following burn injury. Br J Surg. 2001 Apr;88(4):583–7. https://doi.org/10.1046/j.1365-2168.2001.01726.x PMID:11298629

20. Haksal MC, Tiryaki C, Yazıcıoğlu MB, Güven M, Çiftci A, Esen O, et al. General characteristics of paint thinner burns: single center experience. Turk J Trauma Emerg Surg. 2017 Jan;23:51–5. https://doi.org/10.5505/tjtes.2016.66178 PMID:28261771

21. Bessey PQ, Arons RR, DiMaggio CJ, Yurt RW. The vulnerabilities of age: burns in children and older adults. Surgery. 2006 Oct;140(4):705–17. https://doi.org/10.1016/j.surg.2006.07.029 PMID:17011919

22. Lionelli GT, Pickus EJ, Beckum OK, Decoursey RL, Korentager RA. A three decade analysis of factors affecting burn mortality in the elderly. Burns. 2005 Dec;31(8):958–63. https://doi.org/10.1016/j.burns.2005.06.006 PMID:16269217

23. Tan Chor Lip H, Tan JH, Thomas M, Imran FH, Mat AT. Survival analysis and mortality predictors of hospitalized severe burn victims in a Malaysian burns intensive care unit. Burns Trauma. 2019 Jan 28;7:3. https://doi.org/10.1186/s41038-018-0140-1 PMID:30705904

24. Ay N, Alp V, Aliosmanoğlu İ, Sevük U, Kaya Ş, Dinç B. Factors affecting morbidity and mortality in traumatic colorectal injuries and reliability and validity of trauma scoring systems. World J Emerg Surg. 2015 May 12;10(1):1–7. https://doi.org/10.1186/s13017-015-0014-9 PMID:26023317

25. Panjeshahin MR, Lari AR, Talei AR, Shamsnia J, Alaghehbandan R. Epidemiology and mortality of burns in the South West of Iran. Burns. 2001 May;27(3):219–26. https://doi.org/10.1016/s0305-4179(00)00106-6 PMID:11311514

26. Kobayashi K, Ikeda H, Higuchi R, Nozaki M, Yamamoto Y, Urabe M, et al. Epidemiological and outcome characteristics of major burns in Tokyo. Burns. 2005 Jan;31(Suppl 1):S3–11. https://doi.org/10.1016/j.burns.2004.10.007 PMID:15649614

27. Ryan CM, Schoenfeld DA, Thorpe WP, Sheridan RL, Cassem EH, Tompkins RG. Objective estimates of the probability of death from burn injuries. N Engl J Med. 1998 Feb 5;338(6):362–6. https://doi.org/10.1056/NEJM199802053380604 PMID:9449729

28. Chaudhary I. Burns: frequency and mortality related to various age groups. J Surg Pak. 2009 Apr–Jun;14(2):67–71.

29. Ercan GÇ, Özay H, Bombacı E, Çevik B, Çolakoğlu S. The prognosis of two year follow up of burn intensive care unit patients. J Turk Soc Intens Care. 2012;10(3):110–6 (in Turkish). https://doi.org/10.4274/Tybdd.201

30. Güldoğan CE, Kendirci M, Gündoğdu E, Yastı AÇ. Analysis of factors associated with mortality in major burn patients. Turk J Surg. 2018 Nov 20;1–8. https://doi.org/10.5152/turkjsurg.2018.4065 PMID:30475696

31. Pavoni V, Gianesello L, Paparella L, Buoninsegni LT, Barboni E. Outcome predictors and quality of life of severe burn patients admitted to intensive care unit. Scand J Trauma Resusc Emerg Med. 2010 Apr 27;18:24. https://doi.org/10.1186/1757-7241-18-24 PMID:20420719

32. Olaitan PB, Jiburum BC. Analysis of burn mortality in a burns centre. Ann Burns Fire Disasters. 2006 Jun 30;19(2):59–62. PMID:21991024