



Epidemiology of cause and burn pattern in self-immolated patients during 2014-2020

Siamak Soltani ¹, Azadeh Memarian ^{2*}, Kamran Aghakhani ¹, Leyla Abdolkarimi ³, Farrokh Taftachi ³

¹ Department of Forensic & Legal Medicine, School of Medicine, Rasoul Akram hospital, Iran University of Medical Sciences, Tehran, Iran

² Assistant of Clinical Toxicology, Shahid Beheshti University of Medical Sciences, Associate professor, Department of Emergency Medicine, Faculty of Medicine, Mazandaran University of Medical Sciences, Sari, Iran

³ Shahid Rajaei Cardiovascular Medical and Research Center, Tehran, Iran

*Corresponding author: Azadeh Memarian, Address: Department of Emergency Medicine, Faculty of Medicine, Mazandaran University of Medical Sciences, Sari, Iran, Email: a.memarian@mazums.ac.ir, Tel: +98 912 092 2655

Abstract

Background & Aims: Lots of suicides leading to death in Iran are related to self-immolation. This study aimed to evaluate the cause and burn patterns in self-immolated patients referred to Shahid Motahari Trauma and Burn Hospital in Tehran, Iran.

Materials & Methods: This cross-sectional study was conducted on 282 patients who were hospitalized, due to self-immolation, in the above-mentioned hospital between 2014 and 2020. During the study, information such as patients' demographic data, burn percentage, burn grade, and organs involved due to self-immolation, duration of hospitalization, and infection and mortality rates following self-immolation were recorded.

Results: The mean age of self-immolated people was 35.5 ± 12.5 years, and the majority were male (58.2%) and married (61.7%) with non-university education (89.7%) and poor financial status (90.4%). Most of the patients (94%) had used caustic agents. The cause of self-immolation in 84% of people was family disputes and in 13.4% mental illnesses, and 51.1% finally died. The gender of the patients had a statistically significant relationship only with marital status ($P = 0.001$) and whole-body burns ($P = 0.01$).

Conclusion: According to our findings, self-immolation is prevalent in men, especially in upper limbs, and the most common cause of self-immolation is family disputes. Self-immolation mostly results in grade 3 burns in both genders. In the hospital, infection after burn is of great importance; therefore, prevention and control measures of nosocomial infection are necessary.

Keywords: Burn Pattern; Self-Immolation; Suicide

Received 08 December 2022; accepted for publication 03 January 2023

Copyright © 2023 Journal of Health Science Monitor

This is an open-access article distributed under the terms of the Creative Commons Attribution-noncommercial 4.0 International License, which permits copy and redistribute the material just in noncommercial usages as long as the original work is properly cited.

Introduction

Self-immolation, one of the most violent and painful methods of suicide, has a high mortality rate

due to deep and complex wounds and infections (1). Although the rate of self-immolation is low worldwide, the mortality rate is about 60%. Today, the use of this

suicide method is rarely reported in developed countries, but it is relatively common in developing countries, including Iran, with a high prevalence of self-immolation (2). Self-immolation accounts for approximately 16% of all hospitalizations burns, and the rate of self-immolation is expected to be 4.5 cases per 100,000 populations (3). The estimated mean age of self-immolated individuals is about 27.31 years, and females account for 70% of the self-immolation attempts in Iran (4).

Self-immolation occurs for various reasons, such as protest, social problems, family disputes, especially arguments with spouse, mental disorders, psychosis, and psychotropic substance abuse (5, 6). Self-immolation is considered one of the deadliest methods of suicide; according to studies, more than 65% of people who have committed this act die immediately or after hospitalization (4). Likewise, if survive, they will struggle with irreparable injuries, and in many cases suffer from complications such as blindness, amputation of limbs or fingers, flexion contraction, and severe skin fibrosis, which their recovery process is very long and costly (7).

Knowing the underlying causes of self-immolation and also the patterns of burns will help prevent the occurrence of self-immolation. According to literature review, there is no study on the causes and motives of self-immolation and also the pattern of burns in self-immolation patients. Therefore, we conducted a study to determine the cause and burn patterns in self-immolated patients who referred to Shahid Motahari Burns Hospital (Tehran, Iran), the center of burns in the country.

Materials & Methods

This cross-sectional study was conducted on all the patients who were hospitalized in Shahid Motahari

Burns Hospital due to self-immolation between the years 2014 and 2020. During the study, information such as patients' demographic data (age and gender), burn percentage and grade, organs involved and injured in burns, causes and goals of patients' self-immolation, length of hospital stay, mortality rate after self-immolation, and the incidence of secondary burn infection in these patients was collected from patients' records. In the present study, we specifically aimed at investigating the prevalence, causes, and pattern of burns in patients suffering from burns due to self-immolation.

Ethical considerations:

This study was approved by the Ethics Committee of Iran University of Medical Sciences, Tehran (ethical code: IR.IUMS.REC.1399.220), and its protocol was performed in accordance with the Helsinki Convention.

Statistical analysis:

Data were analyzed using SPSS statistical software version 20. The results were expressed as mean \pm SD for quantitative variables, and as a frequency and percentage for qualitative variables through Chi-square test.

Results

Of 282 patients included in this study, 164 (58.2%) were male, and 118 (41.8%) were female. The mean age of the self-immolated cases was 35.5 ± 12.2 years. The youngest and oldest patients were 14 and 83 years old, respectively. The mean age of males was 35.8 ± 12.5 , while that of females was 35.1 ± 11.9 years. The mean age between male and female patients was statistically nonsignificant ($P = 0.7$). The marital status, educational level, and financial status of the patients are shown in Table 1.

Table 1. Marital status, educational level, and financial status of the studied patients

Variable	No. (%)
Marital status	
Married	174 (61.7)
Single	90 (31.9)

Variable	No. (%)
Divorced	16 (5.7)
Education level	
Illiterate	29 (10.3)
Middle school	140 (49.6)
High school	84 (29.8)
University	29 (10.3)
Financial Status	
Weak	255 (90.4)
Moderate	25 (8.9)
Good	2 (0.2)

Based on Table 2, 51.1% of males and 35.1% of females suffered from burns with fuels (oil/gas/gasoline). Also, 2.5% of males and 5.3% of the

females suffered from alcohol burns. There was no statistically significant relationship between the burning factor and gender ($P = 0.5$).

Table 2. Burning factors by genders

Gender	Fuels	Alcohol	Other	P value
Male n (%)	144 (51.1)	7 (2.5)	13 (4.6)	0.5
Female n (%)	99 (35.1)	15 (5.3)	4 (1.4)	
Total n (%)	243 (86.2)	22 (7.8)	17 (6)	

Table 3 summarizes the causes of self-immolation reported by patients. The most common cause of self-immolation was family disputes with a prevalence of 84%, 46.5% in males and 37.5% in females. There was

no statistically significant relationship between patients' gender and the cause of self-immolation ($P = 0.1$).

Table 3. Cause of self-immolation by genders

Gender	Nervous disorders	Depression	Social problems	Family disputes	P value
Male n (%)	12 (4.3)	15 (5.3)	6 (2.1)	131 (46.5)	0.1
Female n (%)	5 (1.8)	6 (2.1)	1 (0.4)	106 (37.5)	
Total n (%)	17 (6)	21 (7.4)	7 (2.5)	237 (84)	

As shown in Table 4, upper limbs (42.1%) in females and lower limbs (60.9%) in males were the organs with the highest rate of burn. There was no statistically significant relationship between gender and

facial ($P = 0.8$), trunk ($P = 0.8$), upper limb ($P = 0.6$), and lower limb ($P = 0.1$) burns. However, there was a statistically significant association between gender and patients' total body burns ($P = 0.01$).

Table 4. Involved organ following self-immolation by gender

Site	Male (%)	Female (%)	P value
Face	58.4	41.6	0.01
Trunk	58.1	41.9	

Site	Male (%)	Female (%)	P value
Upper limbs	57.9	42.1	
Lower limbs	60.9	39.1	
Total body	6.4	33.6	

According to Table 5, 236 (83.7%) patients had grade 3 burns, 45 (16%) cases had grade 2 burns, and one (0.4%) patient had grade 4 burns. Grade 3 had the

highest frequency in both males (49.3%) and females (34.3%). There was no statistically significant relationship between gender and burn grade ($P = 0.5$).

Table 5. Burn grade by gender

Gender	Grade 2	Grade 3	Grade 4	P value
Male n (%)	24 (8.5)	139 (49.3)	1 (0.4)	
Female n (%)	21 (7.4)	97 (34.4)	0 (0)	0.5
Total n (%)	45 (16)	236 (83.7)	1 (0.4)	

The prevalence of burn percentage of patients is summarized in Table 6. The highest percentage of burn was related to 90-100%, with a prevalence of 16.7%.

There was no statistically significant relationship between burn percentage and patients' gender ($P = 0.06$).

Table 6. Burn percentage by gender

Burn percentage	Male n (%)	Female n (%)	P value
0-10	8 (2.8)	6 (2.1)	
10-20	20 (7.1)	13 (4.6)	
20-30	9 (3.2)	19 (6.7)	
30-40	16 (5.7)	14 (5)	
40-50	22 (7.8)	16 (5.7)	
50-60	14 (5)	14 (5)	0.06
60-70	10 (3.5)	8 (2.8)	
70-80	14 (5)	10 (3.5)	
80-90	16 (5.7)	6 (2.1)	
90-100	35 (12.4)	12 (4.3)	
Total	164 (58.2)	118 (41.8)	

According to Table 7, 125 (44.3%) patients were discharged, but 144 (51.1%) cases died. Also, 11 (3.9%) patients left the hospital with a personal consent, and 2 (0.7%) patients were referred to another

medical center. There was no statistically significant relationship between gender and type of discharge ($P = 0.3$).

Table 7. Type of discharge by gender

Gender	Discharged	Discharged with a personal consent	Died	Referred to another medical center	P value
Male n (%)	67 (23.8)	7 (2.5)	88 (31.2)	2 (0.7)	
Female n (%)	58 (20.6)	4 (1.4)	56 (19.9)	0 (0)	0.3
Total n (%)	125 (44.3)	11 (3.9)	144 (51.1)	2 (0.7)	

Discussion

This study investigated the cause and burn patterns in self-immolated patients referred to Shahid Motahari Trauma and Burn Hospital in Tehran, capital city of Iran. The mean age of self-immolated cases in our research was 35.5 ± 12.2 years, as similarly reported by other investigations. In Mobayen et al.'s study in Rasht, the mean age of the self-immolated patients was determined as 37.5 ± 1.5 years (8). Mohammadi et al. have also reported an average age of 31.15 ± 0.452 for self-immolated patients in the south of Iran (9). In another study conducted in a developing country, South Africa, the average age was 31.2 years (10). Other studies in developed countries have also shown similar average ages; for instance, 30 years in Australia (11) and 38 years in Italy (12). This similar mean age of the individuals who committed self-immolation suggest that young people are under more pressure and stress than older people and adolescents. Finding a job and a suitable income, unemployment, marriage-related conditions or problems after marriage, and so forth can be considered as the main factors leading to self-immolation. It has been shown that unemployment among young people, especially educated people, can also be a cause of dissatisfaction and frustration that could lead to suicide (13).

Most patients in this study were male. Of 83.7% patients with grade 3 burns, 59% were men. The only case with grade 4 burn was also male. The highest percentage of burns was related to 90-100% with a prevalence of 16.7%, of which 12.4% were male. In a study in Ilam, the most percentage of burns was reported as 81-100% (14). In another study in Northern Iran, the highest percentage of burns was 80-100% among individuals aged 60-79 years (15). In the current study, there was a significant increase in the total body burns in men than women; however, the results of other studies in Iran, concerning gender, were reverse. In the studies of Mohammadi et al. (63.2%) in southern part of the country (9), Dahmardehei et al. in Zahedan (67.25%) (16), Moradinazar et al. in Kermanshah (83%) (17), and Azizpour et al. in Ilam (88.4%) (18), the rate of self-immolation was higher in females. In

this study, upper limbs, trunk, and face were the most involved organs in patients. In Baziar et al.'s study, most of the burns were related to total body burn (14).

In the current study, the rate of self-immolation was higher in married people. According to the results of the present study, marriage seems to be a driving force towards self-immolation. In other studies conducted in Southern Iran (66.3%), Ilam (55.1%), and Zahedan (74.20%), most of the patients were married, which was similar to the present study (9, 14, 17). Other findings of this study include the low education of patients. There was no difference between gender and the level of education of patients, but most of them had non-university education (89.7%). Education significantly improves a person's mood and increases people's understanding of everyday life and social dynamics, allowing them to better express their dissatisfaction with any injustice. Consistent with our study, in Rezaie et al. investigation, patients who attempted suicide by self-immolation were less educated and married (19). In Baziar et al.'s study on self-immolation in Ilam, most of the cases were married and had non-university education (14). Married young people with lower levels of education appear to be the main victims of suicide through self-immolation. Therefore, considering the above data, we believe that family therapy and marriage counseling can play an important role in preventing self-immolation.

Other important issue studied in the current study was the cause of self-immolation, which family disputes (84%) was the most mentioned issue. According to Ahmadi et al.'s study, marital conflict and conflict with other family members are risk factors for self-immolation (20). In Mobayen et al.'s study, family disputes was the second main leading factor for self-immolation after mental disorder (8). Also, the study of patients' financial situation showed that 90.4% of patients are in poor financial condition. Reports indicate that a variety of factors motivate a person to self-immolate, including family problems, legal or professional issues, chronic illness, low socio-economic status, low level of education, poor financial

situation, limited access to health care, especially for psychological services, and lack of moral principles (7, 15, 21, 22).

This study showed that the use of fuels plays the largest role (94%) in patients' self-immolation. Research has shown that the most common substance used as a fire accelerator is kerosene or gasoline (15, 23). Studies with patients who have survived from self-immolation have shown that easy access to flammable liquids such as kerosene from heating devices is a key factor in their decision to choose the way of suicide. Although various factors play a role in this practice, it can be prevented to some extent by restricting people's easy access to flammable agents (21).

The prevalence of mental illness in people who committed suicide in the present study was 13.4%, which should be given more attention because with proper and timely treatment of these patients such types of accidents can be prevented. There was a history of drug abuse in 1.1% of patients of this study. Patterns of self-immolation among the American population also have shown that a percentage of victims are affected by drug abuse disorders and mental illness (24). In Ahmadi's et al. study, the major depression, history of suicide attempts, and drug abuse were significant predictors of self-immolation (25). Nine patients also had a previous history of suicide, which indicates a poor follow-up of these patients. In this regard, plans should be made to investigate people based on their risk of suicide, to take appropriate measures to prevent suicide. The mortality rate in this study was 51.1%. In other studies in Iran, the mortality rate was 81.4% in Ilam, 74% in northern Iran, 61.8% in Kermanshah, and 64% in South Khorasan (14, 15, 17, 23).

Conclusion

According to the results, self-immolation, especially in upper limbs, is prevalent in men. The most common cause of self-immolation was family disputes. Likewise, self-immolation mostly results in grade 3 burns in both genders. In the hospital, infection following burns is of great importance; thus,

the preventive measures of nosocomial infection need consideration. Due to the high prevalence of suicide by self-immolation among the Iranian population, it is essential to implement strategies and programs to prevent and reduce self-immolation rates. Further studies in this case, which assess risk factors and identify high-risk groups for more targeted approaches, are recommended.

Limitations

There were limitations in our research. This study was performed on hospitalized patients due to the unavailability of all records of self-immolation data in Shahid Motahari Hospital in Tehran. The second limitation was the inadequacy of psychological analysis on patients. It is suggested that these limitations to be removed in future research.

Acknowledgments

None declared.

Conflict of interest

The authors have no conflict of interest in this study.

Funding/support

None declared.

Data availability

The raw data supporting the conclusions of this article are available from the authors upon reasonable request.

References

1. Papadodima SA, Karakasi MV, Pavlidis P, Nastoulis E, Fragkou K, Dimitriou K, et al. Self-immolation Suicide in Greece: A Forensic Psychiatric Autopsy Study between 2011 and 2019. *J Forensic Sci.* 2020;65(5):1656-68.
2. Romm S, Combs H, Klein MB. Self-immolation: cause and culture. *J Burn Care Res.* 2008;29(6):988-93.
3. Saadati M, Azami-Aghdash S, Heydari M, Derakhshani N, Rezapour R. Self-immolation in Iran: Systematic

- Review and Meta-analysis. *Bull Emerg Trauma.* 2019;7(1):1-8.
4. Parvareh M, Hajizadeh M, Rezaei S, Nouri B, Moradi G, Nasab NE. Epidemiology and socio-demographic risk factors of self-immolation: A systematic review and meta-analysis. *Burns.* 2018;44(4):767-75.
 5. Soboslai J, Gruber J. The Bodhisattva, the Dharmarāja, and the Dalai Lamas: Evaluating the Religious and Political Causes of Tibetan Self-Immolation. *Journal of the American Academy of Religion.* 2018;86(3):759-88.
 6. Rezaeinasab Z, Sheikhi MT, Jamilei Kohaneh Shahri F. Self-immolation of women in Ilam city, Iran: a descriptive study. *Journal of School of Public Health and Institute of Public Health Research.* 2018;15(4):365-76.
 7. Ahmadi A. Suicide by self-immolation: comprehensive overview, experiences and suggestions. *J Burn Care Res.* 2007;28(1):30-41.
 8. Mobayen M, Baghi I, Homaei Rad E, Jafaraghaee F, Ashoobi MT. Epidemiological study of self-immolated patients referring to Velayat burn and reconstructive surgery center of Rasht. *Journal of Surgery and Trauma.* 2020;8(2):66-72.
 9. Mohammadi AA, Karoobi M, Erfani A, Shahriarirad R, Ranjbar K, Zardosht M, et al. Suicide by self-immolation in southern Iran: an epidemiological study. *BMC Public Health.* 2020;20(1):1646.
 10. Sukhai A, Harris C, Moorad RG, Dada MA. Suicide by self-immolation in Durban, South Africa: a five-year retrospective review. *Am J Forensic Med Pathol.* 2002;23(3):295-8.
 11. Cameron DR, Pegg SP, Muller M. Self-inflicted burns. *Burns.* 1997;23(6):519-21.
 12. Castellani G, Beghini D, Barisoni D, Marigo M. Suicide attempted by burning: a 10-year study of self-immolation deaths. *Burns.* 1995;21(8):607-9.
 13. Ahmadi A, Mohammadi R, Stavrinou D, Almasi A, Schwebel DC. Self-immolation in Iran. *J Burn Care Res.* 2008;29(3):451-60.
 14. Baziari J, Delpisheh A, Sayehmiri K, Esmailnasab N. Epidemiology of self-immolation in Ilam province in the years 2011 to 2015. *scientific journal of ilam university of medical sciences.* 2016;24(5):109-17.
 15. Ahmadi M, Ranjbaran H, Azadbakht M, Heidari Gorji M, Heidari Gorji A. A survey of characteristics of self-immolation in the northern Iran. *Ann Med Health Sci Res.* 2014;4(Suppl 3):S228-32.
 16. Dahmardehei M, Behmanesh Poor F, Mollashahi G, Moallemi S. Epidemiological Study of Self-Immolation at Khatamolanbia Hospital of Zahedan. *International Journal of High Risk Behaviors and Addiction.* 2014;3(1).
 17. Moradinazar M, Amini S, Baneshi M, Najafi F, Abbasi N, Ataee M. Survival probability in self-immolation attempters: a prospective observational cohort study. *Ulus Travma Acil Cerrahi Derg.* 2016;22(1):23-8.
 18. Azizpour Y, Sayehmiri K, Asadollahi K, Kaikhavani S, Bagheri M. Epidemiological study of suicide by physical methods between 1993 and 2013 in Ilam province, Iran. *BMC Psychiatry.* 2017;17(1):304.
 19. Rezaie L, Khazaie H, Soleimani A, Schwebel DC. Is self-immolation a distinct method for suicide? A comparison of Iranian patients attempting suicide by self-immolation and by poisoning. *Burns.* 2011;37(1):159-63.
 20. Ahmadi A, Mohammadi R, Schwebel DC, Yeganeh N, Soroush A, Bazargan-Hejazi S. Familial risk factors for self-immolation: a case-control study. *J Womens Health (Larchmt).* 2009;18(7):1025-31.
 21. Rezaie L, Hosseini SA, Rassafiani M, Najafi F, Shakeri J, Khankeh HR. Why self-immolation? A qualitative exploration of the motives for attempting suicide by self-immolation. *Burns.* 2014;40(2):319-27.
 22. Ghajari H, Noughjah S, Shahbazian H, Valizadeh R, Tahery N. Postpartum glucose testing, related factors and progression to abnormal glucose tolerance in a rural population with a known history of gestational diabetes. *Diabetes & metabolic syndrome.* 2017;11 Suppl 1:S455-s8.
 23. Mehrpour O, Javadinia SA, Malic C, Dastgiri S, Ahmadi A. A survey of characteristics of self-immolation in the east of Iran. *Acta Med Iran.* 2012;50(5):328-34.
 24. Thombs BD, Bresnick MG, Magyar-Russell G. Who attempts suicide by burning? An analysis of age patterns of mortality by self-inflicted burning in the United States. *Gen Hosp Psychiatry.* 2007;29(3):244-50.

25. Ahmadi A, Mohammadi R, Almasi A, Amini-Saman J, Sadeghi-Bazargani H, Bazargan-Hejazi S, et al. A case-control study of psychosocial risk and protective factors of self-immolation in Iran. *Burns*. 2015;41(2):386-93.