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ORIGINAL ARTICLE

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Epidemiology of work-related burn injuries: A ten-year retrospective study of 429 patients at a referral burn centre in the north of Iran

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Abstract

Work-related burns can have a destructive impact; however, knowledge of the epidemiology of work-related burn injuries in Iran is limited. This study aimed to describe epidemiological characteristics of work-related burn injuries in a burn centre in the north of Iran. This study was a retrospective single-centre study of the medical records of work-related burns between 2011 and 2020. Data collection was done using the hospital information system (HIS). The data were analysed by using descriptive statistical methods and SPSS 24.0 software. Of the 9220 cases treated in the burn centre, 429 (4.65%) had work-related burns. There was an increasing trend of work-related burns during the ten years. The mean age of patients was 37.53 (SD = 13.72). Most patients were male (n = 377, 87.9%), with a male-to-female ratio of 7.25/1. The mean total body surface area burn was 23.39% (SD = 20.03). Most work-related burns occurred in the summer season (46.9%, n = 201), and the upper limb was the most common anatomical site of burns (n = 123, 28.7%). The most common mechanism of injury was fire & flames (266, 62.0%). Inhalation injury was observed in 52 (12.1%) patients, and mechanical ventilation was undertaken in 71 (16.6%) patients. The mean length of stay in the hospital was 10.38 (SD = 10.37) days, and the overall mortality rate was 11.2%. The most common activities associated with burns at the time of the incidents were food preparation and serving related (108, 25.2%), followed by welders (n = 71, 16.6%) and electricians (n = 61, 14.2%). This research is the basis for evaluating work-related burns and identifying the causes of these injuries to develop education and prevention programmes, especially for young male workers.

KEYWORDS

burns, epidemiology, occupational injuries, retrospective studies

Key Messages

- in work-related burns, the upper limbs were the most commonly burned body area
- the work-related burns occurred most frequently in patients aged 25–44 years
- fire & flames were the most common cause of burns (266, 62.0%), followed by electrical (69, 16.1%)
- the mean length of stay in the hospital was 10.38 (SD = 10.37) days, and the overall mortality rate was 11.2%
- the most common activities associated with burns at the time of the incidents were food preparation and serving related (108, 25.2%), followed by welders (n = 71, 16.6%) and electricians (n = 61, 14.2%)

1 | INTRODUCTION

Burn injuries play a significant role in morbidity and mortality and have a considerable financial burden on hospital and rehabilitation expenditures.[1,2] Based on World Health Organisation (WHO) recent reports, more than 95% of thermal burns occur in developing countries.[3,4] Over 0.5 billion burn victims indicate for receiving medical care annually, and nearly 40 000 of those require hospital admission.[5] International Labour Organisation (ILO) has calculated that 153 people worldwide suffer injuries related to jobs every 15 s,[6] while one of the most devastating types of such injuries is burn injuries.[7]

There are several reasons for workplace burn injuries, including thermal, electrical, and ultraviolet sunlight exposure.[8] Furthermore, contact with chemical materials may increase burn risk among workers.[9] Comprehensive investigations have shown that thermal, chemical, and electrical burns account for the major proportion of hospitalised patients.[10,11] Failure of instruments, carelessness, dangerous behaviour, and shortage of protective equipment may lead to work-related burns.[11]

Patients suffer from a wide spectrum of physical, psychological, emotional, and financial complications because of the severity and grade of burn injuries. Emotional stress disorders or severe debilitating pain may remain long-term following third or fourth-degree burn injury, in which all layers of the skin are destroyed.[7,12-14] In severe burns, amputation is suggested to control infection as a common complication following burn injuries.[15] Also, returning to work could take weeks, months, or even years for burn victims. Those who return to work might also experience difficulties reintegrating into the workplace.[16] Despite survival and healing, post-traumatic stress disorders like unsociable personalities, avoidance behaviours, and hyperexcitability have been observed increasingly among post-burned patients.[17]

The prevalence and type of work-related burns (WRB) and their clinical characteristics are dissimilar in different societies and work environments. Various factors such as social, economic, cultural level, occupational settings, safety regulations, industry characteristics, and lifestyle affect it.[7,18] A previous study of WRB in burn centres in New Zealand and Australia over the period 2009–2016 reported that 1828 patients (17%) were admitted due to work-related burn injuries.[7] Another study in the United States revealed that 42% of work-related accidents were due to burns.[19] Etiologic findings have shown that fire/flame/smoke,[20] caustics, hot items, substances,[21] hot water/steam,[22] and flame/scalds[23] are the most common causes of occurred human burn events in the workspace. A study in West Virginia illustrated that the most common occupational groups with a higher risk for WRB injuries include welders, cooks, labourers, food-service workers, and mechanics.[24]

According to the literature, around 25% of all adult burn injury admissions are related to work.[19,25] Given the differences in employment environments, local industry characteristics, and safety regulations, it can be assumed that there are variations in WRB epidemiology between regions. Despite this, little data on the epidemiology of WRB injuries in Iran is available. This study aimed to investigate work-related burns' epidemiological and clinical characteristics in a tertiary care burn centre in north Iran to outline prevention strategies to optimise work safety regulations.

2 | MATERIALS AND METHODS

2.1 | Study design, setting, and population

A retrospective, single-centre study was performed on data adopted from medical records of admitted burned patients

who were referred to the emergency department of a tertiary burn centre in the north of Iran between 2011 and 2020. This centre is the only burn centre in the Guilan province, with 55 beds in the burn ward and ten beds in the burn ICU has approximately 700 admissions annually, covering all burn patients in the area. Ethical approval was achieved by the medical research ethics committee of Guilan University of Medical Sciences with the registration number (IR.GUMS.REC.1400.569). The cases of WRB patients were identified using the hospital information system (HIS) and using Activity Codes (while working for income) described in the International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD-10). If the data field "Activity when burn occurred" was documented as "working for income," the patient was considered as WRB injured individual.

Inclusion criteria for patients in this study included ages between 15 and 64 years and a hospitalisation period of more than 24 h. We excluded subjects with work-related burns who were referred to hospitals for outpatient care and readmission. Demographic and clinical characteristics were extracted, including gender, age, marital status, level of education, place of residence, the season of the event, the primary cause of burns, intention to burn, inhalation injury, burn degree, total body surface area (TBSA) of burning, involved body region, renal complications, compartment syndrome, amputation, mechanical ventilation, length of stay in the hospital, and in-hospital mortality rate.

2.2 | Statistical analysis

Statistics analysis was conducted using the SPSS software package (version 24.0, SPSS Inc., Chicago, IL, USA). There was no missing data. Parametric variables were presented by means and standard deviation (SD), while qualitative variables were presented by number and percentage.

3 | RESULTS

3.1 | Demographic characteristics

A total of 9220 patients were admitted to the burn centre from 2011 to 2020. Of 9220 burn patients hospitalised, 429 (4.65%) had work-related burn injuries. Figure 1 shows the frequency of work-related burn injuries each year. There was an increasing trend of work-related burns during the ten years. Table 1 displays demographic, clinical, and burn-related variables. Most patients were male (n = 377, 87.9%), with a male-to-female ratio of 7.25/1. The mean age of patients was 37.53 (SD = 13.72). The work-related burns occurred most frequently in patients aged 25–44 years (n = 278, 64.8%). Most patients lived in urban regions (n = 255, 59.4%).

3.2 | Burn characteristics and outcomes

Fire & flames were the most common mechanism of injury, accounting for 62% of the WRB. Upper limbs were the most common burned area among work-related burns (n = 123, 28.7%). The mean length of stay in the hospital and TBSA was 10.38 (SD = 10.37) days and 23.39% (SD = 20.03). (Table 1). More burns occurred in summer (46.9%) compared to other seasons (Figure 2). Table 2 shows different job titles among work-related

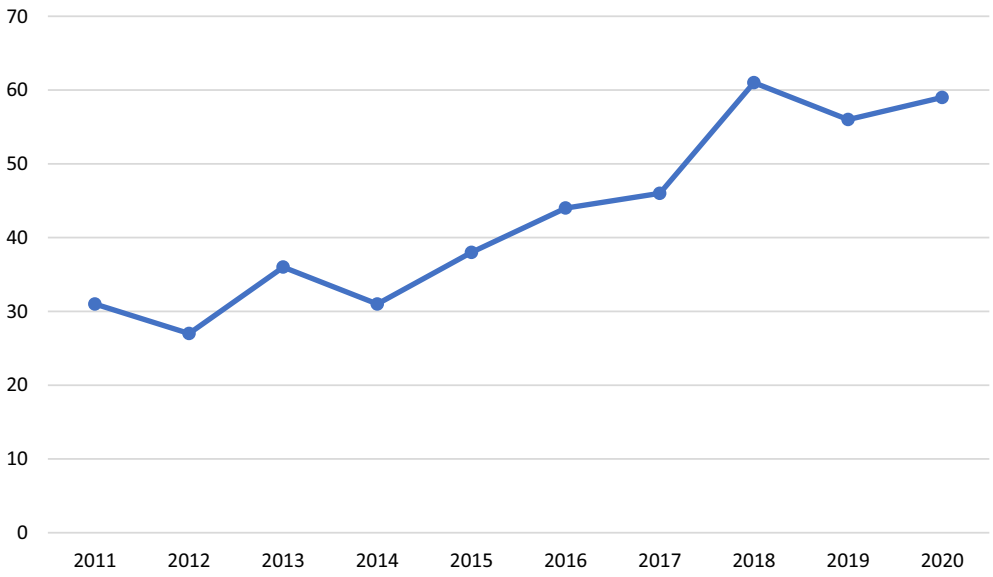

FIGURE 1 Percentage of work-related burn injuries from 2011 to 2020.

TABLE 1 Demographic and clinical information of work-related burns (n = 429).

Variables	N	%
Demographic features		
Age (y)	37.53 (SD = 13.72)	
15–24	54	12.6
25–34	159	37.1
35–44	119	27.7
45–54	63	14.7
55≥	34	7.9
Sex		
Male	377	87.9
Female	52	12.1
Marital status		
Single	131	30.5
Married	298	69.5
Place of Residence		
Urban	255	59.4
Rural	174	40.6
Clinical features		
Primary cause		
Fire & flames	266	62.0
Hot liquids & vapours	60	14.0
Chemical	18	4.2
Contact	16	3.7
Electrical	69	16.1
TBSA (%)	23.39 (SD = 20.03)	
<10	145	33.8
10–19	113	26.3
20–49	127	29.6
≥50	44	10.3
Inhalation injury	52	12.1
Burn degree		
2	145	33.8
3	41	9.6
4	37	8.6
2&3	206	48.0
The body region of burn		
Lower limb	90	21.0
Upper limb	123	28.7
Trunk	67	15.6
Head & Neck	83	19.3
Whole Body	66	15.4
Clinical outcomes		
Renal complications	6	1.4
Compartment Syndrome	3	0.7
Amputation	5	1.2
Mechanical ventilation	71	16.6
Length of stay in hospital (day)	10.38 (SD = 10.37)	
Mortality in-hospital	43	11.2

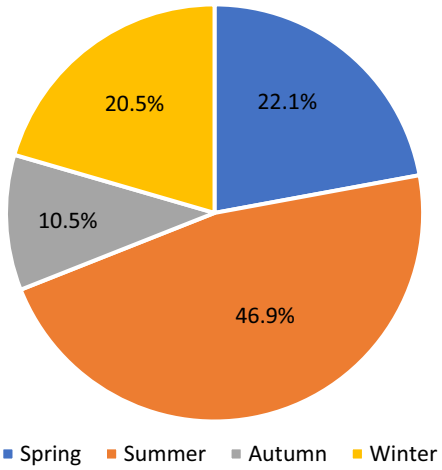

FIGURE 2 The seasonal distribution of work-related burn cases.

TABLE 2 The proportion of occupation groups among work-related burn patients.

Occupation group	N	(%)
Welder	71	16.6
Driver	11	2.6
Food-service workers	108	25.2
Electrician	61	14.2
Chemical manufacturer	32	7.5
Vehicle repairman	26	6.1
Construction worker	17	4.0
Farming occupations	41	9.6
Military specific occupations	4	0.9
Unspecified	58	13.5

burn patients. The most common activities associated with burns at the time of the incidents were food preparation and serving related (108, 25.2%), followed by welders (n = 71, 16.6%) and electricians (n = 61, 14.2%). Inhalation injury was diagnosed in 12.1% of patients, and mechanical ventilation was undertaken in 71 (16.6%) patients. Upper limbs were the most common burned area among work-related burns (n = 123, 28.7%).

4 | DISCUSSION

Among all burned patients admitted to our tertiary health care centre during the study period, 4.65% had a history of burning injury in their workplace, which was explicitly lower in prevalence than recent similar reports.[7,10,26] Data about the prevalence of occupational injuries caused by burn varies significantly from country to country due to differences in socio-economic status, development level, type of industries, lack of proper recording and reporting systems, and other related factors.[27] Also, the lower prevalence in the present study may be due to the underreporting of work-related burns by health providers. It is not uncommon for hospital data to underreport work-related burns; for example, burns sustained by self-employed persons, informal workers (e.g., housekeepers, undocumented immigrant workers), farm workers, and workers in small businesses may fail to report workplace-related injuries. In addition, the current study showed an increasing trend of work-related burns during the ten years. These findings indicate the poor penetration of awareness campaigns regarding preventing burns and first aid and the lack of workplace safety training programmes. In this regard, it is suggested that the Ministry of Health and responsible organisations implement targeted efforts to prevent injuries and Workplace safety training programs to reduce the rate of burn incidences.

In the current study, occupational burn injuries were higher in men than women. This result is consistent with the previous papers.[23,28,29] A possible explanation might be that direct employees in the factory industry are fewer females according to the regional culture. The current study has illustrated that ages 25 to 34 comprise the highest percentage of treated and work-related burns. These results are consistent with the previous studies.[7] Workplace safety training is crucial as it helps reduce workplace injuries, increases productivity, and creates a safer work environment. In this regard, some countries have implemented targeted efforts to prevent injuries among young workers, such as creating injury prevention guidance,[30] an interactive workplace safety curriculum,[31] and safety recommendations-focused electronic tools.[32]

The mortality rate in the present study was higher than in some studies.[10,26] This could be due to the high average percentage of body burns, which were often caused by flames, or the lack of awareness of proper first aid at the workplace. Consistent with the present study, Clouatre et al. reported that the upper limb was the most frequently burned body part.[26] A possible explanation might be that upper limbs are more prone to injury than other organs due to their proximity to machinery and equipment. Similar to other authors' findings,[7,33-36] we observed that fire & flames were the most common mechanism of injury. On the other hand, Hunt et al. and Munnoch et al. have indicated that chemicals and derivates followed by hot objects or substances were the most common source of burns.[21,23] A previous study of work-related burn cases treated in a burns centre in North Carolina,[21] reported that 11.9% of workplace burns were electrical in origin and a study of 330 work-related burn cases admitted to a specialist burn unit in Ontario, Canada, found that electrical burn was the mechanism underlying 27% of cases.[26] The difference can be explained by different industries in different areas and the factory's desired production line. In addition, the average length of stay in the present study was more than in the study conducted in North Carolina study.[10] The higher mean TBSA in the present study than in the North Carolina study may be responsible for these inconsistencies. Consistent with other studies, most patients who suffered work-related burns worked in "food preparation and serving related" occupations.[10,37] These workers are at risk because of coming into contact with fire & flames, and high-temperature liquids while cooking with hot oils and moving containers with hot water.

4.1 | Strengths and limitations

The study has several strengths. The data was extracted from the registry in the north of the country, with specific inclusion criteria, and classified based on standard coding for research. On the other hand, there were some limitations in this study. We did not have access to the people who suffered burns and went to the private centre for treatment. Also, many patients suffering from first-degree burns do not refer to the hospital, so this data must be interpreted cautiously.

4.2 | Implications for future study

It is recommended that future studies while addressing the epidemiology of work-related burns in a multicentre and with a larger population, consider variables affecting the epidemiology of work-related burns and different burn factors. Also, future research should assess the quality of life, post-traumatic stress disorder, and long-term functional outcomes among those with work-related burns.

5 | CONCLUSION

This research is the basis for evaluating work-related burns and identifying the causes of these injuries to

develop education and prevention programmes, especially for young workers. Preventative strategies are crucial in reducing the physical and psychological effects on workers, decreasing medical costs, and the loss of experienced workers. The Ministry of Health and responsible organisations should implement targeted strategies to prevent injuries and Workplace safety training programmes to reduce the rate of burn incidences. These strategies should emphasise food service, welding, and electrical occupations.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ETHICS STATEMENT

The present research was part of M.D. thesis, which was supported by the research deputy of the Guilan University of Medical Sciences. Also, this research was approved by the Ethics Committee of Guilan University of Medical Sciences (IR.GUMS.REC.1400.569). Patient informed consent was not acquired due to the use of previously gathered data from the hospital information system; nevertheless, the names of patients were not gathered from the database for ethical reasons.

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