Li *et al. Archives of Public Health* (2024) 82:132
https://doi.org/10.1186/s13690-024-01360-y

Archives of Public Health

RESEARCH Open Access

Epidemiological characteristics and outcomes of special-cause burns: analysis of 33,619 burn patients in a major regional burn center in China from 2004 to 2021

Ze Li[1†], Meijun Jiang[1†], Maomao Xi[1] and Weiguo Xie[1*]

Abstract

Special-cause burn injuries are usually more severe and difficult to manage, and often contribute to a high mortality in severely injured patients. The aim of this study was to present the epidemiological characteristics of special-cause burn in a major regional burn center in China between 2004 and 2021 and determine the risk factors associated with the mortality of burn patients. A total of 33,619 burn patients were included the study, among which 4,452 (13.2%) were special-cause burn patients. Compared to the thermal burn group, the special-cause burn patients were usually male, elder, married and III-IV degree of burn with onset of upper extremity in summer and autumn. Moreover, a greater proportion of patients in the special-cause burn group underwent surgical treatment and amputation and had a higher median hospital stay and treatment costs. During the multivariate logistic regression, older age, male, unmarried, winter, III-IV degree of burn, ≥ 3 burn sites, and larger total body surface area (TBSA) of burn were significantly associated with higher burn mortality (all $P<0.05$), however, patients with special-cause burn injuries have not increased odds for mortality ($P>0.05$). These results suggested that special cause-burn patients suffer more severe injuries, resulting in longer hospital stays and higher health care expenditures, but it did not significantly increase the mortality risk. Therefore, burn clinicians should not only have the responsibility to cure burns, but also need to know and popularize burn epidemiological characteristic and precaution.

Keywords Special-cause burn, Epidemiology, Mortality, Risk factors

[†]Ze Li and Meijun Jiang contributed equally to this work.

*Correspondence:
Weiguo Xie
Doc_Xie@163.com
[1]Institute of Burns, Tongren Hospital of Wuhan University & Wuhan Third Hospital, Wuhan, China

Text box 1. Contributions to the literature

- Evidence on the epidemiological characteristics of special-cause burns and risk factors of burn mortality is limited in previous public health literature.
- More severe injuries, longer hospital stays and higher health care expenditures caused by special-cause burns cannot be ignored. It effectively expands current knowledge of the special cause-burn impacts.
- These findings provide empirical support for burn management from developing countries.

Introduction

Burns are a global health problem and can cause high morbidity and mortality. Globally, burns cause approximately 200,000 deaths annually and are the fourth most common type of trauma in the world [1]. In low- and middle-income countries, the burden of burns is even greater [2]. Different burns can be associated with different physiological and pathophysiological responses, therefore, in order to develop effective prevention instruments, identification of epidemiology of target burn injuries is important.

A burn is tissue damage that can be caused by heat, electricity, chemicals, radiation or friction and seriously affect human psychology and physiology that impact quality of life [3]. The classification of burns usually depends on the depth of the injury, also known as the burn degree, thus they have been categorized into (I) superficial, (II) superficial partial-, (III) deep partial- and (III) full-thickness injuries [3, 4]. In addition, according to different causes of injury, burns could be divided into thermal burns and some other non-thermal burns, such as electrical burns, chemical burns, radiation burns, etc., which are defined as special-cause burns here [5, 6]. Although the majority of burn injuries are caused by heat from thermal burns, special-cause burn injuries are associated with higher mortality and worse local and systemic damage and treatment outcomes compared to the general burn population [3, 5]. Currently, there are only some sporadic reports on special-cause burns [7, 8], however, the epidemiological studies on special-cause burns with large samples are still lacking.

According to previous researches, burn resource allocation and surveillance, are the key first steps in injury prevention [9, 10]. Burn injuries without adequate information allocation and specific guidelines often result in significant prolonged physical and psychological distress and require long periods of hospitalization [11–13]. Although information on burn epidemiology is critical for resource allocation and prevention, the available data are mainly from high-income countries and are directly related to access to health-care resources, environmental differences and the resources across the various healthcare systems [14–16]. Moreover, it is worth noting that although burn injuries are decreasing in high-income countries, the incidence of burn injuries remains high elsewhere, with approximately 90% of burns occurring in low- and middle-income areas [17].

In this study, we aimed to present a retrospective investigation and analysis of the epidemiological data on burn patients specially special-cause burn at a regional burn center in China from 2004 to 2021. We hypothesized that special cause-burn patients suffer more severe injuries, and specifically provided relevant evidence for the prevention and outcomes of special-cause burns.

Materials and methods

Study design

A retrospective data analysis was performed on all hospitalized patients to the burn center at Tongren Hospital of Wuhan University (Wuhan Third Hospital). The burn center, including the burn ward and the burn intensive care unit (BICU) with 120 beds in total, is one of major specialized burn centers in central China, offering burn treatment service for all burned patients. The cause of burn injury was divided into special-cause and thermal burns. In the present study, injuries caused by electric burns, chemical burns, hot crush injury, firecracker burns, blast, radiation burns, and electrical and lightning, were considered special-cause burns, as defined previously [6]. Whereas, thermal burns included hydrothermal burns, flame burns, hot metal (solid or liquid) burns, or high-temperature gas burns.

Study population

This study included all the burn patients who were admitted to hospital for systematic treatment between January 1, 2004, and December 31, 2021 in our center. Patients diagnosed with burn including thermal burns and the above special-cause burns such as electrical burns, chemical burns, radiation injury, et al. were included. Patients suffering from scars after burning for plastic surgeries and other injuries not associated with burns as well as patients with incomplete data records were excluded from this study. This study was approved by the ethics committee of Tongren Hospital of Wuhan University & Wuhan Third Hospital (No. TR-2022042010). All methods and procedures were performed in accordance with the Declaration of Helsinki and Council for International Organizations of Medical Sciences (CIOMS) International Ethics Guidelines. In addition, all patients had a diagnosis of burn and treatment, according to the American Burn Association (ABA) criteria and Advanced Burn Life Support (ABLS).

Variables

The following factors were included as research variables: age at diagnosis, sex, marital status, cause of burn injury,

the season during diagnosis, percentage of total burn surface area (TBSA), degree of burn, burn site, surgical treatment and amputation, duration of hospital stay, total hospitalization cost, and treatment outcome. The treatment outcomes were defined as follows: cured, treatment abandoned, or death. Due to the fact that grade III and IV burns extend through the full dermis layer, while the grade I and II only involve superficial or deep partial-thickness injuries [3], in the present study we plan grade III and IV together and consider them as more severe burn degree.

Statistical analysis

In the descriptive analysis, normally distributed measurement data is expressed as mean ± standard deviation and compared by using Student's t-test, while non-normally distributed measurement data is expressed as the median and interquartile range (IQR) and compared using Wilcoxon rank-sum test. The classification variables are expressed as numbers (percentage) and analyzed using the chi-square method. Lastly, the risk factors for treatment outcomes (death and cure) were identified by logistic regression analysis and odds ratio (OR) with 95% confidence interval (CI) to express the magnitude of risk. All the *P*-values were bilateral, and a *P*-value of <0.05 was statistically significant. R statistical package (v. 4.2.0) was used for these evaluations.

Results

Baseline characteristics

A total of 33,619 burn patients, including 4,452 special-causes burn patients (13.3% of total burn patients), were included for analysis (Table 1). Overall, thermal burn injuries were determined to be the primary cause of burn injuries, accounting for 86.71% of all-cause burns (Fig. 1A). The hydrothermal burns were the main cause of thermal burns, accounting for 69.40% of thermal burns and 60.13% of all-cause burns (Supplementary Fig. 1A and Fig. 1A). In addition, in the special-cause burn group, electrical-related burns accounted for approximately 60.98%, which were the main cause of special-cause burns (Supplementary Fig. 1B), while only 8.10% of all-cause burns (Fig. 1A). Between 2004 and 2021, the absolute number of total burn patients admitted to the burn center showed an upward trend until 2019, but the number of total burn patients declined in 2020–2021

Table 1 Baseline characteristics

	All	Thermal burns	Special-cause burns	*P*
N (%)	33,619	29,167 (86.7%)	4,452 (13.3%)	
Age at diagnosis. Median (IQR)	23.0 (44.0)	17.0 (43.0)	38.0 (25.0)	< 0.001
Sex. N (%)				< 0.001
Female	11,994 (35.7%)	11,197 (38.4%)	797 (17.9%)	
Male	21,625 (64.3%)	17,970 (61.6%)	3,655 (82.1%)	
Marital status. N (%)				< 0.001
Unmarried	17,584 (52.3%)	16,420 (56.3%)	1,164 (26.1%)	
Married	15,494 (46.1%)	12,252 (42.0%)	3,242 (72.8%)	
Widowed	387 (1.15%)	367 (1.26%)	20 (0.45%)	
Divorced	154 (0.46%)	128 (0.44%)	26 (0.58%)	
Season at diagnosis. N (%)				< 0.001
Spring	8,483 (25.2%)	7,370 (25.3%)	1,113 (25.0%)	
Summer	8,894 (26.5%)	7,550 (25.9%)	1,344 (30.2%)	
Autumn	7,916 (23.5%)	6,758 (23.2%)	1,158 (26.0%)	
Winter	8,326 (24.8%)	7,489 (25.7%)	837 (18.8%)	
Depth of burn. N (%) *				< 0.001
I-II	8,926 (46.5%)	8,426 (49.8%)	500 (21.9%)	
III-IV	10,267 (53.5%)	8,487 (50.2%)	1,780 (78.1%)	
Site of burn. N (%) **				< 0.001
Upper limb alone	3,597 (22.1%)	2,249 (16.5%)	1,348 (50.8%)	
Lower limbs alone	5,295 (32.5%)	4,864 (35.6%)	431 (16.2%)	
Head/face/neck alone	735 (4.5%)	616 (4.5%)	119 (4.5%)	
Trunk/buttocks/perineum alone	547 (3.4%)	496 (3.6%)	51 (1.9%)	
Two sites of above	4,669 (28.6%)	4,185 (30.6%)	484 (18.2%)	
Three sites of above	1,179 (7.2%)	997 (7.3%)	182 (6.9%)	
Four sites of above	286 (1.8%)	248 (1.8%)	38 (1.4%)	

IQR: interquartile range

* 14,426 patients had missing information

** 17,311 patients had missing information

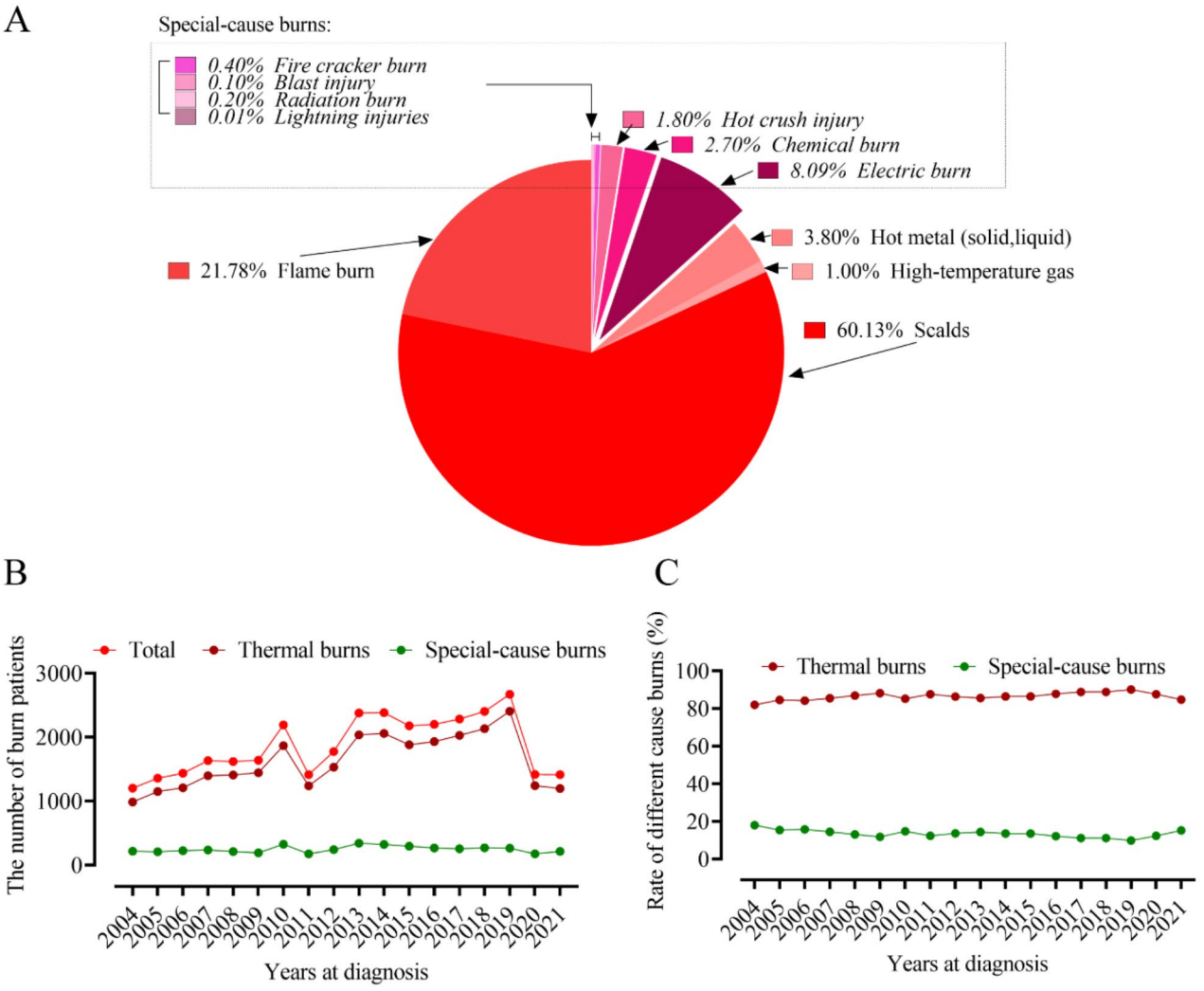

Fig. 1 The proportion of different causes of burns (**A**), the number of patients with different cause burns (**B**), and the annual rate of different cause burns (**C**)

(Fig. 1B). Nonetheless, it can be seen that the number and rate of special-cause burn patients admitted to the burn center remained generally stable during all 2004–2021 (Fig. 1B and C).

Of the 33,619 patients, the median age at diagnosis was 23 years, and the median age of the special-cause burn cohort at diagnosis was higher compared to the thermal burn cohort (38 vs. 17 years; $P<0.001$) (Table 1). Overall, 21,625 were male (64.3%) and 11,994 cases were female (35.7%), with a male to female ratio of 1.8:1. However, the proportion of male patients was more in the special-cause burns cohort than the thermal burns cohort (82.1% vs. 61.6%, $P<0.001$). In addition, compared to the thermal burn group, special-cause burn group was characterized by a greater proportion of married individuals (72.8% vs. 42.0%) with III-IV degree burns (78.1% vs. 50.2%) in the upper extremity (50.8% vs. 16.5%), with burn injuries occurring mostly during summer and autumn (30.2% vs. 25.9% and 26.0% vs. 23.2%) (all $P<0.001$) (Table 1).

In the thermal burn group, pediatric patients aged 0–10 were the primarily affected age group, accounting for 43.2%, followed by the 30-50-year-old population. However, people aged 41–50 were the main incidence group for the special-cause burn cohort, accounting for 23.1% of the special-cause burn cases, and the incidence rate gradually decreased since then (Fig. 2A). In addition, the population with ≤10% burn surface areas accounted for the vast majority in both the special-cause and thermal burns cohorts (all-cause burns: 56.9%, thermal burns: 54.9%, and special-cause burns: 71.3%) (Fig. 2B). Moreover, the 31-60-year-old patients with special-cause burns have larger burn surface area (all $P<0.05$) (Supplementary Table 1).

In the special-cause burn group, the patients with III-IV grade burn degree have larger burn surface area

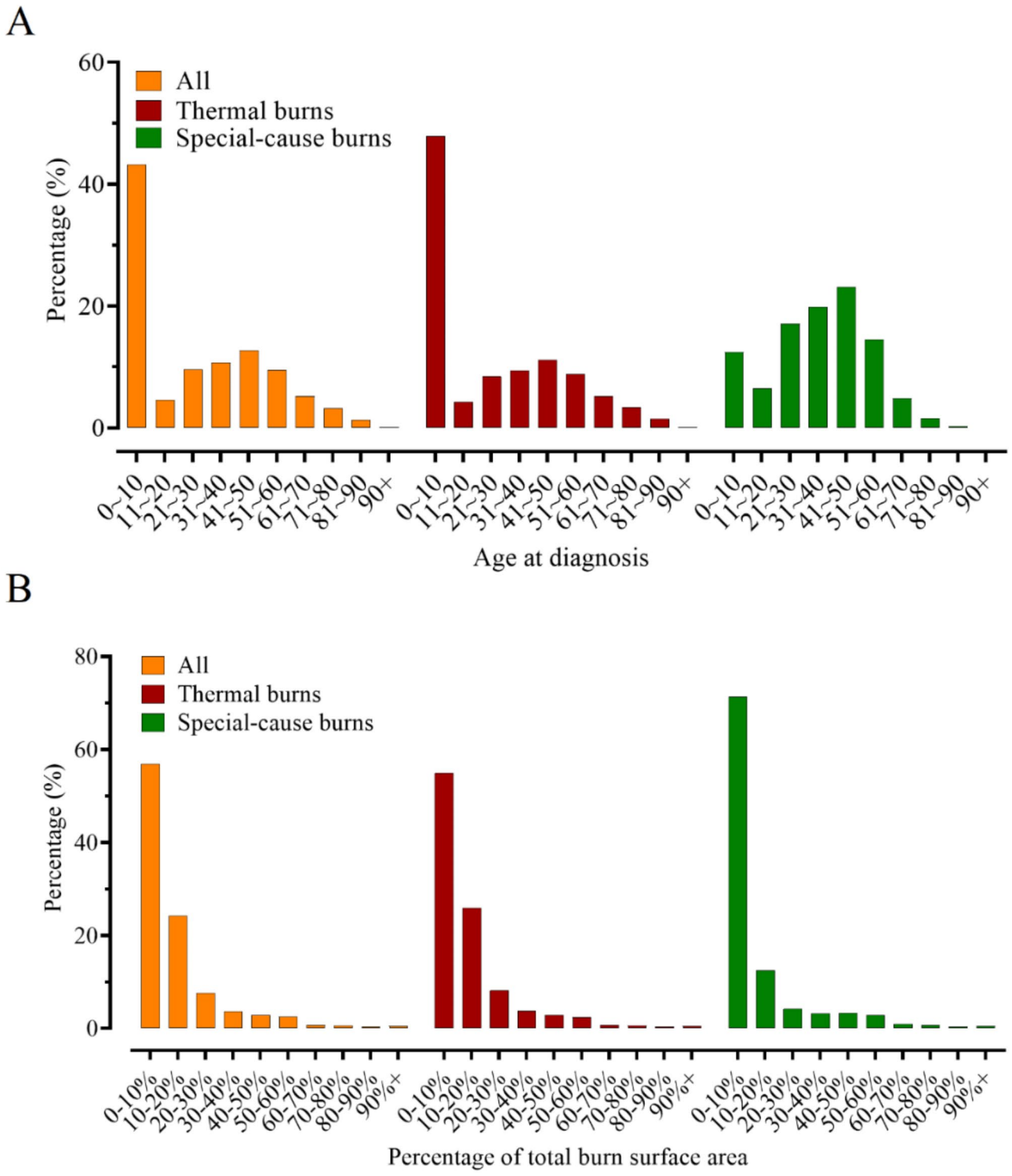

Fig. 2 The proportion of burn patients in different age groups (**A**) and with different burn surface areas (**B**)

(both $P<0.05$) (Supplementary Table 2). In the subgroup analysis, blast injuries in special-cause burns tend to have a large burn surface area (58.3% of the 50%+ burn area; Fig. 3A) and similarly burn degree (58.8% of grades; Fig. 3B). Besides, electrical and lightning injuries and hot crush injury in special cause burns had the largest III-IV grade burn degree proportion (99.5%; Fig. 3B) and surgical treatment proportion (78.8%; Fig. 4A), respectively.

Treatment and outcomes

We found that 67.6% of all burn patients were treated with non-surgical conservative treatments, while 32.4% of patients received surgical treatment (Table 2), and about 1.4% of all patients underwent amputation. In addition, we also found that the surgical (57.2 vs. 28.6%, $P<0.001$) and amputation (6.2 vs. 0.6%, $P<0.001$) rates were higher in the special-cause burn cohort compared to the thermal burn cohort. Moreover, the median duration of hospital stays (15 vs. 11 days, $P<0.001$) and the median cost of treatment (RMB 13,372 vs. 9665, $P<0.001$. The RMB, also known as the Chinese Yuan, is the official currency of the People's Republic of China) were higher for the special-cause burn group than for the thermal burn group. Notably, the proportion of blast injury patients in special cause burns was highest in amputation (19.2%), mortality (9.5%) and median total treatment costs (177,520 RMB) among all burns (Fig. 4B, C and D). With regard to mortality, the post-treatment mortality rate in the general population was 0.7%, with no statistical difference observed between the mortality rates of the two cohorts ($P=0.768$).

Through logistic regression analysis (Table 3), we found that burn patients belonging to the following variables: older (OR: 1.06, 95%CI: 1.05–1.07, $P<0.001$); male (OR: 1.75, 95% CI: 1.24–2.48, $P=0.002$); unmarried (OR: 0.33, 95%CI: 0.20–0.55, $P<0.001$); winter (OR: 1.66, 95%CI: 1.08–2.54, $P=0.02$); III-IV burn degree (OR: 4.24, 95%CI: 1.68–10.72, $P=0.002$); ≥3 burn sites (OR: 5.50, 95%CI: 2.49–12.13, $P<0.001$); and ≥10% TBSA (OR for 10–29%: 3.22, 95%CI: 1.67–6.20; OR for 30–49%: 13.21, 95%CI: 7.02–24.88; and OR for ≥50%: 63.33, 95%CI: 35.23-113.86; all $P<0.001$) were at an increased risk of mortality. However, special-cause burn was not a risk factor for increased mortality ($P=0.695$).

Discussion

Although the majority of burn injuries are caused by thermal burns, special-cause burn injuries are usually more severe and difficult to manage and often contribute to higher mortality [5, 18]. This population-based analysis characterizes the burden of major burn injury in a major regional burn center in central China, providing critical epidemiologic data for future resource planning and injury prevention efforts. We characterized the epidemiological characteristics of special-cause burn, and determined the risk factors associated with the mortality of burn patients. Overall, older age, male, unmarried, winter, III-IV degree of burn, ≥ 3 burn sites, and larger TBSA were significantly associated with higher burn mortality, and special cause-burn patients suffer more severe injuries, resulting in longer hospital stays and higher health care expenditures.

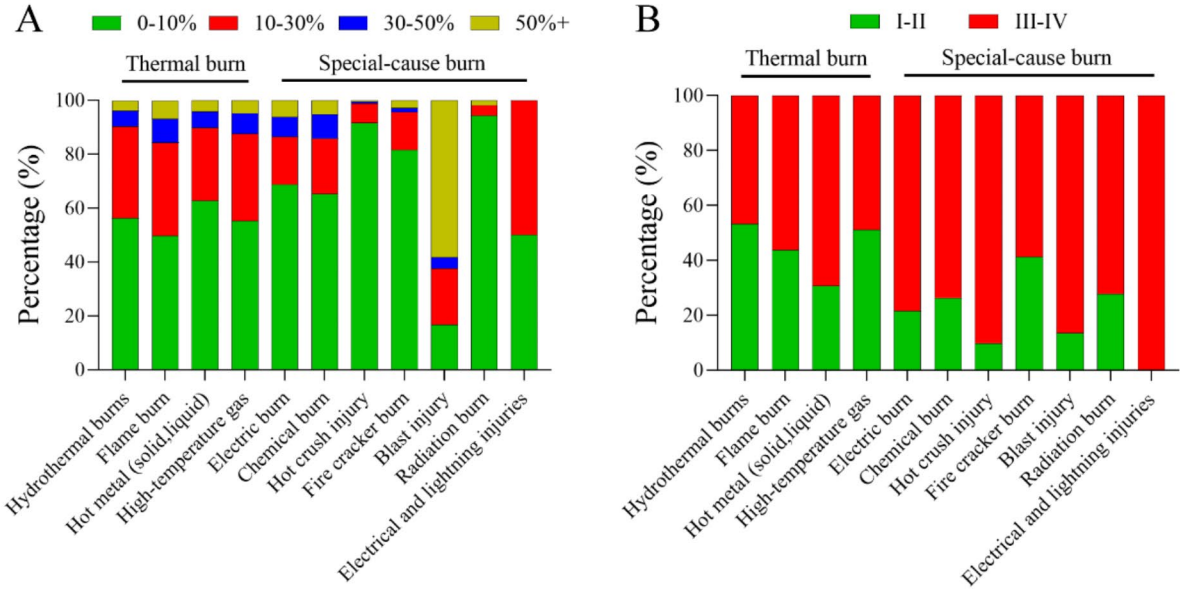

Fig. 3 The proportion of burn surface areas (**A**) and burn degree (**B**) caused by different burn causes

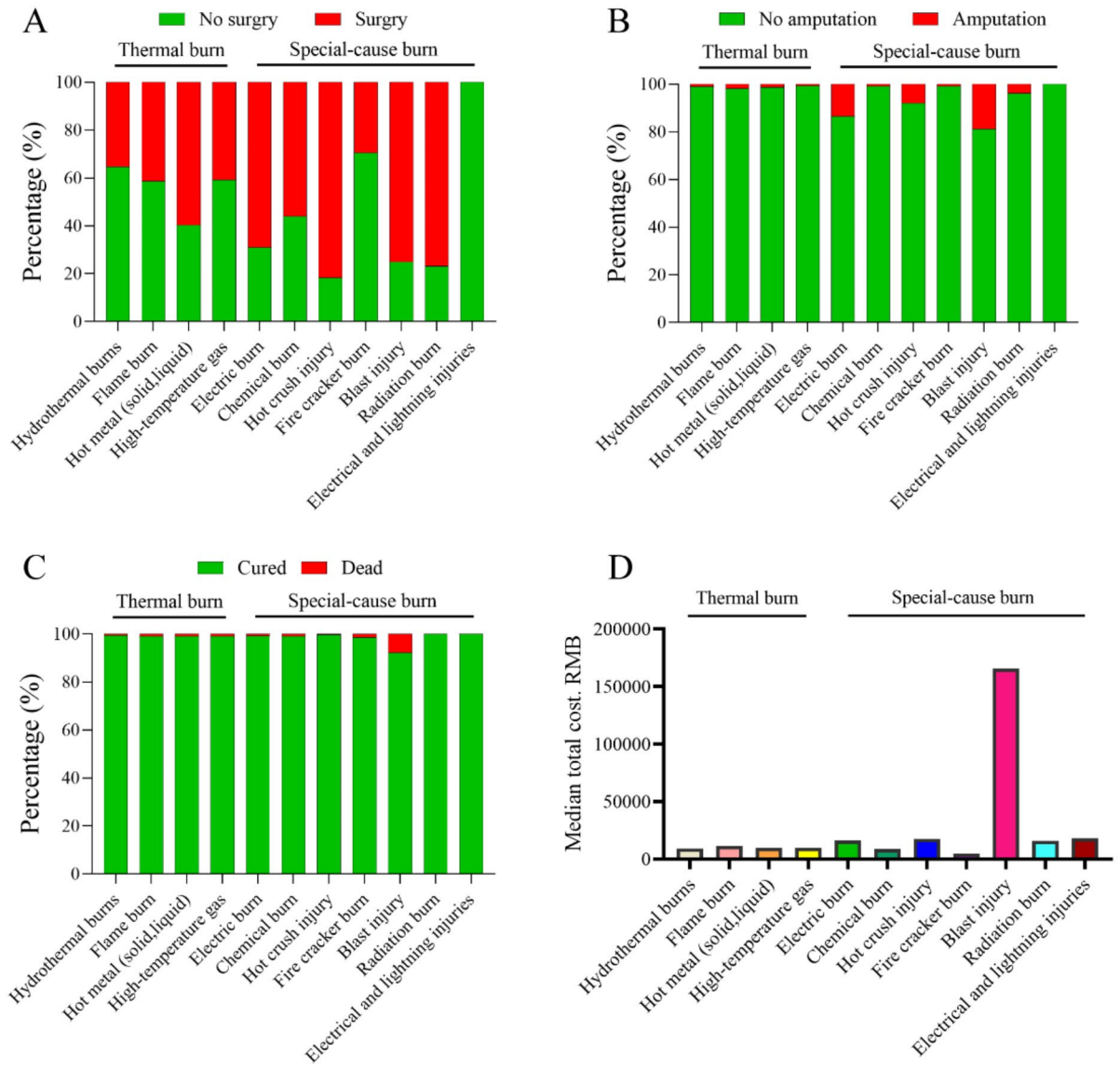

Fig. 4 Proportion of surgical treatment (**A**), amputation (**B**), cure rate (**C**) and median total cost (**D**) for different burn reasons

Table 2 Outcomes of patients

	All	Thermal burns	Special-cause burns	*P*
Surgical treatment. N (%)				< 0.001
No	22,718 (67.6%)	20,812 (71.4%)	1,906 (42.8%)	
Yes	10,901 (32.4%)	8,355 (28.6%)	2,546 (57.2%)	
Amputation performed. N (%)				< 0.001
No	33,156 (98.6%)	28,982 (99.4%)	4,174 (93.8%)	
Yes	463 (1.4%)	185 (0.6%)	278 (6.2%)	
Length of hospital stay. Median (IQR)	12.0 (14.0)	11.0 (12.0)	15.0 (23.0)	< 0.001
Total cost. Median (IQR)	10,009 (17,693)	9,665 (16,383)	13,372 (30,340)	< 0.001
Treatment outcomes. N (%) *				0.768
Cured	32,565 (99.3%)	28,238 (99.3%)	4,327 (99.2%)	
Dead	233 (0.7%)	200 (0.7%)	33 (0.8%)	

IQR: interquartile range

* 821 patients abandoned treatment

Table 3 Predictors of mortality

	Treatment outcomes			Predictors for dead vs. cured			
	Cured	Dead	Abandon treatment	Univariate		Multivariate	
N	32,565	233	821	**OR (95%CI)**	*P*	**OR (95%CI)**	*P*
Age at diagnosis. Median (IQR)	23.0 (44.0)	50.0 (27.0)	30.0 (52.0)	1.04 (1.03–1.04)	< 0.001	1.06 (1.05–1.07)	< 0.001
Sex. N (%)							
Female	11,647 (35.8%)	47 (20.2%)	300 (36.5%)	1 (reference)		1 (reference)	
Male	20,918 (64.2%)	186 (79.8%)	521 (63.5%)	2.20 (1.60–3.04)	< 0.001	1.75 (1.24–2.48)	0.002
Marital status. N (%)							
Unmarried	17,161 (52.7%)	41 (17.6%)	382 (46.5%)	1 (reference)		1 (reference)	
Married	14,912 (45.8%)	171 (73.4%)	411 (50.1%)	4.80 (3.41–6.75)	< 0.001	0.33 (0.20–0.55)	< 0.001
Widowed	355 (1.09%)	13 (5.58%)	19 (2.31%)	15.33 (8.14–28.85)	< 0.001	0.75 (0.30–1.86)	0.529
Divorced	137 (0.42%)	8 (3.43%)	9 (1.10%)	24.44 (11.25–53.10)	< 0.001	1.42 (0.56–3.60)	0.458
Season at diagnosis. N (%)							
Spring	8,226 (25.3%)	46 (19.7%)	211 (25.7%)	1 (reference)		1 (reference)	
Summer	8,626 (26.5%)	74 (31.8%)	194 (23.6%)	1.53 (1.06–2.22)	0.023	0.90 (0.60–1.33)	0.587
Fall	7,701 (23.6%)	59 (25.3%)	156 (19.0%)	1.37 (0.93–2.02)	0.111	1.02 (0.68–1.54)	0.913
Winter	8,012 (24.6%)	54 (23.2%)	260 (31.7%)	1.21 (0.81–1.79)	0.354	1.66 (1.08–2.54)	0.02
Etiologies of burn injury. N (%)							
Thermal burns	28,238 (86.7%)	200 (85.8%)	729 (88.8%)	1 (reference)			
Special-cause burns	4,327 (13.3%)	33 (14.2%)	92 (11.2%)	1.08 (0.74–1.56)	0.695		
Depth of burn. N (%) *							
I-II	8,806 (47.2%)	115 (28.3%)	5 (4.46%)	1 (reference)		1 (reference)	
III-IV	9,869 (52.8%)	291 (71.7%)	107 (95.5%)	19.09 (7.79–46.84)	< 0.001	4.24 (1.68–10.72)	0.002
Site. N (%) **							
One site	9,947 (62.6%)	11 (16.2%)	216 (60.3%)	1 (reference)		1 (reference)	
Two sites	4,556 (28.7%)	10 (14.7%)	103 (28.8%)	1.98 (0.84–4.68)	0.117	2.13 (0.83–5.47)	0.118
Three and more sites	1,379 (8.68%)	47 (69.1%)	39 (10.9%)	30.82 (15.95–59.56)	< 0.001	5.50 (2.49–12.13)	< 0.001
Percentage of total burn surface area. N (%) * **							
~ 10%	15,540 (57.6%)	15 (6.88%)	308 (45.7%)	1 (reference)		1 (reference)	
10–29%	8,668 (32.1%)	27 (12.4%)	168 (24.9%)	3.23 (1.72–6.07)	< 0.001	3.22 (1.67–6.20)	< 0.001
30–49%	1,679 (6.23%)	39 (17.9%)	98 (14.5%)	24.06 (13.24–43.74)	< 0.001	13.21 (7.02–24.88)	< 0.001
50%+	1,076 (3.99%)	137 (62.8%)	100 (14.8%)	131.91 (77.13-225.58)	< 0.001	63.33 (35.23-113.86)	< 0.001

IQR: interquartile range; OR: odds ratio; CI: confidence interval

* 14,426 patients had missing information

** 17,311 patients had missing information

*** 5,764 patients had missing information

Special-cause burns often occur in specific environments such as industrial production, disasters and accidents, wars, and terrorist attacks. Moreover, they are often mass injuries and attract high social attention. There were several groups of burn victims of industrial production or traffic accidents in this study, for instance, one such incident was caused by the explosion and combustion of yellow phosphorus during transportation, causing chemical burns to more than 80 onlookers, fire officers, and soldiers [4]. Notably, as a result of the COVID-19 pandemic and China government-imposed lockdown measures from 23/3/2020, which advised people to stay at home [19], reductions in outdoor activities and lifestyle changes contributed to a decrease in the incidence of burns. Our data confirm that the total number of patient visits for burns decreased in 2020 and 2021, and the number of visits for thermal burn patients decreased by nearly 50%, consistent with a prior study [19].

Our study shows that the burn patients were predominantly male, with burns occurring primarily in the upper limbs. Additionally, patients in the age groups 20–30, 30–40, and 40–50 years old are more afflicted than those of other age groups. The above characteristics reveal that special-cause burns are closely associated with occupation-upper limbs are more likely to be injured during work, men are more likely to engage in dangerous work than women, and people of working age have more

chances of injury. Since there is an increased incidence of construction and agricultural workload in Wuhan during summer and autumn, and the working hours are long and the work intensity is high during these seasons, most burns incidents analyzed in our study occurred during summer and autumn. However, the timing of burn injuries varies with season or month in different studies, which may be associated with the working environment and industries in those regions [20–23]. Mirmohammadi et al. investigated the epidemiology of work-related burns and found that 17.1% of people have occupational burns [21], consistent with our study in Wuhan and other studies conducted in other places [24–27].

Most burn patients had small burn surface areas, but special-cause burn patients had more severe burn degrees, which are difficult to treat. Most special-cause burn patients had ≤ 10% burn surface areas, and the proportion of patients with burn degrees was significantly higher in the special-cause burns cohort than in the thermal burn cohort, during the same period. This could be, in the special-cause burns cohort, the electrical burn was the most common cause (accounting for 63.93% of all special-cause burn patients), followed by chemical burns, thermal crush injuries, fireworks and firecrackers, and radiation burns. As industrialization progressed, the incidence of electrical burns increased substantially [28]. Electrical burns and hot crush injuries often cause destructive deep burns involving tendons, nerves, bones, and other important structures, with a high rate of amputation and disability [29–32]. Whereas, chemical burns not only cause large local damage, but are also often combined with poisoning, and sometimes even small chemical burns can be fatal [33, 34]. Furthermore, injuries from fireworks and firecrackers can occur not only in the production process but also during transportation and use, often causing extensive burns. Further, the setting off of fireworks and firecrackers often causes burns in important body parts, such as hands and eyes [35]. Radiation burns are more common after tumor radiation therapy, and the wounds caused by radiation are often difficult to heal, requiring prolonged treatment and hospitalisation [36, 37], which is consistent with our study results that special cause-burn patients suffer more severe injuries, resulting in longer hospital stays. Collectively, the common characteristics of these special-cause burns are relatively deep wound that are difficult to heal, the injuries that may require surgery, high amputation rate (specially fingers and toes), long duration of treatment, and the overall high treatment costs.

Special-cause burns accounted for 13.2% of all hospitalized burn patients from January 1, 2004, to December 31, 2021. The electrical burn was determined to be the primary cause of burns among these patients, accounting for 60.9% of all special-cause burns. This may be associated with the socio-economic development of one region [38, 39]. Socioeconomic risk factors are generally highly correlated and can therefore not be individual causal components [40]. With the economic development and increasing application of electrical and chemical products in production and everyday life, the incidence of special-cause burns has also increased. Although increasing attention has been paid to safety production and labor protection, the incidence of special-cause burns has not decreased significantly, and the harm and impact of special-cause burns related to industrial production, transportation, and disasters and accidents are still prevalent; indicating that more work is required for the prevention of special-cause burns. This issue also urgently requires the joint attention of the medical institutions, government, management, and society.

The limitation of this study is that the source of data is only the epidemiological investigation of inpatients in a single burn center. Nevertheless, since the relatively sample sizes in most single-center epidemiological studies on burns and the constraint on data consistency in multicenter research, many results in the previous reports were discrepant and the risk factors of burn injury were still not clear or specific [41]. As the only burn center in Wuhan populated over 11 million and the capital of Hubei province, our center receives patients from a vast surrounding region in central China and this extensive dataset spanning 18 years could provide a potentially accurate reflection of the special-cause burn situation. If a multicenter large-scale survey including outpatients could be conducted in conjunction with other units for future research, it would provide a relatively better and more comprehensive reference for the prevention and treatment of special-cause burns.

Conclusions

Our study summarizes the epidemiological characteristics and treatment outcomes of all burn patients. Thermal burns were determined to be the main cause of burns among burn patients. Although the proportion of special-cause burns was small, special-cause burn patients suffer more severe injuries, resulting in longer hospital stays and higher health care expenditures than thermal burn patients. However, special-cause burn did not significantly increase the mortality risk.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s13690-024-01360-y.

Supplementary Material 1

Acknowledgements
Not applicable.

Author contributions
All authors contributed to the study conception and design. Weiguo Xie conceived the research, Ze Li and Meijun Jiang analysed the data, prepared the figures and tables, and wrote the manuscript. All authors read and approved the final manuscript.

Funding
This study was supported by Scientific Research Project of Health Commission of Wuhan (WG19B02); Scientific Research Project of Wuhan Municipal Health and Family Planning Commission (WX17A03).

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
This study was performed in accordance with the Declaration of Helsinki. This study was approved by the ethics committee of Tongren Hospital of Wuhan University & Wuhan Third Hospital (No. TR-2022042010). A waiver of the informed consent requirement was approved by the Institutional Research Ethics Board due to the data in the survey were collected anonymously.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

Received: 24 April 2024 / Accepted: 11 August 2024
Published online: 23 August 2024

References

1. Greenhalgh DG. Management of Burns. N Engl J Med. 2019;380:2349–59. https://doi.org/10.1056/NEJMra1807442.
2. Modjarrad K, McGwin G Jr., Cross JM, Rue LW 3. The descriptive epidemiology of intentional burns in the United States: an analysis of the National burn Repository. Burns: J Int Soc Burn Injuries. 2007;33:828–32. https://doi.org/10.1016/j.burns.2006.11.006.
3. Jeschke MG, et al. Burn injury. Nat Rev Dis Primers. 2020;6:11. https://doi.org/10.1038/s41572-020-0145-5.
4. Weiguo X, Wenwei H, Songguo Y. & Rescue and treatment for the mass burn casualties of yellow phosphorus explosion. Chin J Burns, 36–8 (2008).
5. Hettiaratchy S, Dziewulski P. ABC of burns: pathophysiology and types of burns. BMJ. 2004;328:1427–9. https://doi.org/10.1136/bmj.328.7453.1427.
6. Weiguo X. Research into the prevention and treatment of burns due to specific causes should be highly strengthened. Chin J Burns, 404–7 (2012).
7. Zhu ZX, et al. Experience of 14 years of emergency reconstruction of electrical injuries. Burns: J Int Soc Burn Injuries. 2003;29:65–72. https://doi.org/10.1016/s0305-4179(02)00204-8.
8. Ye C, et al. Ten-year epidemiology of chemical burns in western Zhejiang Province, China. Burns: J Int Soc Burn Injuries. 2016;42:668–74. https://doi.org/10.1016/j.burns.2015.12.004.
9. Peck MD, et al. Burns and injuries from non-electric-appliance fires in low- and middle-income countries Part II. A strategy for intervention using the Haddon Matrix. Burns. 2008;34:312–9. https://doi.org/10.1016/j.burns.2007.08.009.
10. Atiyeh BS, Costagliola M, Hayek SN. Burn prevention mechanisms and outcomes: pitfalls, failures and successes. Burns. 2009;35:181–93. https://doi.org/10.1016/j.burns.2008.06.002.
11. Peck MD. Epidemiology of burns throughout the world. Part I: distribution and risk factors. Burns. 2011;37:1087–100. https://doi.org/10.1016/j.burns.2011.06.005.
12. Reimers A, Laflamme L. Neighbourhood social and socio-economic composition and injury risks. Acta Paediatr. 2005;94:1488–94. https://doi.org/10.1111/j.1651-2227.2005.tb01825.x.
13. Logsetty S, et al. Mental health outcomes of burn: a longitudinal population-based study of adults hospitalized for burns. Burns. 2016;42:738–44. https://doi.org/10.1016/j.burns.2016.03.006.
14. Rybarczyk MM, et al. A systematic review of burn injuries in low- and middle-income countries: Epidemiology in the WHO-defined African Region. Afr J Emerg Medicine: Revue africaine de la Med D'urgence. 2017;7:30–7. https://doi.org/10.1016/j.afjem.2017.01.006.
15. Stylianou N, Buchan I, Dunn K. W. A review of the international burn Injury Database (iBID) for England and Wales: descriptive analysis of burn injuries 2003–2011. BMJ open. 2015;5:e006184. https://doi.org/10.1136/bmjopen-2014-006184.
16. Sethi J, Gawaziuk JP, Cristall N, Logsetty S. The relationship between income and burn incidence in Winnipeg, Manitoba, Canada: a Population Health Study. J burn care Research: Official Publication Am Burn Association. 2018;39:645–51. https://doi.org/10.1093/jbcr/iry017.
17. Smolle C, et al. Recent trends in burn epidemiology worldwide: a systematic review. Burns: J Int Soc Burn Injuries. 2017;43:249–57. https://doi.org/10.1016/j.burns.2016.08.013.
18. Getzmann JM, et al. The impact of non-thermal injuries in combined burn trauma: a retrospective analysis over the past 35 years. J Plast Reconstr Aesthet Surg. 2019;72:438–46. https://doi.org/10.1016/j.bjps.2018.10.022.
19. Farroha A. Effects of COVID-19 pandemic on burns epidemiology. Burns: J Int Soc Burn Injuries. 2020;46:1466. https://doi.org/10.1016/j.burns.2020.05.022.
20. Rahmani A, et al. Descriptive study of Occupational accidents and their causes among Electricity Distribution Company Workers at an eight-year period in Iran. Saf Health work. 2013;4:160–5. https://doi.org/10.1016/j.shaw.2013.07.005.
21. Mirmohammadi SJ, Mehrparvar AH, Kazemeini K, Mostaghaci M. Epidemiologic characteristics of occupational burns in yazd, Iran. Int J Prev Med. 2013;4:723–7.
22. Sayhan MB, Sayhan ES, Yemenici S, Oguz S. Occupational injuries admitted to the emergency department. J Pak Med Assoc. 2013;63:179–84.
23. Horwitz IB, McCall BP. An analysis of occupational burn injuries in Rhode Island: workers' compensation claims, 1998 to 2002. J Burn Care Rehabil. 2005;26:505–14. https://doi.org/10.1097/01.bcr.0000185399.39280.bd.
24. Ozkan S, et al. Occupational injuries admitted to the Emergency Department. Ulusal Travma ve acil Cerrahi Dergisi = Turkish J Trauma Emerg Surgery: TJTES. 2010;16:241–7.
25. Ince H, Kandemir E, Ince N, Güloğlu R, Safran N. Burn and vital risk criteria in industrial accidents (as forensic medicine approach). Ulusal Travma ve acil Cerrahi Dergisi = Turkish J Trauma Emerg Surgery: TJTES. 2008;14:145–8.
26. Mian MA, et al. Workplace-related burns. Annals Burns fire Disasters. 2011;24:89–93.
27. Jackson LL. Non-fatal occupational injuries and illnesses treated in hospital emergency departments in the United States. *Injury prevention: journal of the International Society for Child and Adolescent Injury Prevention* 7 Suppl 1, i21-26 (2001). https://doi.org/10.1136/ip.7.suppl_1.i21
28. Ready FL, et al. Epidemiologic shifts for burn injury in Ethiopia from 2001 to 2016: implications for public health measures. Burns: J Int Soc Burn Injuries. 2018;44:1839–43. https://doi.org/10.1016/j.burns.2018.04.005.
29. Shih JG, Shahrokhi S, Jeschke MG. Review of Adult Electrical burn Injury outcomes Worldwide: an analysis of low-voltage vs High-Voltage Electrical Injury. J burn care Research: Official Publication Am Burn Association. 2017;38:e293–8. https://doi.org/10.1097/bcr.0000000000000373.
30. Dash S, Arumugam PK, Muthukumar V, Kumath M, Sharma S. Study of clinical pattern of limb loss in electrical burn injuries. Injury. 2021;52:1925–33. https://doi.org/10.1016/j.injury.2021.04.028.
31. Di Castri A, et al. The entity of thermal-crush-avulsion hand injury (hot-press roller burns) treated with fast acting debriding enzymes (nexobrid): literature review and report of first case. Annals Burns fire Disasters. 2018;31:31.
32. Tarim A, Ezer A. Electrical burn is still a major risk factor for amputations. Burns: J Int Soc Burn Injuries. 2013;39:354–7. https://doi.org/10.1016/j.burns.2012.06.012.
33. Nguyen ATM, Chamberlain K, Holland AJ. A. Paediatric chemical burns: a clinical review. Eur J Pediatrics. 2021;180:1359–69. https://doi.org/10.1007/s00431-020-03905-z.
34. Brosh K, Rozenman Y. Chemical burn-Induced Stromal demarcation line. Cornea. 2016;35:286–8. https://doi.org/10.1097/ico.0000000000000667.
35. Moore JX, McGwin G Jr., Griffin RL. The epidemiology of firework-related injuries in the United States: 2000–2010. Injury. 2014;45:1704–9. https://doi.org/10.1016/j.injury.2014.06.024.
36. Friedstat J, Brown DA, Levi B, Chemical. Electrical, and Radiation injuries. Clin Plast Surg. 2017;44:657–69. https://doi.org/10.1016/j.cps.2017.02.021.
37. Ruocco E, Di Maio R, Caccavale S, Siano M, Lo Schiavo A. Radiation dermatitis, burns, and recall phenomena: meaningful instances of

immunocompromised district. Clin Dermatol. 2014;32:660–9. https://doi.org/10.1016/j.clindermatol.2014.04.014.
38. Marsden NJ, et al. The impact of socio-economic deprivation on burn injury: a nine-year retrospective study of 6441 patients. Burns. 2016;42:446–52. https://doi.org/10.1016/j.burns.2015.08.019.
39. Rode H, Cox SG, Numanoglu A, Berg AM. Burn care in South Africa: a micro cosmos of Africa. Pediatr Surg Int. 2014;30:699–706. https://doi.org/10.1007/s00383-014-3519-5.
40. Stirbu I, Kunst AE, Bos V, van Beeck EF. Injury mortality among ethnic minority groups in the Netherlands. J Epidemiol Commun Health. 2006;60:249–55. https://doi.org/10.1136/jech.2005.037325.
41. Dissanaike S, Rahimi M. Epidemiology of burn injuries: highlighting cultural and socio-demographic aspects. Int Rev Psychiatry. 2009;21:505–11. https://doi.org/10.3109/09540260903340865.

Publisher's Note