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Epidemiology and mortality in patients hospitalized for burns in Catalonia, Spain

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Burn injuries are one of the leading causes of morbidity worldwide. Although the overall incidence of burns and burn-related mortality is declining, these factors have not been analysed in our population for 25 years. The aim of this study has been to determine whether the epidemiological profile of patients hospitalized for burns has changed over the past 25 years. We performed a retrospective cohort study of patients hospitalised between 1 January 2011 and 31 December 2018 with a primary diagnosis of burns. The incidence of burns in our setting was 3.68/10^5 population. Most patients admitted for burns were men (61%), aged between 35 and 45 years (16.8%), followed by children aged between 0 and 4 years (12.4%). Scalding was the most prevalent mechanism of injury, and the region most frequently affected was the hands. The mean burned total body surface (TBSA) area was 8.3%, and the proportion of severely burned patients was 9.7%. Obesity was the most prevalent comorbidity (39.5%). The median length of stay was 1.8 days. The most frequent in-hospital complications were sepsis (16.6%), acute kidney injury (7.9%), and cardiovascular complications (5.9%). Risk factors for mortality were advanced age, high abbreviated burn severity index score, smoke inhalation, existing cardiovascular disease full-thickness burn, and high percentage of burned TBSA. Overall mortality was 4.3%. Multi-organ failure was the most frequent cause of death, with an incidence of 49.5%. The population has aged over the 25 years since the previous study, and the number of comorbidities has increased. The incidence and severity of burns, and the percentage of burned TBSA have all decreased, with scalding being the most prevalent mechanism of injury. The clinical presentation and evolution of burns differs between children and adults. Risk factors for mortality were advanced age, smoke inhalation, existing cardiovascular disease, full-thickness burn, and high percentage of burned TBSA.

Abbreviations

TBSA	Total body surface area
LOS	Length of stay
AKI	Acute kidney injury
ABSI	Abbreviated Burn Severity Index
MOF	Multiple Organ Failure
HUVH	Hospital Universitario Vall d' Hebrón

Burns are a common problem in people of all age groups, from all walks of life, all over the world.

Nonfatal burns, the most prevalent type, are one of the leading causes of morbidity, including prolonged hospitalization, disfigurement, and disability.

Recent years have seen a significant decrease in both burn incidence and burn-related mortality, although figures continue to be very high. In 2017, burns accounted for 9 million injuries and 120,000 deaths worldwide[1].

In addition to the decrease in incidence and mortality, a systematic review published by Smolle[2] reported a downward trend in burn-related length of hospital stay (LOS) between 2001 and 2016. The length of stay/percentage of burned total body surface area (LOS/%TBSA) ratio has decreased from 1.5–3 days to 0.5–1.4 days[2–4].

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A multitude of epidemiological studies published in Europe over the past 10 years have reported a decrease in incidence, mortality, and severity of burns (a major burn is defined as > 20% TBSA[5]) and LOS[6–16]. However, few studies describe comorbidities in relation to burned patients and their effect on morbidity and mortality[17–20].

The last epidemiological study performed in Catalonia was published in 1999[21], and showed that comorbidity and female sex were not associated with higher mortality.

The healthcare system in Catalonia and in Spain is public system. The Hospital Universitario Vall d'Hebron (HUVH) is a tertiary hospital and there *is only this burn unit that receives patients not only from the local Barcelona area but also from other provinces*, with a catchment area of 9 million inhabitants. It is also one of the leading burn units in Spain. The Hospital has been awarded the CSUR certificate of clinical quality in Spain, is a member of the European network of burns disasters, and is certified by the EBA (European Burns Association).

The aim of this study has been to describe the epidemiological profile of the hospitalised burned patient, the complications occurring during their hospital stay, and the burn-related mortality rate, and to compare these variables with data published 25 years ago.

Material and method

Study design and patient selection.

The study was approved by the Hospital Universitario Vall d' Hebron ethics committee (PR[ATR]385/2016). The requirement for informed consent from the study subjects was waived by the IRB of Hospital Universitario Vall d' Hebron due to the retrospective study. The study follows the recommendations of the STROBE statement for reporting observational studies and all research was performed in accordance with the Declaration of Helsinki.

This is a retrospective cohort study of patients admitted to the HUVH from 1 January 2011 to 31 December 2018.

Inclusion criteria were: all patients admitted to the HUVH with a primary diagnosis of burns. The primary diagnosis was coded according to the criteria of the International Classification of Diseases (the ICD-9 was used from 2011 to 2016 and the ICD-10 from 2017 to 2018).

Patients diagnosed with burns who died within the first 12 h of admission were excluded.

Data were taken from the patient's digital clinical history and supplemented with data from their primary care records. The cost was calculated using data from the annual budget of the burn unit. Patients were monitored at 30 and 90 days after hospital discharge by the follow-up specialist.

Study variables were (see Appendix 1): Age, sex, burned TBSA, burn location, burn degree, mechanism of injury, work accident, Abbreviated Burn Score Index (ABSI), and smoke inhalation. Comorbidities were: toxic habits, cardiovascular or respiratory disease, diabetes mellitus, chronic kidney failure, liver disease, clotting disorder, use of antiplatelet agents or oral anticoagulants, chronic anaemia, neuromuscular disorders, active neoplasia, and obesity. Variables collected during hospitalisation were: LOS, ICULOS, surgical intervention and reintervention. Complications during admission included compartment syndrome, cardiovascular complications, acute respiratory distress syndrome, need for tracheostomy and time from admission to tracheostomy, days on mechanical ventilation, acute kidney injury (AKI), stroke, and sepsis. Outcomes variables were: In-hospital mortality 12 h after admission, cause of death, and 30- and 90-day mortality.

Smoke inhalation was defined either by clinical suspicion or diagnosed through fibro-bronchoscopy. MOF (Multiple Organs Failure) was defined as the failure of two or more of the following organs or systems: cardiovascular, respiratory, neurological, renal, hematological, gastrointestinal, hepatic, and neurological. We followed the recommendations of the ABA (American Burn Association) for definition of sepsis[22]. AKI (Acute Kidney Injury) diagnosis was based on the RIFLE clinical criteria[23].The diagnosis of ARDS (Acute Respiratory Distress Syndrome) adhered to the diagnostic criteria outlined in the Berlin definition[24].

Data were extracted from the Redcap project database (Tennessee, USA).

Statistical analysis.

The Redcap project (https://www.project-redcap.org/) database was used for this study. Statistical analysis was performed on R (version 4.1.1, R Core Team, Vienna, Austria) by the Statistics and Bioinformatics Unit (UEB) of the Vall d'Hebrón Hospital Research Institute.

For categorical variables, the frequency and 95% confidence interval were calculated. For continuous variables, the mean and standard deviation were calculated together with the mean 95% confidence interval and the median and interquartile range (IQR).

A group comparison test was performed to compare the different categories of the variable of interest. The Kruskall–Wallis test was used for quantitative variables. The chi-square test or Fisher's exact test was used for categorical variables when the expected count was less than 5. Kaplan–Meier curves were used to analyse the factors associated with an increase in mortality. A univariate Cox regression model was fitted to quantitative variables. The Hazard Ratio was calculated with a 95% confidence interval. Variables were selected attending at clinical reasons from those related at the univariate analysis in order to avoid overfitting". For variable selection in automatic model, Lasso technique has been used. This technique penalized the función of maximization of the coeficients. This penalization is lead by a lamda parameter that is maximized to obtain the optimal value and select all the variables over the lambda value.

Ethics approval and consent to participate.

This study was approved by the HUVH ethics committee (PR(ATR)385/2016). The recommendations of the STROBE statement for reporting observational studies were followed.

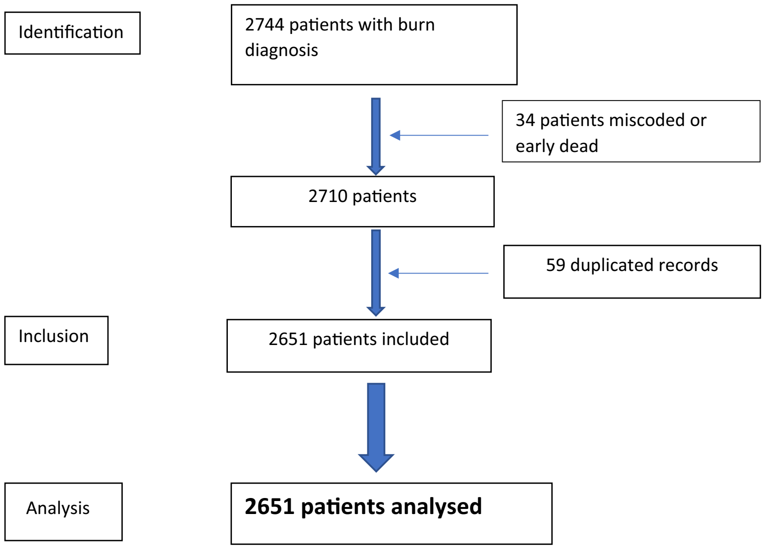

Figure 1. Study flow chart.

Results

A total of 2744 patients were included in the study (Fig. 1). Of these, 34 were misdiagnosed or patients died within 12 h of admission, and therefore eliminated. Two separate admissions (discharged and re-admitted for surgery or burn-related complications) were recorded for 59 patients. These double admissions with their corresponding hospital stays were merged into a single variable. The date of the first admission was taken as the date of admission to simplify the calculation of other time-related variables, such as the time from admission to various procedures.

Demographics. The incidence of hospital admission was 3.68/100,000 inhabitants (Table 1). Of the 2651 study patients, 2169 were adults (81.8%) and 482 were aged under 16 years (children). Male patients accounted for 61.9% of admissions. Mean age was 41.4 ± 24.7 years. The most numerous age group was 35–45 years in adults (16.8%) and 0–4 years (12.4%) in children.

Burn characteristics. The mean burned TBSA was 8.3% (Table 1) full-thickness burns were diagnosed in 23.4% of adults and 7.3% of children. In 75.1% of patients, less than 10% of TBSA was affected. In 9.7% of patients, > 20% of TBSA was affected; in adults, this incidence (10.6%) was double that of children ($p < 0.001$). In all age group, burns in the arms (64.8%) were most frequent, followed by the legs (51.8%), and the head and neck (35.3%).

Scalding (37.7%) was the most prevalent mechanism of injury overall; however, after adjusting for age and sex, the most prevalent mechanism of injury in adult males was flame (39%), and scalding in adult females and in children (45.9% and76.6%, respectively); 14.1% of burns occurred in the workplace. Summer was the season with the highest number of admissions (28%).

Comorbidities. In adults, 31.5% of patients were smokers and 8.4% reported alcohol dependence. Obesity was the most prevalent comorbidity (39.5%), along with cardiovascular disease (29.9%) and dyslipidaemia (21.1%). In children, respiratory disease (asthma) was the most prevalent comorbidity (7.3%) (Table 2).

Treatment. Table 3 summarizes the treatments administered. Over half (63.8%) of the sample underwent surgery; the difference between children (41.4%) and adults (68.9%) was statistically significant ($p < 0.001$). Of the surgical patients, 19.5% required a median of 1 (IQR 1.2) reintervention. Median time from the burn event to surgery was 16 [IQR 12–21.8] days in children and 14 [IQR 9–20] days in adults ($p < 0.001$). In contrast, Table 4 shows that the median waiting time for surgery is 10 days [IQR 7–15] days, compared to patients with minor burns, with a median of 15 days ($p < 0.001$).

Complications/Outcomes. Some (13%) patients required admission to the ICU; this percentage was significantly higher in children (25.9%) than in adults (10.7%) ($p < 0.001$), although children remained in the unit for a median of 1 (IQR 1.4) day and adults for a median of 13 [IQR 3.30] days (Table 5).

Mechanical ventilation was required in 3.9% of children and 9.4% of adults ($p < 0.001$). Median time on mechanical ventilation was significantly lower in children (6 days [IQR 3.15.5]) compared to adults (10 days [IQR 2.25]).

In adults, the most prevalent complications during hospital stay were sepsis (16.6%), AKI (7.9%), and cardiovascular complications (5.9%). Among children, the most frequent complication was sepsis (14.9%). The

		< 16 year	> 16 year	ALL	*p* value	n	Missing
Demographic variables							
		482 (18.18%)	2169 (81.82%)	**2651 (100%)**		2651	0
Age$_2$		482 4.1 (4.2) CI (3.8; 4.5) 2.2 (1.3, 5.4)	2169 49.7 (19) CI(48.9; 50.5) 47.4 (34.9, 63.1)	**2651** **41.4 (24.7)** **CI (40.5; 42.4)** **41.5 (24.6,59)**	< 0.001	2651	0
Sex$_1$	Men	291 (60.4%) CI (55.9; 64.8)	1343 (61.9%) CI) 59.8; 64)	**1634 (61.6%)** **(59.8; 63.5)**	0.563^3	2651	0
	Women	191 (39.6%) CI (35.2; 44.1)	826 (38.1%) CI (36; 40.2)	**1017 (38.4%)** **(36.5; 40.2)**			
Burn-related variables							
Mechanism$_1$	Flame	52 (10.8%) (8.2; 13.9)	880 (40.6%) (38.5; 42.7)	**932 (35.2%)** **(33.3; 37)**	< 0.001	2651	0
	Scalding	369 (76.6%) (72.5; 80.3)	630 (29%) (27.1; 31)	**999 (37.7%)** **(35.8; 39.6)**			
	Explosion	5 (1%) (0.3; 2.4)	150 (6.9%) (5.9; 8.1)	**155 (5.8%)** **(5; 6.8)**			
	Electrocution	23 (4.8%) (3; 7.1)	151 (7%) (5.9; 8.1)	**174 (6.6%)** **(5.7; 7.6)**			
	Contact	25 (5.2%) (3.4; 7.6)	146 (6.7%) \ (5.7; 7.9)	**171 (6.5%)** **(5.5; 7.5)**			
	Chemicals	3 (0.6%) (0.1; 1.8)	166 (7.7%) (6.6; 8.9)	**169 (6.4%)** **(5.5; 7.4)**			
	Unknown	2 (0.4%) (0.1; 1.5)	17 (0.8%) (0.5; 1.3)	**19 (0.7%)** **(0.4; 1.1)**			
	Other	3 (0.6%) (0.1; 1.8)	29 (1.3%) (0.9; 1.9)	**32 (1.2%)** **(0.8; 1.7)**			
Location$_1$						2651	0
	Head and neck$_1$	204 (42.3%) (37.9; 46.9)	732 (33.7%) (31.8; 35.8)	**936 (35.3%)** **(33.5; 37.2)**	< 0.001		
	Arms$_1$	297 (61.6%) (57.1; 66)	1421 (65.5%) (63.5; 67.5)	**1718 (64.8%)** **(63; 66.6)**	0.117		
	Chest	187 (38.8%) (34.4; 43.3)	485 (22.4%) (20.6; 24.2)	**672 (25.3%)** **(23.7; 27.1)**	< 0.001		
	Abdomen	71 (14.7%) (11.7; 18.2)	373 (17.2%) (15.6; 18.9)	**444 (16.7%)** **(15.3; 18.2)**	0.213		
	Back	62 (12.9%) (10; 16.2)	274 (12.6%) (11.3; 14.1)	**336 (12.7%)** **(11.4; 14)**	0.951		
	Legs	187 (38.8%) (34.4; 43.3)	1187 (54.7%) (52.6; 56.8)	**1374 (51.8%)** **(49.9; 53.7)**	< 0.001		
	Genitals$_1$	29 (6%) (4.1; 8.5)	77 (3.6%) (2.8; 4.4)	**106 (4%)** **(3.3; 4.8)**	0.018		
Burn-related variables							
Season	Winter	123 (25.5%) CI (21.7; 29.7)	503 (23.2%) CI (21.4; 25)	**626 (23.6%)** **(22; 25.3)**	0.379^3	2651	0
	Spring	132 (27.4%) CI (23.5; 31.6)	561 (25.9%) CI (24; 27.8)	**693 (26.1%)** **(24.5; 27.9)**			
	Summer	132 (27.4%) CI (23.5; 31.6)	609 (28.1%) CI (26.2; 30)	**741 (28%)** **(26.2; 29.7)**			
	Autumn	95 (19.7%) CI (16.2; 23.5)	496 (22.9%) CI (21.1; 24.7)	**591 (22.3%)** **(20.7; 23.9)**			
Transfer from another centre$_1$	Yes	265 (55.2%) (50.6; 59.7)	950 (43.9%) (41.8; 46)	**1215 (46%)** **(44; 47.9)**	< 0.001	2644	7
Delay$_1$	< 6 h	336 (70.7%) (66.4; 74.8)	1149 (54.1%) (51.9; 56.2)	**1485 (57.1%)** **(55.2; 59.1)**	< 0.001	2599	52
	6 h to 12 h	37 (7.8%) (5.5; 10.6)	186 (8.8%) (7.6; 10)	**223 (8.6%)** **(7.5; 9.7)**			
	12 h to 24 h	15 (3.2%) (1.8; 5.2)	95 (4.5%) (3.6; 5.4)	**110 (4.2%)** **(3.5; 5.1)**			
	> 24 h	87 (18.3%) (14.9; 22.1)	694 (32.7%) (30.7; 34.7)	**781 (30.1%)** **(28.3; 31.9)**			
Work-related burn$_1$	Yes	0 (0%) (0; 1.5)	**286 (14.1%)** **(12.6; 15.7)**	**286 (12.5%)** **(11.2; 14)**	< 0.001	2651	0
%TBSA$_2$		6.9 (7.4) (6.2; 7.6) 5 (2.5, 8.4)	8.6 (12.8) (8; 9.1) 4.5 (1.5, 10)	**8.3 (12.1)** **(7.8; 8.7)** **5 (2, 9.5)**	0.128	2651	0
Continued							

		< 16 year	> 16 year	ALL	*p* value	n	Missing
TBSA$_1$	0–10%	372 (77.2%) (73.2; 80.9)	1620 (74.7%) (72.8; 76.5)	**1992 (75.1%) (73.5; 76.8)**	< 0.001	2651	0
	> 20%	26 (5.4%) CI (3.6; 7.8)	230 (10.6%) CI (9.3; 12)	**256 (9.7%) (8.6; 10.8)**	< 0.001	2651	0
Smoke inhalation$_1$	Yes	4 (0.8%) (0.2; 2.2)	139 (6.5%) (5.5; 7.6)	**143 (5.5%) (4.6; 6.4)**	< 0.001	2610	41
Full-thickness burn$_1$	Yes	35 (7.3%) CI (5.1; 10)	507 (23.4%) CI (21.6; 25.2)	**542 (20.4%) (18.9; 22)**	< 0.001	2651	0
ABSI$_2$		2.8 (1) (2.7; 2.9) 3 (2, 3)	5 (1.9) (5; 5.1) 5 (4, 6)	**4.6 (1.9) (4.6; 4.7) 4 (3.6)**	< 0.001	2648	3

Table 1. Demographic and burn-related variables. 1: n(%)(Exact CI) *p* value: [4]Chi-2: N mean(sd)(mean 95% CI)median(IQR) *p* value: [3]Chi-squared. Significant values are in bold.

Comorbidities	< 16 year	> 16 year	ALL	n	Missing
Cardiovascular$_1$	4 (0.8%) CI (0.2; 2.1)	649 (29.9%) CI (28; 31.9)	**653 (24.7%) (23; 26.3)**	2649	2
Respiratory$_1$	35 (7.3%) CI (5.1; 10)	260 (12%) CI (10.7; 13.5)	**295 (11.2%) (10; 12.4)**	2644	2
Diabetes mellitus$_1$	2 (0.4%) CI (0.1; 1.5)	260 (12%) CI (10.7; 13.4)	**262 (9.9%) (8.8; 11.1)**	2649	2
Chronic kidney injury$_1$	0 (0%) CI (0; 0.8)	85 (3.9%) CI (3.1; 4.8)	**85 (3.2%) (2.6; 4)**	2649	2
Liver disease$_1$	0 (0%) CI (0; 0.8)	57 (2.6%) CI (2; 3.4)	**57 (2.2%) (1.6; 2.8)**	2649	2
Clotting disorders/OAC's/APT$_1$	1 (0.2%) CI (0; 1.2)	204 (9.4%) CI (8.2; 10.7)	**205 (7.7%) (6.7; 8.8)**	2649	2
Active neoplasm$_1$	0 (0%) CI (0; 0.8)	42 (1.9%) CI (1.4; 2.6)	**42 (1.6%) (1.1; 2.1)**	2649	2
Neuromuscular disorders$_1$	7 (1.5%) CI (0.6; 3)	58 (2.7%) CI (2; 3.4)	**65 (2.5%) (1.9; 3.1)**	2649	2
Obesity$_1$	10 (3.9%) CI (1.9; 7.1)	617 (39.5%) CI (37.1; 42)	**627 (34.5%) (32.3; 36.8)**	1816	835
Chronic anaemia$_1$	1 (0.2%) CI (0; 1.2)	77 (3.6%) CI (2.8; 4.4)	**78 (2.9%) (2.3; 3.7)**	2649	2
Dyslipidaemia$_1$	1 (0.2%) CI (0; 1.2)	456 (21.1%) CI (19.4; 22.8)	**457 (17.3%) (15.8; 18.8)**	2647	4
Toxic habits					
Smoking$_1$	1 (0.2%) CI (0; 1.2)	684 (31.5%) CI (29.6; 33.5)	**685 (25.8%) (24.2; 27.6**	2651	0
Cannabis$_1$	0 (0%) CI (0; 0.8)	95 (4.4%) CI (3.6; 5.3)	**95 (3.6%) (2.9; 4.4)**	2651	0
Enolism$_1$	1 (0.2%) CI (0; 1.2) 184	183 (8.4%) CI (7.3; 9.7)	**184 (6.9%) (6; 8)**	2651	0
Cocaine$_1$	0 (0%) CI (0; 0.8)	59 (2.7%) CI (2.1; 3.5)	**59 (2.2%) (1.7; 2.9)**	2651	0
Other	0 (0%) CI (0; 0.8)	34 (1.6%) CI (1.1; 2.2)	**34 (1.3%) (0.9; 1.8)**	2651	0

Table 2. Comorbidities. 1: n(%)(Exact CI) *p* value: [4]Chi-2: N mean(sd) (mean 95% CI)median(IQR) *p* value: Mann–Whitney U. *OAC's* Oral anticoagulants, *APT* Antiplatelet therapy. Significant values are in bold.

most frequent foci of infection in our sample were burns (50.7%), following by respiratory (35.2%), and urine (27.9%) infections.

Blood transfusion was required in 13.7% of patients; the rate of transfusion was significantly higher in adults vs. children ($p < 0.001$).

Overall mortality in the study period was 3.5%; the age-adjusted the mortality rate in children was 0% vs. 4.3% in adults. Table 6 describes the clinical differences between survivors and deceased.

The most frequent cause of death was multiple organ failure (MOF) (49.5%); 9.5% of deaths were due to sepsis. Mortality at 30 and 90 days was 2% in the group of adults, while no children died during post-discharge follow-up. At 30 days, 148 patients had been lost to follow-up, and 235 at 90 days. The mean age of patients who died was 68.6 years. The mean LOS in our population was 14.6 (± 20.4) days; this was significantly lower in children (11.8 [± 14.8] days). The median LOS/TBSA ratio was 1.9 for adults and 1.5 for children. In the univariate

Treatment	< 16 year	> 16 year	ALL	p value	n	Missing
Surgery$_1$	198 (41.4%) (37; 46)	1450 (68.9%) (66.8; 70.8)	**1648 (63.8%) (61.9; 65.6)**	< 0.001	2584	67
Reintervention$_1$	31 (16.3%) (11.4; 22.4)	283 (19.9%) (17.9; 22.1)	**314 (19.5%) (17.6; 21.5)**	0.283[4]	1612	36
Total number of Reintervention$_2$	31 1.9 (1.8) (1.3; 2.6) 1 (1, 2.5)	283 1.9 (1.5) (1.7; 2) 1 (1, 2)	**314 1.9 (1.5) (1.7; 2) 1 (1, 2)**	0.663	314	0
Time from burn to Surgery$_2$	198 20.2 (25.6) CI (16.6; 23.8) 16 (12, 21.8)	1449 18.3 (30.5) CI (16.8; 19.9) 14 (9, 20)	**1647 18.6 (29.9 CI) (17.1; 20) 14 (10, 20)**	< 0.001	1647	1

Table 3. Treatment. 1: n(%)(Exact CI) p value: [4]Chi-2: N mean(sd) (mean 95% CI)median(IQR) p value: Mann–Whitney U.

TBSA	Days to surgery (Median)	IQR	p value
[0,10)	15	[10, 22]	< 0.001
[10,20)	12	[9, 17]	
[20,99]	10	[7, 15]	

Table 4. Median Days burn until surgery by TBSA—Kruskall–Wallis Test.

analysis, the Kaplan–Meier survival curve was calculated (Figs. 2, 3, 4, 5, 6, 7, 8, 9 and 10) for each qualitative variable (Table 7).

In the clinical adjusted multivariate analysis (Table 8), the factors that increased mortality were ABSI ≥ 7 (HR 15.55 [95% CI 6.62–36.54]; p < 0.001), age over 80 years (HR 23.52 [95% CI 10.10–54.77] p < 0.001), smoke inhalation (HR 3.30 [95% CI 2.15–5.07]; p < 0.001), burned TBSA (1.02 [95% CI 1.02–1.03]; p < 0.001), cardiovascular comorbidity (HR 2.12 [95% CI 1.34–3.34]; p < 0.001), and full-thickness burn (1.69 [95% CI 1.06–2.68]; p = 0.027). Table 9 shows the multivariate analysis of factors associated with mortality (unadjusted). The observed mortality correlated with the ABSI-predicted mortality, with no statistically significant differences (Table 10).

Economic factors. In our study, mean annual expenditure was €5,030,043.85, with a mean cost per patient of €15,179.31.

Discussion

This is the first study to describe the epidemiological profile of children and adults presenting with burns in Catalonia. It is also the first to describe the overall in-hospital complications presented by patients admitted for burns, since these complications are usually analysed in a subgroup, such as major burn patients.

Demographics. Burns were more frequent among men (61.6%)—a global trend due to the predominance of men working in metallurgy or agriculture. In our review, this incidence was somewhat lower than that reported in 1998 (64%), 2008 (65%), and 2018 (66%)[21,25,26], and is consistent with the trend observed in other developed countries[6–8,15,27–30]. In Palacios[31], however, 51% of burn patients were men.

The mean age in our study was 41.4 years (49.7 years in adults). This is similar to Palacios [31] and higher than the earlier study published by Barrett[21], and reflects a global trend due to worldwide population ageing.

The proportion of burns in children (18.1%) is lower than in other developed countries[7,28,32,33] and far lower than that reported in developing countries[11,34]. One of the reasons for this low incidence is the consistently low birth rate in Spain over the past few decades and compulsory school education. Interestingly, the age range with the highest incidence of burns is usually 0–4 years, in some cases accounting for up to 50% of all admissions[32,35–38]. In our study, the incidence in this age group was 68%. This percentage, though similar to that reported in other studies, is still very high, and suggests that the authorities should promote health education and implement preventive measures in this age group (including their parents). A relatively simply measure would be to introduce legislation to lower the maximum permitted temperature of household water, an approach that has proven effective in other countries[39,40].

Characteristic of burns. Scalding was the most frequent mechanism of injury (37.7%) in our review, whereas flame was the most prevalent cause of burns in the 1990s. After adjusting for age and sex, flame was the most prevalent mechanism in adult men, and scalding was the most prevalent mechanism in adult women and in children. These results are in line with studies published in other countries, such as Portugal[41], Israel[29], China[42–44], Switzerland[9], and Holland[7]. In Europe, flame was the most prevalent mechanism of injury, although scalding was more prevalent in children[27].

		< 16 year	> 16 year	ALL	*p* value	n	Missing
Complications							
LOS ICU[2]		125 5.8 (13.5) CI (3.4; 8.2) 1 (1, 4)	233 20.7 (25.5) CI (17.4; 24) 13 (3, 30)	**358 15.5 (23.2) CI (13.1; 17.9) 5 (1.21. 8)**	< 0.001	358	0
Days on mechanical ventilation[2]		19 13 (18.7) CI (4; 22) 6 (3.5. 15.5)	204 16.9 (19.7) CI(14.2; 19.6) 10 (2, 25)	**223 16.6 (19.6 CI) (14; 19.2) 10 (2, 24)**	0.379	223	0
Compartmental syndrome[1]	Yes	0 (0%) CI (0; 0.8)	77 (3.6%) CI (2.9; 4.5)	**77 (2.9%) (2.3; 3.7)**	< 0.001	2612	39
Abdominal compartment syndrome[1]	Yes	0 (0%) CI (0; 0.8)	26 (1.2%) CI (0.8; 1.8)	**26 (1%) (0.7; 1.5)**	0.009[3]	2607	44
Cardiovascular[1]	Yes	1 (0.2%) CI (0; 1.2)	125 (5.9%) CI (4.9; 7)	**126 (4.8%) (4; 5.7)**	< 0.001	2611	40
ARDS[1]	Yes	4 (0.8%) CI (0.2; 2.1)	85 (4%) CI (3.2; 4.9)	**89 (3.4%) (2.7; 4.2)**	< 0.001	2613	38
Tracheostomy[1]	Yes	3 (0.6%) CI (0.1; 1.8)	97 (4.6%) CI (3.7; 5.5)	**100 (3.8%) (3.1; 4.6)**	< 0.001	2612	39
Days since admission to tracheostomy[2]		3 13 (1.7) CI (8.7; 17.3) 14 (12.5, 14)	94 7.6 (4.9) CI (6.6; 8.6) 7 (4, 11)	**97 7.8 (4.9 CI) (6.8; 8.8) 7 (4, 11)**	0.035	97	3
Acute kidney injury[1]	Yes	0 (0%) CI (0; 0.8)	167 (7.9%) CI (6.7; 9.1)	**167 (6.4%) (5.5; 7.4)**	< 0.001	2606	45
Sepsis[1]	Yes	72 (14.9%) CI (11.9; 18.4)	354 (16.6%) CI (15.1; 18.3)	**426 (16.3%) (14.9; 17.8)**	0.404[4]	2612	39
Stroke[1]	Yes	0 (0%) CI (0; 0.8)	14 (0.7%) CI (0.4; 1.1)	**14 (0.5%) (0.3; 0.9)**	0.087[3]	2614	37
Blood transfusion[1]	Yes	38 (7.9%) CI (5.7; 10.7)	322 (15%) CI (13.5; 16.6)	**360 (13.7%) (12.4; 15.1)**	< 0.001	2627	24
Thrombosis	Yes	1 (0.2%) CI (0; 1.2)	15 (0.7%) CI (0.4; 1.2)	**16 (0.6%) (0.4; 1)**	0.333	2612	39
DVT/PE[1]	DVT	1 (100%) CI (2.5; 100)	10 (83.3%) CI (51.6; 97.9)	**11 (84.6%) (54.6; 98.1)**	1[3]	13	3
	PE	0 (0%) CI (0; 97.5)	2 (16.7%) CI (2.1; 48.4)	**2 (15.4%) (1.9; 45.4)**			
Outcomes							
LOS[2]		482 11.8 (14.8) (10.5; 13.1) 8 (3, 17)	2169 15.2 (21.4) (14.3; 16.1) 9 (3, 21)	**2651 14.6 (20.4) (13.8; 15.4) 9 (3, 21)**	0.014	2651	0
LOS/TBSA[2]		482 2.6 (4.7) CI (2.1; 3) 1.5 (0.8, 2.7)	2168 4.6 (17) CI (3.8; 5.3) 1.9 (0.8, 4)	**2650 4.2 (15.5) CI (3.6; 4.8) 1.8 (0.8, 3.6)**	0.002	2650	1
days_burn_to surgery[2]		198 20.2 (25.6) (16.6; 23.8) 16 (12, 21.8)	1449 18.3 (30.5) (16.8; 19.9) 14 (9, 20)	**1647 18.6 (29.9) (17.1; 20) 14 (10, 20)**	< 0.001	1647	1
In-hospital mortality[1]	Yes	0 (0%) CI (0; 0.8)	95 (4.3%) CI (3.5; 5.3)	**95 (3.5%) (2.9; 4.3)**	< 0.001	2651	0
30-day mortality[1]	Yes	0 (0%) CI (0; 0.8)	49 (2.4%) CI (1.8; 3.2)	**49 (2%) (1.5; 2.6)**	0.001[4]	2503	148
90-day mortality[1]	Yes	0 (0%) CI (0; 0.8)	49 (2.5%) CI (1.9; 3.3)	**49 (2%) (1.5; 2.7)**	0.001[4]	2416	235
Death (cause)[1]	MOF	0 (NaN%) CI (0; 100)	47 (49.5%) CI (39.1; 59.9)	**47 (49.5%) (39.1; 59.9)**		95	0
	CV	0 (NaN%) CI (0; 100)	15 (15.8%) CI (9.1; 24.7)	**15 (15.8%) (9.1; 24.7)**			
	ARDS	0 (NaN%) CI (0; 100)	13 (13.7%) CI (7.5; 22.3)	**13 (13.7%) (7.5; 22.3)**			
	SEPSIS	0 (NaN%) CI (0; 100)	9 (9.5%) CI (4.4; 17.2)	**9 (9.5%) (4.4; 17.2)**			
	Other	0 (NaN%) CI (0; 100)	11 (11.6%) CI (5.9; 19.8)	**11 (11.6%) (5.9; 19.8)**			

Table 5. Complications and outcomes. 1: n(%)(Exact CI) *p* value: [4]Chi^2 *p* value: [3]Fisher's exact 2: N mean(sd) (mean 95% CI) median(IQR) *p* value: Mann–Whitney U. *DVT* Deep vein thrombosis, *PE* pulmonary embolism, *CV* cardiovascular. Significant values are in bold.

Variables		Survivors 2074 (95.62%)	Non-survivors (4.38%)	ALL	*p* value	n
Gender$_1$	Men	1283 (61.9%) CI [59.7; 64]	60 (63.2%) CI [52.6; 72.8]	**1343 (61.9%) [59.8; 64]**	0.884[4]	2169
	Women	791 (38.1%) CI [36; 40.3]	35 (36.8%) CI [27.2; 47.4]	**826 (38.1%) [36; 40.2]**		
TBSA$_2$		2074 7.2 (9.8) CI [6.8; 7.7] 4 [1.5, 9]	95 37.7 (28) CI [31.9; 43.4] 30 [13.5, 53.5]	**2169 8.6 (12.8) CI [8; 9.1] 4.5 [1.5, 10]**	< 0.001	2169
Delay$_1$	> 24 h	687 (33.9%) CI [31.8; 36]	7 (7.4%) CI [3; 14.6]	**694 (32.7%) [30.7; 34.7]**	< 0.001	2124
	12 h a 24 h	93 (4.6%) CI [3.7; 5.6]	2 (2.1%) CI [0.3; 7.4]	**95 (4.5%) [3.6; 5.4]**		
	6 h a 12 h	176 (8.7%) CI [7.5; 10]	10 (10.5%) CI [5.2; 18.5]	**186 (8.8%) [7.6; 10]**		
	< 6 h	1073 (52.9%) CI [50.7; 55.1]	76 (80%) CI [70.5; 87.5]	**1149 (54.1%) [51.9; 56.2]**		
Smoker$_1$	Yes	650 (31.3%) CI [29.3; 33.4]	34 (35.8%) CI [26.2; 46.3]	**684 (31.5%) [29.6; 33.5]**	0.424[4]	2169
Enolism$_1$	Yes	161 (7.8%) CI [6.6; 9]	22 (23.2%) CI [15.1; 32.9]	**183 (8.4%) [7.3; 9.7]**	< 0.001	2169
Cocaine$_1$	Yes	56 (2.7%) CI [2; 3.5]	3 (3.2%) CI [0.7; 9]	**59 (2.7%) [2.1; 3.5]**	0.742[3]	2169
Cannabis$_1$	Yes	94 (4.5%) CI [3.7; 5.5]	1 (1.1%) CI [0; 5.7]	**95 (4.4%) [3.6; 5.3]**	0.125[3]	2169
Cardiovascular comorbidity$_1$	Yes	596 (28.7%) CI [26.8; 30.7]	53 (57%) CI [46.3; 67.2]	**649 (29.9%) [28; 31.9]**	< 0.001	649
HTA$_1$	Yes	545 (91.4%) CI [88.9; 93.6]	42 (79.2%) CI [65.9; 89.2]	**587 (90.4%) [87.9; 92.6]**	0.008[4]	649
Ischaemic heart disease$_1$	Yes	73 (12.2%) CI [9.7; 15.2]	16 (30.2%) CI [18.3; 44.3]	**89 (13.7%) [11.2; 16.6]**	< 0.001	649
Heart failure$_1$	Yes	38 (6.4%) CI [4.6; 8.6]	7 (13.2%) CI [5.5; 25.3]	**45 (6.9%) [5.1; 9.2]**	0.083[3]	649
Arrhythmias$_1$	Yes	73 (12.2%) CI [9.7; 15.2]	18 (34%) CI [21.5; 48.3]	**91 (14%) [11.4; 16.9]**	< 0.001	649
Valvulopathy$_1$	Yes	30 (5%) CI [3.4; 7.1]	7 (13.2%) CI [5.5; 25.3]	**37 (5.7%) [4; 7.8]**	0.024[3]	649
Vasculopathy$_1$	Yes	36 (6%) CI [4.3; 8.3]	6 (11.3%) CI [4.3; 23]	**42 (6.5%) [4.7; 8.6]**	0.142[3]	649
Pulmonary comorbidity$_1$	Yes	245 (11.8%) CI [10.5; 13.3]	15 (16.1%) CI [9.3; 25.2]	**260 (12%) [10.7; 13.5]**	0.28[4]	2162
Diabetes Melitus$_1$	Yes	239 (11.5%) CI [10.2; 13]	21 (22.6%) CI [14.6; 32.4]	**260 (12%) [10.7; 13.4]**	0.002[4]	2167
Chronic kidney injury$_1$	Yes	80 (3.9%) CI [3.1; 4.8]	5 (5.4%) CI [1.8; 12.1]	**85 (3.9%) [3.1; 4.8]**	0.41[3]	2167
Hepatopaty$_1$	Yes	52 (2.5%) CI [1.9; 3.3]	5 (5.4%) CI [1.8; 12.1]	**57 (2.6%) [2; 3.4]**	0.095[3]	2167
Clotting disorders/OAC's/APT$_1$	Yes	178 (8.6%) CI [7.4; 9.9]	26 (28%) CI [19.1; 38.2]	**204 (9.4%) [8.2; 10.7]**	< 0.001	2167
Obesity$_1$	Yes	595 (39.5%) CI [37; 42]	22 (41.5%) CI [28.1; 55.9]	**617 (39.5%) [37.1; 42]**	0.875[4]	1561
Chronic anaemia	Yes	75 (3.6%) CI [2.9; 4.5]	2 (2.2%) CI [0.3; 7.6]	**77 (3.6%) [2.8; 4.4]**	0.771[3]	2167
Dislipemia$_1$	Yes	427 (20.6%) CI [18.9; 22.4]	29 (31.2%) CI [22; 41.6]	**456 (21.1%) [19.4; 22.8]**	0.021[4]	2165
Smoke inhalation$_1$	No	1952 (95.5%) CI [94.5; 96.3]	46 (50%) CI [39.4; 60.6]	**1998 (93.5%) [92.4; 94.5]**	< 0.001	2137
	Yes	93 (4.5%) CI [3.7; 5.5]	46 (50%) CI [39.4; 60.6]	**139 (6.5%) [5.5; 7.6]**		
ABSI$_2$		2071 4.8 (1.5) CI [4.8; 4.9] 5 [4, 6]	95 9.6 (2.6) CI [9.1; 10.1] 9 [8, 11.5]	**2166 5 (1.9) CI [5; 5.1] 5 [4, 6]**	< 0.001	2166
ARDS$_1$	Yes	42 (2.1%) CI [1.5; 2.8]	43 (46.2%) CI [35.8; 56.9]	**85 (4%) [3.2; 4.9]**	< 0.001	2131
Age$_1$	17 to 65	1624 (78.3%) CI [76.5; 80.1]	39 (41.1%) CI [31.1; 51.6]	**1663 (76.7%) [74.8; 78.4]**	< 0.001	2169
	65 to 80	301 (14.5%) CI [13; 16.1]	18 (18.9%) CI [11.6; 28.3]	**319 (14.7%) [13.2; 16.3]**		
Continued						

Variables		Survivors 2074 (95.62%)	Non-survivors (4.38%)	ALL	*p* value	n
	> 80	149 (7.2%) CI [6.1; 8.4]	38 (40%) CI [30.1; 50.6]	**187 (8.6%) [7.5; 9.9]**		
$TBSA_1$	< 20	1908 (92%) CI [90.7; 93.1]	31 (32.6%) CI [23.4; 43]	**1939 (89.4%) [88; 90.7]**	< 0.001	2169
	> 20	166 (8%) CI [6.9; 9.3]	64 (67.4%) CI [57; 76.6]	**230 (10.6%) [9.3; 12]**		
Full thickness $burn_1$	Yes	441 (21.3%) CI [19.5; 23.1]	66 (69.5%) CI [59.2; 78.5]	**507 (23.4%) [21.6; 25.2]**	< 0.001	2169
Mecanismo $causal_1$	Others	1264 (60.9%) CI [58.8; 63.1]	25 (26.3%) CI [17.8; 36.4]	**1289 (59.4%) [57.3; 61.5]**	< 0.001	2169
	Flame	810 (39.1%) CI [36.9; 41.2]	70 (73.7%) CI [63.6; 82.2]	**880 (40.6%) [38.5; 42.7]**		
ABSI_cat	(0,3]	377 (18.2%) CI [16.6; 19.9]	1 (1.1%) CI [0; 5.7]	**378 (17.5%) [15.9; 19.1]**	< 0.001	2166
	(4,5]	1092 (52.7%) CI [50.6; 54.9]	0 (0%) CI [0; 3.8]	**1092 (50.4%) [48.3; 52.5]**		
	(6,7]	495 (23.9%) CI [22.1; 25.8]	20 (21.1%) CI [13.4; 30.6]	**515 (23.8%) [22; 25.6]**		
	(8,9]	85 (4.1%) CI [3.3; 5.1]	31 (32.6%) CI [23.4; 43]	**116 (5.4%) [4.4; 6.4]**		
	(10,11]	17 (0.8%) CI [0.5; 1.3]	19 (20%) CI [12.5; 29.5]	**36 (1.7%) [1.2; 2.3]**		
	(12,16]	5 (0.2%) CI [0.1; 0.6]	24 (25.3%) CI [16.9; 35.2]	**29 (1.3%) [0.9; 1.9]**		

Table 6. Description of mortality variables. 1: by col n(%) [Exact CI] *p* value: [4]Chi-squared *p* value: [3]Fisher's exac. 2: N mean(sd) [CI95% mean] median[IQR] *p* value: Mann–Whitney U. Significant values are in bold.

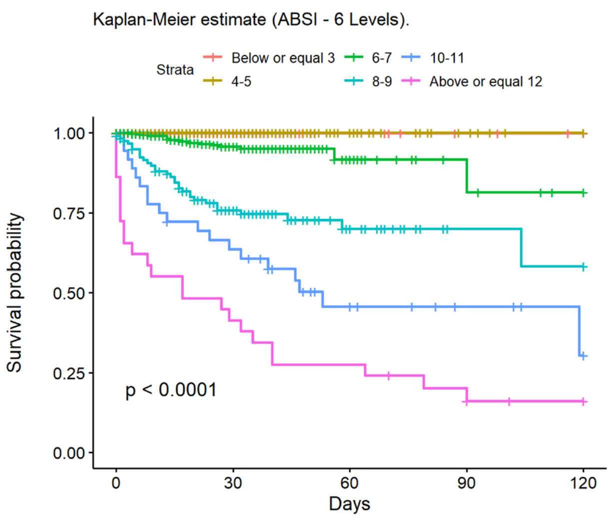

Figure 2. Kaplan–Meier survival curve for ABSI score.

The mean burned TBSA was 8.3%, significantly lower than previous studies, such as 16% in Barrett[21] and 18% in Sánchez[25]. This reduction in burned TBSA may be due to a lower incidence of flame burns, which are usually severe, extensive, and accompanied by smoke inhalation[45].

The proportion of patients with burns covering less than 10% of total body surface has increased from 60% in 1995 to 75% today. This is a global trend that has also been reported in other studies[7,16,43,46,47], and could be due to the decline of flame as the main cause of burns in our setting. For the same reason, the number of patients with 20% of TBSA affected has decreased to 9.7%. According to figures from the ABA (American Burn Association), 22.5% of burn patients in 2013 presented major burns[48]. In children, 77% of patients presented burns affecting less than 10% TBSA, in line with other studies[28,35,36,41,49].

Comorbidities. Our study provides an overview of comorbidities in burn patients and their effect on mortality. Smoking is the most prevalent comorbidity (25.8%), while the rate of cardiovascular disease (24%) is similar to Barret et al. [21], and significantly higher than that reported by other authors, such as 8% in Knowlin[50].

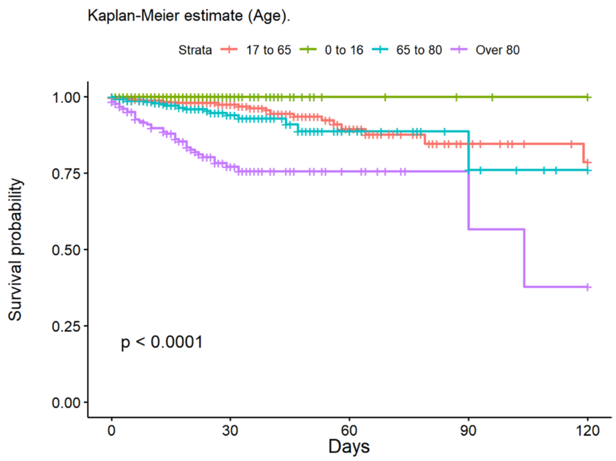

Figure 3. Kaplan–Meier survival curve for Age.

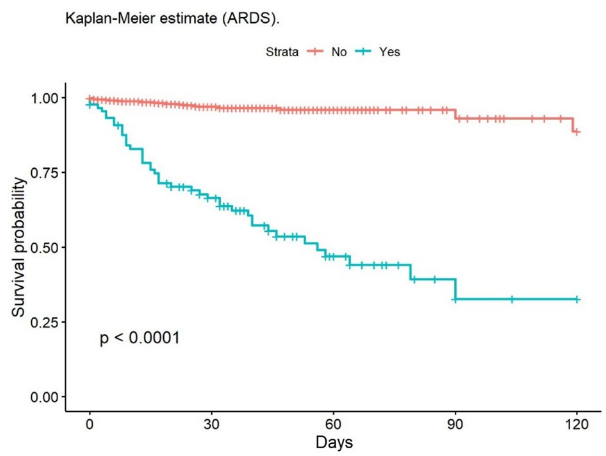

Figure 4. Kaplan–Meier survival curve for ARDS.

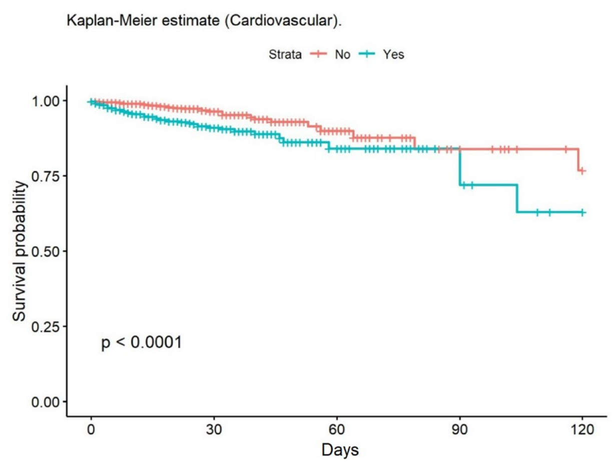

Figure 5. Kaplan–Meier survival curve for Cardiovascular comorbidity.

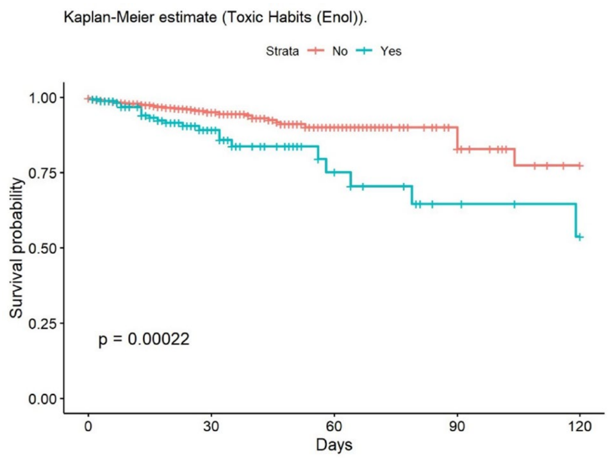

Figure 6. Kaplan–Meier survival curve for Enolism.

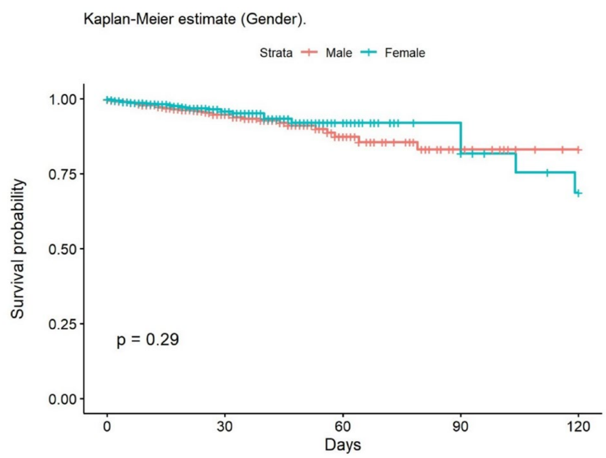

Figure 7. Kaplan–Meier survival curve for Gender.

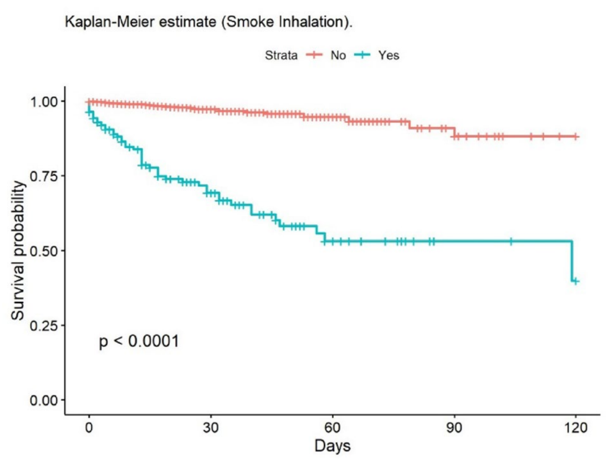

Figure 8. Kaplan–Meier survival curve for Smoke Inhalation.

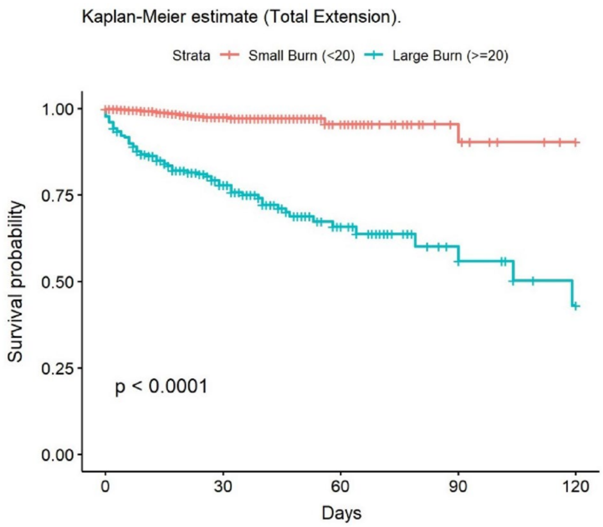

Figure 9. Kaplan–Meier survival curve for TBSA (%).

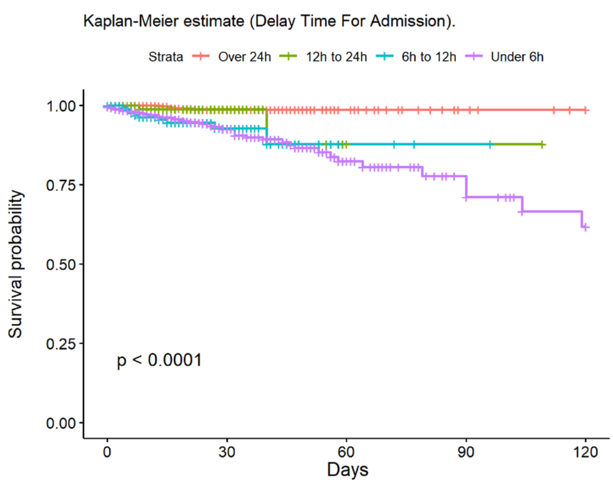

Figure 10. Kaplan–Meier survival curve for delay time for admission.

The percentage of in-hospital cardiovascular complications was also higher in our series compared with Knowlin (5.9% vs. 3%), while cardiovascular comorbidity increased mortality at a rate similar to that observe by Knowlin[50] (HR 2.12 [95% CI 1.34–3.34], $p = 0.001$).

Alcohol abuse was reported in 6.9% of patients in our study, a high rate compared to the average of 4.2% in the Spanish population in 2019[51]. These figures are consistent with those reported by Eiroa-Orosa, who showed that a higher proportion of burn patients had a history of substance abuse compared with the general population[52].

In Spain, according to the ENPE study, 22% of the population is obese, and obesity is more prevalent in men aged over 65 years from low-income groups[53] . In Catalonia, the percentage of obesity (16%) is lower than the Spanish average. In our series, 34.5% of adult patients were obese, a proportion that contrasts with most reports in the literature; however, according to the Center for Disease Control, 42.4% of the US population was obese in 2017[54], while Jeschke reported a prevalence of 29%[55]. In our population, obesity was not associated with increased mortality.

Treatment. Surgery was required in 64% of our patients, a percentage that is higher than other studies, such as Dokter[7]. The significant difference in the rate of surgery observed between adults and children is consistent with other studies, in which burns in children are usually less severe and respond well to conservative treatment, particularly high protein intake.

Complications. None of the studies identified in our database search summarise the most common complications during hospital admission.

Variables	Hazard ratio	95% CI	*p* value
Sex	1.58	0.597–1.125	0.29
Age 0–16	inf	inf	inf
16–64	Ref	Ref	Ref
65–80	1.770	1.011–3.100	0.046
> 80	6.782	4.333–10.62	< 0.001
Mechanism: Flame	4.686	2.966–7.403	< 0.001
Mechanism: Other	Ref	Ref	Ref
ABSI < 7	Ref	Ref	Ref
ABSI ≥ 7	51.79	23.86–112.4	< 0.001
Delay > 6 h	Ref	Ref	Ref
Delay < 6 h	8.263	3.807–17.93	< 0.001
TBSA ≥ 20%	11.08	07:13–17.23	< 0.001
Smoke Inhalation	13.02	8.560–19.81	< 0.001
Enolism	2.428	1.495–3.944	< 0.001
Cardiovascular comorbidity	2.429	1.608–3.668	< 0.001
Clotting disorder	2.623	1.658–4.149	< 0.001
ARDS	14.70	9.609–22.49	< 0.001
TBSA% Full-thickness burn	6.820	3.689–12.61	< 0.001
TBSA (%)	1.047	1.040–1.054	< 0.001
ABSI	1.745	1.641–1.856	< 0.001

Table 7. Cox Regression analysis of factors associated with mortality. *CI* Confidence Interval.

Multivariate analysis	Hazard ratio	95% CI	*p* value
Age 65–80	4.85	2.28–10.31	**< 0.001**
Age 80	23.52	10.10–54.77	**< 0.001**
ABSI ≥ 7	15.55	6.62–36.54	**< 0.001**
Smoke inhalation	3.30	2.15–5.07	**< 0.001**
TBSA %	1.02	1.02–1.03	**< 0.001**
Cardiovascular comorbidity	2.12	1.34–3.34	**0.001**
Full thickness burn (YES/NO)	1.69	01:06–2.68	**0.027**

Table 8. Multivariate analysis of factors related to mortality (adjusted for clinical factors). R^2 Nagelkerke: 0.267 CI: Confidence Interval. Significant values are in bold.

Several authors have described AKI as an independent risk factor for mortality[56–60]. This complication arose in 8% of patients in our study, whereas an incidence of 30% has been reported in other studies[60] with an 80% mortality rate[56,61]. However, it is important to bear in mind that nearly all these studies were performed in critically ill patients[17,62], so the findings cannot be extrapolated to the general population. Burn patients are at increased risk of suffering potentially fatal infection of any cause in the first 5 years after the burn[63], and sepsis increases LOS and ICULOS[64]. In our study, 16.3% of patients were diagnosed with sepsis, somewhat higher than the figures published in Belgium[65].

Outcomes. Mortality remained at 3.5% (0% in children under 16 years of age and 4.3% in adults). This rate is somewhat higher than that reported in most developed European countries[6,10,15,65,66].

We compared observed vs. predicted mortality based on the ABSI to determine the accuracy of this score in our population[67]. The ABSI correlated with observed mortality, except in mild injury patients (ABSI < 6) and very severe injury patients (ABSI ≥ 12), in which mortality was lower than predicted.

A factor that has changed substantially over the years is cause of death. In Barrett et al., the main causes were acute respiratory distress syndrome (ARDS) (34%), MOF (26.8%) and sepsis (13.2%). The decrease in ARDS (13.7%) is striking, and may be due to improvements in critical care, a decrease in flame burns, and advances in mechanical ventilation. The incidence of sepsis-related deaths has also declined, and it is now the cause of death in 9.5% of patients, 50% lower than the figure reported by Barret et al.[21] and in line with the findings of a Belgian study[65]. The decrease in mortality due to sepsis is a promising development, and may be due to the implementation of strict care protocols in critically ill patients[68], together with improvements in the use of antibiotics and in the management of septic shock.

	Hazard ratio	CI (lower)	CI (upper)	Pr(>|z|)
Age: 0 a 16	9.053e−08	0.000	Inf	0.997
Age: 65 a 80	4.651	1.704	12.70	0.003
Age: > 80	27.57	9.068	83.81	< 0.001
Flame	1.917	0.9183	4.00	0.083
ABSI ≥ 7	1.436	0.2972	6.939	0.652
Delay: 12 h a 24 h	1.589	0.1748	14.46	0.681
Delay: 6 h a 12 h	1.797	0.3706	8.713	0.467
Delay: < 6 h	2.574	0.8010	8.271	0.112
TBSA (%)	1.057	1.035	1.079	< 0.001
Enolism: Yes	2.036	0.8788	4.715	0.097
Cannabis: Yes	0.3402	0.09000	1.286	0.112
Chronic kidney injury: Yes	0.3851	0.1210	1.226	0.106
Hepatopaty: Yes	11.21	2.807	44.79	0.001
ARDS: Yes	0.7269	0.3736	1.414	0.348
Cardiovascular comorbidity	1.520	1.108	2.087	0.010
Smoke inhalation: Yes	2.750	1.408	5.369	0.003
TBSA Full thickness: 11 a 20%	1.828	0.8390	3.982	0.129
TBSA Full thickness: > 20%	1.205	0.4030	3.601	0.739

Table 9. Multivariate analysis of factors related to mortality (unadjusted).

ABSI	n observed	Observed mortality (%)	n predicted	Predicted mortality	*p* value$_1$
2–3	1	0.26	4	< 1%	0.204
4–5	3	0.69	21	2%	0.218
6–7	19	12.7	51	10–20%	0.126
8–9	30	39.6	35	30–50%	0.414
10–11	19	72.4	22	60–80%	0.312
≥ 12	23	86.6	26	> 90%	0.178
Total	95		159		

Table 10. Observed versus predicted mortality[67]. 1: Chi-squared.

In our study, the main cause of death was MOF (49.5%). According to the American Burn Association, MOF is the cause in 27.5% of fatalities[48,69] . In other studies, this percentage increases to 40%.[17,70].

The main predictors of in-hospital mortality identified in this study are age over 80 years, ABSI ≥ 7, smoke inhalation, cardiovascular comorbidity, full-thickness burn, and burned TBSA. These factors have also been described as predictors elsewhere[8,27,33,43,46,50,71,72]. Interestingly, there is scant evidence elsewhere of the association between cardiovascular comorbidity and increased mortality; however, in our series, this comorbidity increased the probability of dying by 112%. We, like some other authors, did not find gender to be associated with increased mortality[8,73,74], although this contrasts with the findings of other studies[67].

The number of admissions for burns has decreased dramatically from 6.6/10^5 population/year to 3.68/10^5 population/year This is a global trend[1,2,15,33,75], despite significantly higher rates of admission reported in some of our European neighbours, such as 18.9/10[541] in Portugal, and 36.9/10^5 in Romania.[11] Both LOS and LOS/TBSA in Catalonia are above the average in developed countries[2,4,6,11,13,71], possibly due to 2 factors: first, the average waiting time from burn event to surgery is 18 days, far higher than the average 14.7 days in the Netherlands[7]; second, home care in our region is underdeveloped, a situation that places an additional burden on in-hospital care.

In total, 14% of adults were admitted for burns occurring in the workplace, similar to the percentage reported by Barrett, and midway between the 5.9% reported by Palacios[31] and 20.9% by Sánchez[25]. Other countries that have published statistics relating to burns in the workplace include Germany, with an incidence that ranges from 18%-33.7%[12,76], Switzerland with 31%[9], the USA with 18%[77], China with 78%[72], Australia with 17% [74,78], and Austria with 14.9%[8].

Economic factors. Care costs are currently one of the main problems in the healthcare sector. The economic downturn followed by the SARS-CoV-2 pandemic has brought public health systems in Spain to the brink of collapse, and it is now more important than ever to optimise resource management. As mentioned above, mean annual expenditure was €5,030,043.85, with a mean cost per patient of €15,179.31; these cost estimates were not TBSA-weighted. In Portugal, meanwhile, the cost per patient is €8,030[41], in Holland it is €26,540[30] and in Finland, €25,000[3].

This study has several limitations.

As our study was performed in a single hospital, our findings cannot be assumed to reflect the situation in other regions; however, this single-centre design ensures that both the study population and the treatment of burns is homogeneous.

Selection bias cannot be ruled out, since patients with non-severe burns are not initially treated at or transferred to the HUVH, so we were unable to include these data in our analysis. Another potential source of selection bias stems from our retrospective design, insofar as some patients were lost because doctors did not always strictly adhere to the 90-day follow-up schedule.

In the study of comorbidities, patients were not assessed using the gold-standard Charlson index, and the presence of psychiatric disorders was not recorded.

Conclusions

This study shows that changes have occurred in the pattern of burn injuries, their extent, and their severity, and burns are now predominantly less extensive and deep in our setting. The pattern of clinical presentation differed been children and adults. In our series, children ages between 0 and 4 years of age account for 68% of all children admitted for burns. This means that they are still most important risk group and should be the target of preventive measures and health education campaigns. The factors associated with a higher risk of mortality were age, %TBSA, full-thickness burns, smoke inhalation, and cardiovascular comorbidity. Unlike other studies, in our series female sex was not a risk factor for mortality. Prospective, multicentre studies are needed to obtain a more accurate picture of the situation of burn patients in Spain.

Data availability

The data collected in this study is available upon reasonable request. Please, contact with Luis Abarca Vilchez; labarcavilchez@gmail.com.

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Author contributions
Study design: L.A., M.J.C. Study conduct: L.A., M.J.C. Data analysis: L.A., P.G.,M.J.C Final approval of the contents: J.P.B. Wrote the manuscript and approved the final manuscript: L.A., P.G., G.U., N.M., M.J.C. Reviewed the final version: L.A., M.J.C.

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Additional information
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