CLINICAL RESEARCH

e-ISSN 1643-3750
© Med Sci Monit, 2026; 32: e951713
DOI: 10.12659/MSM.951713

Received: 2025.10.01
Accepted: 2026.05.01
Available online: 2026.05.27
Published: 2026.XX.XX

Prognostic Value of Mortality Scoring Systems in Patients With Severe Burns: Identifying Key Predictors of Mortality and Comparative Analysis Between Survivors and Non-Survivors

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
Literature Search F
Funds Collection G

ABCDEFG 1 **Piotr Tomaka**
ACDEF 2 **Patryk Rzońca**
BCEF 1 **Mateusz Rzońca**
ACEF 3,4 **Adam Stepniewski**
ACDFG 4,5 **Jerzy Strużyna**
ACDEFG 4,5 **Tomasz Korzeniowski**

1 Department of Anesthesiology and Intensive Care, District Hospital, Łęczna, Poland
2 Department of Human Anatomy, Faculty of Health Sciences, Medical University of Warsaw, Warsaw, Poland
3 Division of Plastic Surgery, Department of Trauma Surgery, Orthopedics and Plastic Surgery, University Medical Center Goettingen, Goettingen, Germany
4 East Center of Burns Treatment and Reconstructive Surgery, Łęczna, Poland
5 Department of Plastic, Reconstructive Surgery and Burn Treatment, Medical University of Lublin, Lublin, Poland

Corresponding Author: Tomasz Korzeniowski, East Center of Burns Treatment and Reconstructive Surgery, District Hospital in Leczna, Krasnystawska 52, Łęczna 21-010, Poland, Phone: +48602797279, e-mail: t.korzeniowski@gmail.com
Financial support: This work has been supported by grant DS310 of the Medical University of Lublin
Conflict of interest: None declared

Background: Burns remain a major public health challenge for modern healthcare systems due to high mortality and long-term consequences. This study evaluated the effectiveness of several scoring systems in predicting mortality and identified key prognostic factors in patients with severe burns.

Material/Methods: A retrospective analysis of 144 adult burn patients admitted to the intensive care unit was conducted. Mortality risk was assessed using total body surface area (TBSA), revised Baux, Abbreviated Burn Severity Index (ABSI), Belgium Outcome Burn Injury (BOBI), and Burn Mortality Prediction (BUMP) scores. Two analytical approaches were applied: a baseline clinical model including key independent variables (age, TBSA, inhalation injury), and separate logistic regression models for each scoring system. Predictive performance was evaluated using receiver operating characteristic (ROC) curves and compared using the DeLong test.

Results: Overall mortality rate was 43.1%. Non-survivors were older (59.2 vs 46.5 years), had larger burned surface area (42.3% vs 35.3%), and more frequently presented with inhalation injury (59.7% vs 26.8%). The baseline model demonstrated excellent discriminative ability (AUROC=0.87, $P<0.001$). Among scoring systems, the revised BAUX achieved the highest AUROC (0.86, $P<0.001$), followed by BOBI and BUMP (both 0.83, $P<0.001$). However, pairwise comparisons showed no statistically significant differences between the best-performing scores.

Conclusions: The baseline clinical model and composite scoring systems demonstrated strong and comparable predictive performance. Simple clinical models based on key variables may provide an effective alternative for mortality risk assessment, while established scoring systems remain valuable due to their ease of use in routine practice. The findings highlight the need for early identification of high-risk patients and timely clinical management optimization.

Keywords: **Burns • Mortality • Prognosis • Risk Factors**

Full-text PDF: https://www.medscimonit.com/abstract/index/idArt/951713

3647 4 1 27

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Introduction

Burn injuries pose a significant clinical and economic challenge to modern healthcare systems worldwide. Although they represent one of the most common unintentional injuries, recent decades have seen a global reduction in burn incidence, a decrease in the severity of burns, and a reduction in the length of hospital stays, which is associated with advances in medical care and increased availability of specialized treatments. Despite this progress, burn-related mortality remains substantial [1,2], with an estimated 180 000 deaths annually and mortality rate in burn centers commonly ranging from 10% to 20% [3,4].

While prevention is the most effective strategy in burn care, once a severe injury occurs, early identification of patients at high risk of death becomes a clinical priority. Numerous prognostic tools are used in everyday practice, including the Baux score and revised Baux score, Abbreviated Burn Severity Index (ABSI), Belgium Outcome Burn Injury (BOBI), and Burn Mortality Prediction (BUMP). Most of these tools were developed based on patient data from diverse populations, with varying demographic and epidemiological profiles. Although age and total body surface area (TBSA) are widely recognized as fundamental determinants of survival, they remain insufficient as isolated predictors. Consequently, burn centers worldwide continue to seek an optimal and comprehensive prognostic assessment tool, underscoring the need for further research [5,6].

In Central and Eastern Europe, including Poland, epidemiological data on severe burns, particularly among patients requiring intensive care, remain limited. Moreover, few regional studies have directly compared commonly used prognostic scales within a single cohort, creating a gap in evidence relevant for local clinical practice and healthcare planning. Therefore, the aim of this study was to perform a retrospective analysis of patients hospitalized in the intensive care unit (ICU) of the East Center of Burns Treatment and Reconstructive Surgery from 2018 to 2022. The objectives were to evaluate the effectiveness of TBSA, ABSI, revised BAUX, BUMP, BOBI scores in predicting mortality, and to identify key prognostic factors, providing data that may contribute to optimizing treatment strategies and improving the prevention of severe burns worldwide.

Material and Methods

Study Design

We conducted a retrospective analysis of medical records of burn patients admitted to the burn ICU. The study covered a 5-year period, from January 1, 2018, to December 31, 2022. The East Center of Burns Treatment and Reconstructive Surgery, the largest burn center in Poland, served as the study site. During this timeframe, treatment standards and clinical protocols at our institution remained consistent, and no systematic changes or additional factors were introduced that could have acted as confounders.

Study Population

The total of 144 patients were included in the final analysis. During the study period, all adult burn patients admitted to the center were screened. Patients not requiring ICU admission, those under 18 years of age, and those with incomplete data were excluded. The final cohort consisted exclusively of ICU-treated patients, representing the most severe burn cases.

Data Collection

Data were extracted retrospectively from electronic and paper medical records using a structured data extraction form developed specifically for this study. The form was created based on variables commonly reported in burn-related prognostic research and aligned with recommendations for observational retrospective studies. To ensure reliability, the extraction form was pilot-tested and revised to improve clarity and consistency. Data extraction was conducted independently by 2 trained researchers, and discrepancies were resolved through consensus to minimize the risk of information bias. Missing data were handled using a complete-case analysis approach. The proportion of missing data for individual variables was assessed prior to analysis and was below 10% for all variables included in the final models. Variables with incomplete records were not imputed due to the retrospective nature of the study. Inhalation injury and burn depth were assessed based on clinical documentation and bronchoscopy findings where available, which may introduce interobserver variability. The overall process was designed and reported in accordance with the STROBE guidelines for retrospective observational studies [7].

Variables and Prognostic Scores

The following variables were collected: age, sex, presence of third-degree burns, inhalation injury, selected medical procedures performed during the ICU stay, basic vital signs on admission, results of laboratory tests, and length of ICU stay. Burn depth was assessed in our center clinically by experienced burn surgeons based on standard criteria, including visual inspection and intraoperative findings where applicable.

The following prognostic scoring systems were calculated retrospectively based on clinical data. The TBSA was estimated using the Lund Browder Chart and expressed as percentage of total body surface area burned. The Baux score was calculated as the sum of age and TBSA, and the revised Baux score additionally included inhalation injury (+17 points if present). The ABSI incorporates age, sex, presence of inhalation injury, and burn depth, producing a cumulative score associated with mortality risk. The BOBI is based on categorized age, TBSA, and inhalation injury. The BUMP is a multivariable model incorporating demographic, clinical, and laboratory parameters. All scores were calculated according to their original published definitions.

To evaluate and compare the prognostic performance of individual clinical variables and established composite scoring systems, 2 complementary analytical approaches were applied. First, the baseline model included age, TBSA, and inhalation injury as core predictors, as these variables are consistently recognized as key determinants of mortality in burn patients. Second, the predictive performance of commonly used burn scoring systems (ABSI, revised BAUX, BUMP, and BOBI) was assessed individually. Selected pairwise comparisons were performed focusing on clinically relevant models.

Variables considered to be downstream consequences of clinical deterioration, such as renal replacement therapy, were not included in the multivariable model, to avoid overadjustment and potential collider bias.

Ethics Statement

The study was conducted in accordance with the principles of the Declaration of Helsinki. The study received approval from the Institutional Ethics Committee of the Independent Public District Hospital in Leczna (ref. number: 03/WCLO/2023). Due to the retrospective nature of the study and the use of data derived from routine clinical procedures, all of which were fully anonymized and did not permit patient identification, the requirement for informed consent was waived by the institutional ethics committee.

Statistical Analysis

Data are presented as number (n) and percentage (%). Data with a normal distribution are expressed as mean and standard deviation (SD). Non-normal data are expressed as median and interquartile range (IQR). Data distribution was assessed using the Kolmogorov-Smirnov test and the Lilliefors test. Baseline data were compared using the chi-square test or Fisher exact test for categorical variables, and the *t* test or Mann-Whitney U test for continuous variables, depending on data distribution.

To address potential multicollinearity between composite scoring systems and their constituent variables, 2 separate multivariable logistic regression approaches were applied. First, a baseline clinical model was constructed including independent variables identified as significant in univariate analysis, including age, TBSA, inhalation injury, and intubation-related variables. Variables were selected based on clinical relevance and to avoid overfitting, rather than including all variables significant in univariate analysis. Second, separate logistic regression models were developed for each prognostic scoring system (ABSI, revised Baux, BUMP, and BOBI), with each score included as a single predictor variable.

The discriminative ability of both the baseline clinical model and individual prognostic scores was assessed using receiver operating characteristic (ROC) curves and the area under the ROC curve (AUROC). In addition to discrimination, model calibration was evaluated using the Hosmer-Lemeshow goodness-of-fit test and calibration plots. ROC curves were generated using MedCalc Statistical Software based on the study dataset. No external images or templates were used.

Pairwise comparisons between AUROC values were performed using the DeLong test to determine whether differences between models were statistically significant. Optimal cut-off values were determined using the Youden index. Sensitivity and specificity were calculated accordingly.

Data were statistically analyzed using IBM SPSS for Windows, version 25.0 (IBM Corp, Armonk, NY, USA) and MedCalc Statistical Software version 20.218 (MedCalc Software Ltd, Ostend, Belgium). A 2-sided *P* value of <0.05 was considered statistically significant.

Results

Patient Characteristics

In the 5-year period from 2018 to 2022, a total of 144 burn patients were admitted to the ICU of the East Center of Burns Treatment and Reconstructive Surgery, of whom 62 died (43.1%). The group was 75% male with an average age of 52 years. Most patients presented with third-degree burns (93.1%), and inhalation injury was identified in 41.0% of cases. The median length of stay was 26 days.

Univariate Analysis

The univariate comparison of characteristics between surviving and non-surviving patients is summarized in **Table 1**. Patients who did not survive were older (59.2 years vs 46.5 years), presented more frequently with respiratory tract burn injury (59.7% vs 26.8%), underwent endotracheal intubation on-site more often (54.8% vs 37.8%), and were more likely to require renal replacement therapy (53.2% vs 22.0%). Non-survivors also had higher median TBSA (42.3% vs 35.3%) and

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Table 1. Clinical characteristics of all patients treated in the burns intensive care unit and a comparative analysis between the surviving and non-surviving groups.

Variable	All cases (N=144)	Survivors (n=82)	Non-survivors (n=62)	*P* value
Year, n (%)				
2018	28 (19.4)	10 (12.2)	18 (29.0)	0.068
2019	20 (13.9)	10 (12.2)	10 (16.1)	
2020	19 (13.2)	11 (13.4)	8 (12.9)	
2021	40 (27.8)	28 (34.2)	12 (19.4)	
2022	37 (25.7)	23 (28.0)	14 (22.6)	
Sex, n (%)				
Male	108 (75.0)	61 (74.4)	47 (75.8)	0.846
Female	36 (25.0)	21 (25.6)	15 (24.2)	
Age (years), mean (SD)	52.0 (18.3)	46.5 (17.0)	59.2 (17.4)	<0.001
Third-degree burns, n (%)	134 (93.1)	75 (91.5)	59 (95.2)	0.387
Respiratory tract burn injuries, n (%)	59 (41.0)	22 (26.8)	37 (59.7)	<0.001
Intubation, n (%)				
No	20 (13.9)	17 (20.7)	3 (4.8)	0.004
At the scene	65 (45.1)	31 (37.8)	34 (54.8)	
In another hospital	26 (18.1)	19 (23.2)	7 (11.3)	
In the intensive care unit of a burn center	33 (22.9)	15 (18.3)	18 (29.1)	
Extubation, n (%)	59 (41.0)	53 (64.6)	6 (9.7)	<0.001
Renal replacement therapy (0-14 days), n (%)	51 (35.4)	18 (22.0)	33 (53.2)	<0.001
Duration of hospital stay, median (IQR)	26.0 (12.0-46.5)	23.0 (10.0-48.0)	26.5 (13.0-45.0)	0.449
TBSA (in%), median (IQR)	38.5 (23.5-55.0)	35.3 (20.0-49.0)	42.3 (28.0-60.0)	0.014
ABSI, median (IQR)	7 (6-9)	7.0 (5.0-8.0)	8.0 (7.0-9.0)	<0.001
Rev. BAUX, mean (SD)	91.6 (23.6)	82.4 (22.9)	103.9 (18.4)	<0.001
BUMP, mean (SD)	-1.7 (1.8)	-2.3 (1.8)	-1.0 (1.5)	<0.001
Probability of death BUMP, median (IQR)	13.0 (5.7-37.3)	8.5 (3.1-22.1)	26.7 (11.7-52.5)	<0.001
BOBI, mean (SD)	3.7 (2.0)	2.8 (1.6)	4.8 (1.7)	<0.001

Abbreviations: SD, standard deviation; IQR, interquartile range; TBSA, total body surface area; ABSI, Abbreviated Burn Severity Index; Rev. Baux, revised Baux; BUMP, Burn Mortality Prediction; BOBI, Belgium Outcome in Burn Injury.

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Table 2. Descriptive statistical results on laboratory test results and a comparative analysis between the surviving and non-surviving groups of patients.

Variable	All cases (N=144)	Survivors (n=82)	Non-survivors (n=62)	*P* value
Lactate value 0 h (mmol/L), median (IQR)	2.4 (1.7; 3.8)	2.2 (1.5; 3.5)	2.8 (1.8; 4.6)	0.097
Lactate value 24 h (mmol/L), median (IQR)	1.8 (1.2; 3.0)	1.7 (1.1; 2.4)	2.1 (1.4; 3.2)	0.091
Lactate value 48 h (mmol/L), median (IQR)	1.4 (0.9; 1.9)	1.2 (0.9; 1.7)	1.4 (1.0; 2.0)	0.068
Lactate value change after 24 h (%), median (IQR)	-24.0 (-46.4; 9.0)	-23.5 (-46.3; 13.6)	-26.1 (-46.7; 8.0)	0.977
Lactate value change after 48 h (%), median (IQR)	-44.7 (-65.6; -25.9)	-51.3 (-63.1; -23.5)	-39.5 (-66.7; -25.9)	0.760
Base excess 0 h (mEq/L), mean (SD)	-5.3 (5.8)	-4.5 (5.5)	-6.5 (6.1)	0.039
Base excess 24 h (mEq/L), median (IQR)	0.1 (-3.2; 2.2)	0.3 (-2.3; 2.1)	-0.1 (-4.4; 2.4)	0.257
Base excess 48 h (mEq/L), median (IQR)	3.7 (1.5; 5.4)	3.8 (1.9; 5.3)	3.5 (1.0; 5.5)	0.567
Base excess change after 24 h (%), median (IQR)	82.7 (40.0; 134.1)	83.1 (37.2; 137.0)	79.2 (47.1; 131.3)	0.771
Base excess change after 48 h (%), median (IQR)	144.2 (97.0; 242.8)	143.7 (83.3; 213.8)	146.3 (107.4; 262.5)	0.192
Platelet count 0 h (thousand/µL), median (IQR)	226.5 (172.0; 283.5)	219.5 (160.0; 273.0)	231.5 (178.0; 299.0)	0.290
Platelet count 24 h (thousand/µL), median (IQR)	172.0 (132.0; 219.0)	174.0 (124.0; 220.0)	170.5 (134.0; 206.0)	0.921
Platelet count 48 h (thousand/µL), median (IQR)	121.0 (93.5; 158.0)	124.5 (96.0; 163.0)	118.0 (90.0; 154.0)	0.583
Platelet count change after 24 h (%), median (IQR)	-21.9 (-37.8; -10.4)	-19.7 (-35.1; -8.6)	-22.6 (-41.2; -13.1)	0.279
Platelet count change after 48 h (%), median (IQR)	-40.0 (-55.9; -22.0)	-38.3 (-54.2; -18.8)	-41.7 (-57.1; -30.1)	0.110
Creatinine value 0 h (mg/dL), median (IQR)	0.9 (0.8; 1.3)	0.9 (0.8; 1.3)	1.0 (0.8; 1.3)	0.939
Creatinine value 24 h (mg/dL), median (IQR)	1.0 (0.8; 1.5)	1.0 (0.8; 1.4)	1.0 (0.8; 1.5)	0.694
Creatinine value 48 h (mg/dL), median (IQR)	0.8 (0.7; 1.2)	0.8 (0.6; 1.2)	0.9 (0.7; 1.4)	0.012
Creatinine value change after 24 h (%), median (IQR)	0.9 (-16.4; 22.5)	-3.8 (-16.4; 20.7)	6.1 (-14.8; 28.3)	0.306
Creatinine value change after 48 h (%), median (IQR)	-9.3 (-28.4; 18.0)	-14.9 (-32.7; 4.5)	5.6 (-18.9; 33.7)	0.002
Sodium 5 day (mmol/L), median (IQR)	142.1 (136.0; 147.0)	140.4 (137.4; 146.5)	143.5 (139.7; 147.4)	0.077
Sodium 10 day (mmol/L), median (IQR)	144.0 (138.3; 148.2)	140.6 (137.5; 147.2)	145.0 (139.5; 149.0)	0.034
Sodium change after 10 days (%), median (IQR)	0.8 (-4.1; 4.7)	0.4 (-4.1; 4.4)	2.0 (-4.1; 5.1)	0.424

Abbreviation: IQR, interquartile range.

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Table 3. Logistic regression analysis evaluating the impact of selected factors to predict mortality in patients treated in the intensive care unit.

Variable	B	SE	OR	95% CI	*P*
Age	0.08	0.02	1.08	1.04-1.12	<0.001
TBSA	0.07	0.01	1.07	1.04-1.1	<0.001
Inhalation injury	1.32	0.48	3.76	1.46-9.66	0.006
Intubation at the scene*	1.60	0.90	4.95	0.87-28.1	0.076
Intubation in another hospital*	1.71	0.97	5.52	0.83-36.7	0.079
Intubation in the ICU*	1.64	0.91	5.13	0.85-30.9	0.077

* Indicates reference variable, no intubation. Abbreviations: B, regression coefficient; SE, standard error; OR, odds ratio; ICU, intensive care unit; TBSA, total body surface area.

ABSI scores (8.0 vs 7.0). Similarly, higher mean revised BAUX (103.9 vs 82.4), BUMP (-1.0 vs -2.3), and BOBI (4.8 vs 2.8) scores were observed among non-survivors.

Laboratory parameters assessed in the univariate analysis showed significant differences in creatinine levels on day 2 after admission (0.9 vs 0.8) and sodium levels on day 10 (145.0 vs 140.6). A significant change in creatinine levels between admission and day 2 was also noted among non-survivors (5.6 vs -14.9). No additional significant differences were identified. Detailed data is presented in **Table 2**.

Multivariable and ROC Analysis

In the baseline clinical multivariable logistic regression model, age, TBSA, and inhalation injury remained independently associated with mortality. Increasing age and TBSA were associated with a higher risk of death, while the presence of inhalation injury significantly increased mortality risk. Intubation variables showed elevated odds ratios; however, their statistical significance was attenuated after adjustment for other clinical variables (**Table 3**). The Hosmer-Lemeshow goodness-of-fit test did not indicate poor model fit (χ^2=14.11, df=8, *P*=0.079).

The baseline clinical model demonstrated excellent discriminative ability, with an AUROC of 0.87 (95% CI, 0.81-0.93). In separate logistic regression models, each prognostic scoring system was significantly associated with mortality. The revised BAUX score demonstrated the highest discriminative ability (AUROC 0.86; 95% CI, 0.80-0.92), followed by BUMP (AUROC 0.83; 95% CI, 0.76-0.89) and BOBI (AUROC 0.83; 95% CI, 0.76-0.89). The ABSI score showed moderate performance (AUROC 0.78; 95% CI, 0.70-0.85), whereas TBSA and creatinine at 48 hours demonstrated lower predictive value (AUROC 0.68 and 0.63, respectively). Pairwise comparisons of AUROC values using the DeLong test showed no statistically significant difference between BOBI and revised BAUX scores (*P*=0.185),

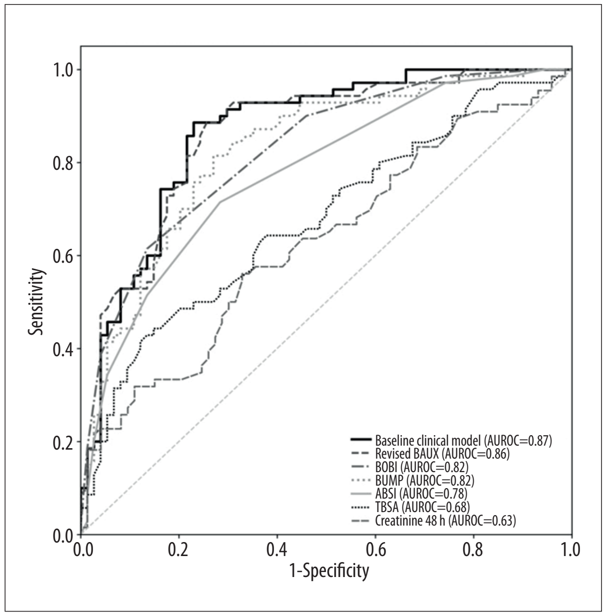

Figure 1. Receiver operating characteristic (ROC) curves for the baseline clinical model and prognostic scores in predicting in-hospital mortality among patients with severe burns. Abbreviations: TBSA, total body surface area; ABSI, Abbreviated Burn Severity Index; BUMP, Burn Mortality Prediction; BOBI, Belgium Outcome in Burn Injury.

nor between BOBI and BUMP (*P*=0.998). However, the revised BAUX score performed significantly better than ABSI (*P*<0.001) and TBSA (*P*<0.001). When compared with the baseline clinical model, no statistically significant differences were observed for the revised BAUX score (*P*=0.526), while the baseline model demonstrated superior performance compared with ABSI (*P*=0.0009). Findings are presented in **Figure 1**. For clarity, AUROC values are also presented in **Table 4**.

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

Table 4. Diagnostic performance assessment of prognostic models and scores (receiver operating characteristic analysis with pairwise comparisons).

Score	AUC (95% CI)	*P* value	Comparison (DeLong)
Baseline clinical model	0.87 (0.81-0.93)	<0.001	Reference
Rev. BAUX	0.86 (0.80-0.92)	<0.001	vs baseline: *P*=0.526
BOBI	0.83 (0.76-0.89)	<0.001	vs Rev. BAUX: *P*=0.185
BUMP	0.83 (0.76-0.89)	<0.001	vs BOBI: *P*=0.998
ABSI	0.78 (0.70-0.85)	<0.001	vs Rev. BAUX: *P*<0.001
TBSA	0.68 (0.59-0.76)	0.012	vs Rev. BAUX: *P*<0.001
Creatinine 48 h	0.63 (0.53-0.72)	0.010	vs Rev. BAUX: *P*<0.001

Abbreviations: TBSA, total body surface area; ABSI, Abbreviated Burn Severity Index; Rev. Baux, revised Baux; BUMP, Burn Mortality Prediction; BOBI, Belgium Outcome in Burn Injury.

These findings indicate that both the baseline clinical model and selected composite scores, particularly the revised BAUX, BOBI, and BUMP scores, provide strong and comparable predictive performance.

Discussion

Despite advances in the care of patients with severe burns, their prognosis still depends on many factors, such as the extent of the injury, age, the presence of inhalation trauma, and comorbidities. Effective assessment of mortality risk is crucial for making treatment decisions and allocating medical resources [6,8].

Our analysis, consistent with that of Lip et al [9] and Brusselaers et al [10], suggests that men are at greater risk of burns, likely due to occupational exposure. Furthermore, the mean age of patients in our study was 52 years, with non-survivors being older (59.2 vs 46.5 years), confirming that age is a significant risk factor for mortality among patients with severe burns. This may be due to poorer regenerative capacity of the body and a higher incidence of comorbidities (with emphasis on heart disease, diabetes, and chronic obstructive pulmonary disease) [11]. Heng et al demonstrated that comorbidities assessed using the Charlson Comorbidity Index are independent predictors of mortality [12]. A further difficulty faced by this older population, one that may contribute to poorer outcomes, is the tendency toward extended hospital stays. In addition, burn injuries often necessitate lengthy and complex psychological and mental rehabilitation, which can continue long after discharge and may further influence overall recovery and survival [13].

There was also a high percentage of patients with respiratory tract burns (41.0%), which were significantly more common in the group of people who died (59.7% vs 26.8%). Haddadi et al reported that inhalation burns are one of the main predictors of death [3]. Although some investigators have sought to develop an optimal grading system for inhalation injury severity, no scale has yet been validated or widely adopted across burn centers [14,15]. Although existing scoring systems account for the presence of inhalation injury, they typically apply a uniform score without distinguishing degrees of severity. To address this limitation, Yamamoto et al incorporated additional factors, including whether the injury occurred in a closed space, whether it was self-inflicted, the severity of bronchoscopy findings, and the need for mechanical ventilation, to develop a more reliable severity grading scale (modified ABSI), which may prove more applicable in patients with burn-related inhalation injuries [16]. Patients who did not survive had a higher rate of on-scene intubation and were more likely to require renal replacement therapy within the first 14 days of hospitalization. On-scene endotracheal intubation was a significant factor in increasing mortality. Furthermore, a significantly larger burn surface area was observed in this group. An Israeli study by Duek et al confirms our findings, indicating that prehospital intubation increases the risk of death and pneumonia in patients with body burns [17]. The high rate of respiratory tract burns in the analyzed group and their significant impact on mortality indicate the need for early diagnosis of inhalation injuries and aggressive respiratory support.

Our findings showed that mortality in the group of patients with severe burns hospitalized in the ICU was high, at 43.1%, which is higher than that reported in other studies of burn patients. In the study by Lip et al conducted in Malaysia, the mortality rate was 11.8% [8], while in the study by Yoshimura et al, conducted in Japan on a sample of 7911 patients, the mortality rate was 10.7% [6]. In the European study by Brusselaers et al, the mortality rate ranged from 1.4% to 18% [10]. Most

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

studies report mortality rates for the overall population of burn patients treated in burn centers, without distinguishing the most severe cases requiring intensive care. The higher mortality rate in our study may be due to the analysis of cases treated exclusively in the ICU (which represents only one-fifth of the inpatients in our burn center) and the high percentage of patients with respiratory tract burns, considered a key risk factor for death [14]. In a study conducted in Brazil involving 293 severely burned patients treated in the ICU, the reported mortality rate was 32.8% [18]. Similar to the present investigation, that study focused exclusively on patients admitted to the ICU. However, when comparing the severity profile of the study group, our cohort presented with substantially more extensive burns (38.5% vs 26.6% TBSA), a markedly higher prevalence of inhalation injury (41% vs 31.4%), more frequent need for renal replacement therapy, and, importantly, a considerably higher mean age (52 vs 38 years). The profile of the most severe injuries treated in our center is also reflected in the length of stay. The mean duration of hospitalization in our cohort was 26 days, which was substantially longer than that in the study by Zhang et al, in which the average length of stay ranged from 6 to 14 days [4]. The high mortality rate observed in our center reflects the predominance of extremely severe burn cases, in which, according to established prognostic factors, the probability of survival is inherently low.

Brusselaers et al described a significant increase in mortality in patients with burns above 20% TBSA, and the TBSA in those who died ranged from 44% to 55% [10]. Numerous other studies in the literature confirm that TBSA is a significant risk factor for death in patients with burns [6,9,10,19]. In addition to burn extent, burn depth is a critical determinant of clinical outcomes. In our cohort, full thickness burns were identified in more than 93% of patients. Evidence from a U.S. study showed that the proportion of full thickness burns independently and significantly increases the risk of mortality [20].

Among laboratory test results, creatinine levels 48 hours after admission, as well as the dynamics of creatinine changes, deserve particular attention as factors influencing mortality in patients with burns. The analysis shows that a rise in creatinine levels was significantly associated with an increased risk of death. Similar findings regarding the predictive value of this parameter were made by Rehou and Jeschke [21] and Yoon et al [22].

In the present study, both the baseline clinical model and composite prognostic scores demonstrated good discriminatory ability in predicting mortality among patients with severe burns. Notably, the baseline model, based on readily available clinical variables such as age, TBSA, and inhalation injury, achieved predictive performance comparable to the best-performing scoring systems within this cohort.

Among the evaluated scores, the revised BAUX score demonstrated the highest AUROC. However, differences between revised BAUX, BOBI, and BUMP scores were not statistically significant. These findings suggest that although some scores may appear superior descriptively, their clinical performance is largely comparable. Yoshimura et al found that the BAUX score, ABSI, and revised BAUX score had the best predictive ability, with the Baux score found to be the most optimal for the Japanese population [6]. There are some studies in the literature analyzing the prognostic value of various tools in predicting mortality in patients with severe body burns from different continents [6,9,23]. According to researchers in the United States, the identified correlations between revised Baux and BOBI scores and increased mortality risk highlight the clinical usefulness of these scoring systems in guiding treatment strategies and resource allocation [24]. Prasad et al reported that the revised Baux score demonstrated strong discriminatory value in predicting outcomes among burn patients [25].

The importance of predictive models requires a system characterized by simplicity with acceptable sensitivity and specificity. This makes it challenging to identify a tool that is both straightforward and consistently reliable. Selecting an appropriate prognostic method remains particularly demanding, as it must align with the burn center profile, clinical capacities, and regional variations in epidemiology and outcomes. These considerations highlight the necessity for further large-scale, preferably multicenter, comparative studies to refine and validate prognostic approaches in burn care [26,27].

Our findings highlight that simplified scoring systems such as the revised Baux or BOBI remain clinically useful due to their ease of application, but their apparent superiority should be interpreted with caution. From a practical perspective, our results suggest that both structured scoring systems and well-constructed clinical models can be effective. The choice of tool can therefore depend on clinical context, availability of data, and ease of implementation rather than clear superiority of one model over another.

Although the baseline clinical model is not as immediately bedside-friendly as point-based scores, it can still be used to estimate individual mortality risk through the logistic regression equation. In this approach, patient-specific values of age, TBSA, and inhalation injury are entered into the model to obtain a predicted probability of death. Therefore, the baseline model may represent a promising prognostic tool, particularly when implemented as a calculator or nomogram. However, established point-based scores remain easier to apply in routine bedside practice.

Study Limitations

The limitations of our study include its retrospective design and the fact that it was conducted in single center, which may

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

introduce selection bias and limit the generalizability of our findings. The study population represents a highly selected cohort of critically ill patients, which can limit the generalizability of the findings to less severe burn populations. The relatively small sample size may increase the risk of overfitting, particularly in multivariable analyses. Additionally, our database lacks complete information on patient comorbidities, restricting the ability to incorporate this variable into the analysis. Prospective studies could provide more robust and accurate data regarding the influence of therapeutic interventions or comorbidities on mortality outcomes.

Moreover, the regional character of the cohort limits the broader novelty of the findings, as the results may not fully reflect differences in burn care practices across other health systems or geographic settings. Importantly, while BOBI, ABSI, and revised BAUX scores all incorporate similar core variables, differences in predictive performance may arise from variations in weighting schemes and categorization thresholds. The slightly higher performance observed for specific models in this study may reflect better calibration to the characteristics of the analyzed population rather than a fundamentally superior model structure. Alternatively, given the lack of statistically significant differences between the highest-performing scores, these variations may also represent random fluctuations related to sample size.

Conclusions

Our findings confirm that both baseline clinical variables and composite prognostic scores provide meaningful support in assessing mortality risk in patients with severe burns. The baseline clinical model, based on age, TBSA, and inhalation injury, demonstrated excellent predictive performance comparable to the best-performing scoring systems. Among the evaluated tools, the revised BAUX score achieved the highest discriminatory ability. However, differences between revised BAUX, BOBI, and BUMP scores were not statistically significant, suggesting comparable clinical utility.

These findings indicate that simple clinical models may serve as effective alternatives for mortality prediction, particularly when implemented as calculators or nomograms. At the same time, established scoring systems remain valuable due to their simplicity and ease of bedside application. Further refinement of mortality prediction methods and better integration of coordinated multidisciplinary burn care remain essential. Multicenter prospective studies are needed to validate these observations and determine their applicability across different healthcare settings.

Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

References:

1. Yakupu A, Zhang J, Dong W, et al. The epidemiological characteristic and trends of burns globally. BMC Public Health. 2022;22(1):1596
2. Nickel KJ, Omeis T, Papp A. Demographics and clinical outcomes of adult burn patients admitted to a single provincial burn centre: A 40-year review. Burns. 2020;46(8):1958-67
3. Haddadi S, Parvizi A, Niknama R, et al. Baseline characteristics and outcomes of patients with head and neck burn injuries; A cross-sectional study of 2181 cases. Arch Acad Emerg Med. 2020;9(1):e8
4. Zhang Y, Su J, Liu Y, et al. Epidemiological and clinical characteristics of burns in adults: A 6-year retrospective study in a major burn center in Suzhou, China. Front Public Health. 2024;12:1413986
5. Obed D, Salim M, Dastagir N, et al. Comparative analysis of composite mortality prediction scores in intensive care burn patients. Int J Environ Res Public Health. 2022;19(19):12321
6. Yoshimura Y, Saitoh D, Yamada K, et al. Comparison of prognostic models for burn patients: A retrospective nationwide registry study. Burns. 2020;46(8):1746-55
7. Vandenbroucke JP, von Elm E, Altman DG, et al; STROBE Initiative. Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): Explanation and elaboration. PLoS Med. 2007;4(10):e297
8. Mrad MA, Al Qurashi AA, Shah Mardan QNM, et al. Risk models to predict mortality in burn patients: A systematic review and meta-analysis. Plast Reconstr Surg Glob Open. 2022;10(12):e4694
9. Lip HTC, Idris MAM, Imran FH, et al. Predictors of mortality and validation of burn mortality prognostic scores in a Malaysian burns intensive care unit. BMC Emerg Med. 2019;19(1):66
10. Brusselaers N, Monstrey S, Vogelaers D, et al. Severe burn injury in Europe: A systematic review of the incidence, etiology, morbidity, and mortality. Crit Care. 2010;14(5):R188
11. Forbinake NA, Ohandza CS, Fai KN, et al. Mortality analysis of burns in a developing country: A Cameroonian experience. BMC Public Health. 2020;20(1):1269
12. Heng JS, Clancy O, Atkins J, et al. Revised Baux Score and updated Charlson comorbidity index are independently associated with mortality in burns intensive care patients. Burns. 2015;41(7):1420-27
13. Harats M, Ofir H, Segalovich M, et al. Trends and risk factors for mortality in elderly burns patients: A retrospective review. Burns. 2019;45(6):1342-49
14. You K, Yang HT, Kym D, et al. Inhalation injury in burn patients: Establishing the link between diagnosis and prognosis. Burns. 2014;40:1470-75
15. Walker PF, Buehner MF, Wood LA, et al. Diagnosis and management of inhalation injury: An updated review. Crit Care. 2015;19:351
16. Yamamoto R, Shibusawa T, Aikawa N, Sasaki J. Modified abbreviated burn severity index as a predictor of in-hospital mortality in patients with inhalation injury: Development and validation using independent cohorts. Surg Today. 2021;51(2):242-49
17. Duek OS, Ben Naftali Y, Bar-Lavie Y, et al. Pneumonia risk in urgently intubated burn patients. Isr Med Assoc J. 2018;20(12):737-40
18. Queiroz LF, Anami EH, Zampar EF, et al. Epidemiology and outcome analysis of burn patients admitted to an Intensive Care Unit in a University Hospital. Burns. 2016;42(3):655-62
19. Nickel KJ, Omeis T, Papp A. Demographics and clinical outcomes of adult burn patients admitted to a single provincial burn centre: A 40-year review. Burns. 2020;46(8):1958-67

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]

20. Atkins K, Schneider A, Rodriguez C, et al. The predictive probability of mortality in the presence of full-thickness burns. Am J Surg. 2023;225(4):793-99
21. Rehou S, Jeschke MG. Admission creatinine is associated with poor outcomes in burn patients. Burns. 2022;48(6):1355-63
22. Yoon J, Kym D, Won JH, et al. Trajectories of longitudinal biomarkers for mortality in severely burned patients. Sci Rep. 2020;10(1):16193
23. Nasution RB, Abdi Tarigan U, Bietra Buchari F. Comparison of assessment of Abbreviated Burn Severity Index (ABSI) and Belgian Outcome of Burn Injury (BOBI) at H. Adam Malik General Hospital. Sumat. Med. J. 2022;5(1):1-17
24. Rahimpour A, Fox N, Kahley G, et al. Burn Mortality in an Appalachian Referral Center: An examination of mortality prediction scores in a 13-year retrospective study. Cureus. 2024;16(6):e62912
25. Prasad A, Thode HC Jr., Singer AJ. Predictive value of quick SOFA and revised Baux scores in burn patients. Burns. 2020;46(2):347-51
26. Zieliński M, Wróblewski P, Kozielski J. Prognostic factors in patients with burns. Anaesthesiol Intensive Ther. 2020;52(4):330-35
27. Chen H, Wu X, Zou L, et al. A comparative study of the predictive value of four models for death in patients with severe burns. Burns. 2024;50(3):550-60

Indexed in: [Current Contents/Clinical Medicine] [SCI Expanded] [ISI Alerting System] [ISI Journals Master List] [Index Medicus/MEDLINE] [EMBASE/Excerpta Medica] [Chemical Abstracts/CAS]