

ORIGINAL ARTICLE

Assessment of Abbreviated Burn Severity Index Scoring System for Predicting Mortality Outcome in Burns at Kirtipur Hospital

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ABSTRACT

Introduction: Global burn incidence is disproportionately high in low- and middle-income countries, with Southeast Asia serving as an “epicenter” for fire-related deaths. Clinicians frequently face challenges in predicting patient outcomes upon initial presentation, necessitating the use of validated scoring systems. This study evaluates the validity of the Abbreviated Burn Severity Index (ABSI) for predicting mortality at Kirtipur Hospital, Nepal.

Method: This observational study reviewed 800 burn in-patients admitted between July 2024 and June 2025. A pre-formatted ABSI proforma was utilized for data collection. Statistical analyses, including univariate and multivariate logistic regression and ROC analysis were performed to identify independent mortality predictors and determine the Lethal Area 50 (LA50).

Result: The overall mortality rate was 11.1% (89 deaths). Inhalation injury (OR=14.74) and full-thickness burns (OR=9.06) were the most significant independent predictors of death. While the ABSI score demonstrated excellent univariate discrimination (AUC=0.904), its multivariate contribution was attenuated (OR=0.88, p=0.74), suggesting the score largely captures severity already reflected by TBSA and burn depth. The LA50 point estimate was 47.43% TBSA. Mortality risk stratified by ABSI scores ranged from 9.03% (score ≤10) to 100% (score ≥14).

Conclusion: The ABSI is a reliable tool for risk stratification in the local Nepalese context but provides limited independent prognostic information beyond core clinical variables like inhalation injury. Developing locally calibrated models or adopting modified scoring systems is recommended to improve bedside accuracy for family counseling and resource allocation

Keywords: ABSI, burn mortality, inhalation Injury, TBSA, nepal, LA50.

INTRODUCTION

Of the global annual incidence of 11 million burns about 95-96% incidents happen in low- and middle-income countries (LMICs).^{1,2} Southeast Asia is considered the “epicenter of burn injuries” because more than half of these occur in this region alone.³ The Ministry of Health, Nepal, reported an annual

incidence of 55,902 burn injuries with 2,100 deaths.⁴ In developing countries, several factors play a pivotal role: Time to care, pre-existing conditions, infection and sepsis, surgical intervention.⁵ ABSI is commonly used to predict the mortality outcome.⁶ In any Burns patient, ABSI sums up the allocated numerical value to five variables: age, percentage of total body surface area burned, presence of a full-thickness burn, gender

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and presence of inhalation injury; and the resultant score is graded to categorize the burn outcome. The objective of this article is to assess the validity of ABSI Scoring System for admitted burns patients at Kirtipur Hospital.

METHODS

This was a retrospective study conducted at the Department of Burn, Plastic and Reconstructive Surgery in Kirtipur Hospital over a 12-month time period. Ethical clearance was obtained from the Institutional Review Committee. All burns patients admitted to Kirtipur Hospital (1st July 2024 to 30th June 2025) were included. Chart review of all patients done. The inpatient number from the patient’s record was used for data entry and analysis. Minor burns, OPD patients, Day Care surgical cases and patients with incomplete data were excluded. Anonymized data, without any names, was retrieved. A pre-formatted ABSI proforma was used for data collection. Data was tabulated in MS Excel 2024 and Analyses were performed in Python (‘Statsmodels 0.14.5’ for logistic regression and ‘Scikit-learn v1.7.2’ for ROC analysis).

RESULTS

An analysis of 802 burn patients was done. There was 89 death, mortality rate of 11.%.During Data Cleaning, it was noted that Age had two missing values; therefore, ABSI-only model used in 802 participants and full multivariable model used 800 participants.

Table 1 presents the baseline characteristics of 802 patients, comparing those who survived (n=713) with those who died (n=89). On average, patients who died were older (mean age 41.4 vs. 28.3) and had significantly more severe burns, as indicated by a mean Total Body Surface Area (TBSA%) of 40.9% compared to 14.4% for survivors. This increased severity is also reflected in the Abbreviated Burn Severity Index (ABSI), which averaged 9.1 for the deceased group versus 4.9 for survivors. Additionally, the deceased group had a higher proportion of females (60.7% vs. 43.1%) and much higher rates of critical injury markers, with 97.8% suffering from full-thickness burns and 55.1% experiencing inhalation injuries, compared to 52.0% and 3.8% respectively in the survivor group.

Table 1: Baseline characteristics of all participants

Predictor	OR (95% CI)	p-value	N
Age (per year)	1.02 (1.01–1.03)	<0.001	800
Sex (Female vs Male)	2.040 (1.300–3.20)	0.0019	802
TBSA% (per 1%)	1.10 (1.08–1.11)	<0.001	802
Burn thickness=1 vs 0	40.10 (9.80–164.16)	<0.001	802
Inhalation=1 vs 0	31.12 (17.64–54.91)	<0.001	802
ABSI (per unit)	2.09 (1.82–2.39)	<0.001	802

Table 2 provides the results of a univariable logistic regression analysis identifying individual clinical and demographic predictors of mortality in a cohort of approximately 802 patients. The data reveals that burn thickness (Full-thickness vs. Partial) is the most significant single risk factor, with an Odds Ratio (OR) of 40.10, indicating a massive increase in the likelihood of death for patients with deeper burns. Similarly, the presence of an inhalation injury significantly increases the risk of mortality, with an OR of 31.12.

Other clinical metrics also show strong statistical associations with mortality; specifically, every 1% increase in TBSA increases the odds of death by a factor of 1.10, and each one-unit increase in the ABSI score more than doubles the risk (OR 2.09). Demographic factors further influence outcomes, as female patients are twice as likely to experience mortality compared to males (OR 2.040), and advancing age carries a consistent, incremental risk of 1.02 per year. All six predictors analyzed in this table achieved high statistical significance, with p-values of 0.0019 or less

Table 2. Univariable logistic regression for mortality

Predictor	OR (95% CI)	p-value	N
ABSI (per unit)	0.88 (0.43–1.83)	0.739	800
TBSA% (per 1%)	1.07 (1.00–1.15)	0.056	800

Predictor	OR (95% CI)	p-value	N
Inhalation=1 vs 0	14.74 (5.29–41.10)	<0.001	800
Burn thickness=1 vs 0	9.06 (1.67–48.98)	0.011	800
Sex (Female vs Male)	1.40 (0.54–3.60)	0.489	800
Age (per year)	1.03 (1.00–1.07)	0.083	800

Table 3 presents an exploratory multivariable logistic regression analysis conducted on a cohort of 800 patients to determine the independent impact of various clinical factors on mortality. The analysis identifies inhalation injury as the most dominant independent predictor, with an Adjusted Odds Ratio (OR) of 14.74, meaning patients with inhalation injuries are nearly 15 times more likely to face mortality when controlling for other variables ($p < 0.001$). Full Burn thickness also remains a highly significant independent risk factor with an OR of 9.06 ($p = 0.011$). In contrast, factors that were significant in univariable models show diminished impact in this multivariable context: TBSA% ($p = 0.056$) and age ($p = 0.083$) only show marginal significance, while sex ($p = 0.489$) and the ABSI score ($p = 0.739$) are not statistically significant independent predictors when other clinical covariates are included in the model.

Table 3. Exploratory multivariable logistic regression

Model	N	AUC	Brier	Calibration intercept	Calibration slope
ABSI-only	802	0.904	0.067	0.000	1.000
Full (ABSI + covariates)	800	0.932	0.056	-0.000	1.000

This evaluates the performance of two mortality prediction models—the ABSI-only model and a Full model incorporating ABSI plus additional covariates—demonstrating that while both are highly effective, the comprehensive approach offers superior predictive power. The ABSI-only model shows excellent discriminative ability with an AUC (Area Under the

Curve) of 0.904, but this is further improved in the Full model, which reaches an AUC of 0.932.

Additionally, the Full model achieves a lower Brier score (0.056 vs. 0.067), indicating that its mortality predictions are more accurate and have a lower overall error rate than the model relying solely on the ABSI score. Notably, both models exhibit perfect calibration, with intercepts of 0.000 and slopes of 1.000, confirming that the predicted mortality risks generated by these models perfectly match the actual observed outcomes in the patient population.

The Brier score measures the accuracy of mortality predictions by calculating the mean squared difference between the predicted probability of death and the actual outcome (whether the patient survived or died) and a lower Brier score indicates a more accurate model with less overall prediction error.

The point estimate Lethal Area 50 (LA 50) in the univariate logistic regression model calculated from this cohort of 802 total cases and 89 deaths, was 47.43% TBSA. The model indicates that the odds ratio for mortality increases by 1.097 for every additional 1% of TBSA burn. Additionally, the 95% confidence interval for this LA 50 estimate ranges from 43.11% to 51.76% TBSA.

DISCUSSION

A Health Professional attending burns patients is always challenged by the attendant's query about the eventual outcome of a burns patient upon initial presentation at the hospital. For this, there are numerous Burn Outcome Indices being practiced worldwide.⁷ Most notable among them are: the Baux Score, revised Baux score,⁸ Abbreviated Burn Severity Index (ABSI),⁹ Belgian Outcome of Burn Injury (BOBI) and Fatality by Longevity, APACHE II, Measured Extent of burn, and Sex (FLAMES).¹⁰ Tobiasen and colleagues introduced the ABSI in 1982.⁶ Since then, ABSI has been validated in multiple studies and is widely used for triage, clinical decision-making, and resource allocation in both developed and resource-limited settings.¹¹

The analysis of ABSI in this cohort observed a mortality rate of 11.1%. The univariate analysis identified inhalation injury and full-thickness burns as the

most significant independent predictors of mortality. Inhalation injury, in particular, presented a 31.03-fold increased risk of death in univariate models. This aligns with international meta-analyses which confirm that inhalation injury remains a dominant driver of poor outcomes and is also consistent with the long-standing consensus that inhalation injury independently increases death risk.¹² It is therefore included in major scores (ABSI and revised Baux). The “revised Baux” score (age + TBSA + inhalation injury) is widely used specifically because inhalation injury meaningfully shifts mortality risk at a given TBSA/age, consistent with this separation.¹³

When inhalation injury is present alongside full-thickness burns, the risk becomes multiplicative, showing an odds ratio (OR) of approximately 137. Consequently, early diagnostic measures like bronchoscopy and immediate respiratory support are vital for suspected cases.

The data reveals that burn depth (Full-thickness vs. Partial) is also a significant single risk factor, with an Odds Ratio (OR) of 40.10, indicating a massive increase in the likelihood of death for patients with deeper burns. For every 1% increase in TBSA increases the odds of death by a factor of 1.10, This data shows a steep mortality gradient by TBSA% and an extremely high univariable association for burn thickness (binary proxy for deeper burns). It matches the broader evidence base where burn size and depth reflect physiologic burden, infection risk, operative burden, and organ dysfunction risk.¹⁴ Many score comparison studies show that TBSA- and inhalation-based indices (ABSI, Baux/revised Baux, BOBI) remain among the best-performing parsimonious models, reinforcing that these key predictors are not “center-specific artifacts” but core burn epidemiology signals.¹⁵

The ABSI demonstrated excellent discriminative performance in this cohort, with an AUC-ROC ranging between 0.904 and 0.932. The system effectively stratified risk, showing a 100% mortality rate for patients with a score of 14 or above.⁹ A contemporary comparative analysis reports ABSI AUC around 0.904 (with confidence intervals in the high-0.8 to low-0.9 range), essentially mirroring the observed discrimination.¹⁶ Another burns ICU comparison paper

(in a Swiss ICU setting) reports strong performance for burn-specific scores including ABSI and revised Baux, with AUC values reported around the ~0.9 range.¹⁷ Many published comparisons explicitly evaluate multiple burn scores side-by-side (ABSI, BOBI, revised Baux, Ryan) using AUC and calibration-type assessments—mirroring the approach these results support.¹⁷

The multivariable model including ABSI plus its correlated constituents (age/ TBSA/depth/ inhalation proxies) showed attenuation of the ABSI coefficient. This is methodologically expected and consistent with how score-validation papers interpret such results: a composite score should be validated primarily as a single predictor (discrimination + calibration), while multivariable models should either be: compared score vs score (e.g., ABSI vs revised Baux), or compare components-only models vs score-based models, rather than mixing the score with overlapping components (to avoid multicollinearity/ over-adjustment). This does not contradict ABSI validity; it reflects model specification choices widely discussed in score validation literature.¹¹

Recent literature indicates that the classical Abbreviated Burn Severity Index (ABSI) tends to overestimate mortality in modern burn centers.¹⁸ A meta-analysis by Deng et al. in 2025 established a benchmark odds ratio (OR) of 1.72, this study’s univariate data showed a higher predictive strength with an OR of 2.09.¹¹ Notably, the significance of the ABSI score was attenuated in multivariate models (OR 0.88), suggesting that the score largely captures severity through simpler variables like TBSA and burn depth rather than providing unique independent prognostic information.

Clinical epidemiology studies define LA50 as the TBSA associated with 50% mortality probability and compute it via regression-based methods in adult burn cohorts.¹⁹ Kasenda S. et.al demonstrates an estimation of LA50 from TBSA–mortality data.²⁰ The LA 50 for this cohort was calculated at 47.43% and indicates that the odds of mortality increase by a factor of 1.097 for every 1% increase in TBSA. Even though, this cohort analysis show a strong mortality gradient by TBSA%, it demonstrates a very strong association for inhalation injury and burn thickness, which implies that a single

pooled LA50 may conceal important heterogeneity.¹²

Centers have used LA50 to describe improvement in burn care over time (increasing LA50 implies improved survival at larger burn size), reporting year-to-year LA50 changes.^{5,21} A recent cohort-based analysis explicitly evaluates LA50 and temporal shifts, positioning LA50 as a population-level marker influenced by demographics, mechanisms of injury, and health system capacity.²²

LA50 is strongly modified by pertinent factors: Age strata (e.g., pediatric, adult, older adult); Inhalation injury (0 vs 1), since it can substantially shift mortality at a given TBSA; Full thickness Burn (0 vs 1), because deeper burns increase physiologic burden and infection risk.²³ So, a Stratified LA50 is recommended.

The study's primary limitations involve statistical instability and confounding interactions that complicate the interpretation of individual risk factors. Approximately 70% of the cohort was aged 0 to 40 years, leading to less stable mortality estimates for the elderly (81+ years) due to a small sample size. The predictive power of age and TBSA was largely explained by their strong correlation with inhalation injury and burn thickness in multivariate analysis. Patient outcomes may be influenced by withdrawal from clinical care due to familial, social, or financial constraints, a common challenge in the regional context.

CONCLUSION

While the ABSI score demonstrates excellent predictive discrimination (AUC 0.904) and reliably distinguishes between high-risk and low-risk patients, its independent prognostic value is limited as it largely captures burn severity already measurable by TBSA and full-thickness burn variables. Because the combination of inhalation injury and full-thickness burns creates a massive multiplicative risk, clinicians should prioritize early diagnostic measures such as bronchoscopy, carboxyhemoglobin measurement, and respiratory support for suspected exposures

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