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Diagnostic Accuracy of the Modified ABSI Versus the Revised Baux Score for In-Hospital Mortality Prediction in Adult Burn Patients at a Tertiary Indonesian Burn Centre

Ilham Taufan Ikramiawan[1*], Abda Arif[2], Theodorus[3]

[1]Department of Surgery, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

[2]Department of Plastic Surgery, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

[3]Department of Pharmacology, Faculty of Medicine, Universitas Sriwijaya, Palembang, Indonesia

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***Corresponding author:**
Ilham Taufan Ikramiawan

E-mail address:
ilhamtaufan0@gmail.com

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A B S T R A C T

Introduction: Rapid bedside risk stratification of burn-injured patients informs intensive-care admission, fluid-resuscitation intensity, and timing of early surgical excision and grafting. The Modified Abbreviated Burn Severity Index (mABSI) and the Revised Baux (R-Baux) score are widely cited but have not previously been compared head-to-head in a Sumatran tertiary burn unit. **Methods:** STARD-aligned retrospective diagnostic-accuracy study of consecutive thermal-burn patients admitted to the Burn Unit, Dr. Mohammad Hoesin General Hospital Palembang (January–December 2025). Patients with concurrent major trauma or incomplete records were excluded. Both scores were calculated from medical records by an investigator blinded to the outcome. In-hospital mortality was the reference standard. Receiver-operating-characteristic, Wilson-CI sensitivity/specificity, DeLong AUC comparison, McNemar paired test, and Cohen's κ analyses were performed in SPSS v25 (α = 0.05). **Results:** Of 45 included patients (mean age 40.8 years; 77.8% male; 64.4% fire burns), 20 (44.4%) died. Optimal cutoffs were mABSI ≥ 5 (AUC 0.811, 95% CI 0.688–0.934; sensitivity 72.0%, specificity 75.0%, Youden 0.47) and R-Baux > 60 (AUC 0.808, 95% CI 0.678–0.938; sensitivity 52.0%, specificity 82.0%, Youden 0.34). Inter-test agreement was substantial (κ = 0.69, 95% CI 0.48–0.90; p < 0.001), with overall accuracy of 84.4% when R-Baux was treated as the comparator. **Conclusion:** Both scores discriminated burn mortality well; the Modified ABSI offered higher sensitivity and Youden index, supporting its evaluation as a primary triage tool in similar Indonesian tertiary burn units, while the Revised Baux retained complementary specificity for confirmatory risk classification.

1. Introduction

Burn injury remains a leading global cause of preventable death and long-term disability, with the World Health Organization estimating more than 180,000 deaths each year and a heavier per-capita burden in low- and middle-income countries (LMICs).[1,2] Beyond the headline mortality figures, burn injury accounts for an estimated eleven million presentations to medical attention annually and contributes substantially to global disability-adjusted life-years through scarring, contracture, amputation, post-traumatic stress disorder, and protracted rehabilitation. The economic toll is equally pronounced: prolonged inpatient stays, multiple operative interventions, intensive nutritional and rehabilitative support, and lifelong reconstructive needs combine to make severe burn one of the most resource-intensive forms of trauma encountered by surgical services worldwide.

Mortality from major burn in South-East Asia and South Asia exceeds that of high-income regions by an order of magnitude, driven by late presentation, transport delay, partial peripheral-hospital management, restricted intensive-care capacity, and constrained access to early excision, autografting and modern critical-care support.[3,4] Pakistani, Vietnamese, and Indian series consistently report inpatient mortality between 25% and 45% for hospitalised burn patients, in stark contrast to the 4–8% reported by contemporary North American and European registries. Within Indonesia, hospital-based series from Cipto Mangunkusumo Jakarta and Dr. Soetomo Surabaya report inpatient mortality of 25–35% for severe burns, broadly congruent with the 44% in-hospital mortality observed at Dr. Mohammad Hoesin General Hospital Palembang (RSMH) in the present cohort.[5-7] This high baseline mortality is not solely an indicator of disease severity; it also reflects the constrained surgical infrastructure typical of an Indonesian provincial referral centre, in which intensive-care beds, mechanical ventilators, blood-product availability, and operating-theatre time must be allocated dynamically across competing acute surgical demands.

Acute burn injury triggers a hyperinflammatory and hypermetabolic cascade — capillary leak driving burn shock, immune dysregulation predisposing to sepsis, and a persistent open wound surface that sustains catabolism and acts as a portal of entry for nosocomial pathogens. These mechanisms drive the late causes of burn mortality, principally sepsis, multiple-organ dysfunction syndrome, and acute respiratory distress syndrome.[1,8] Inhalation injury independently doubles or triples mortality across cohorts and is uniformly the strongest non-anatomical predictor.[9,10] Modern burn-surgery practice therefore emphasises early tangential excision and autografting, structured Surviving Sepsis After Burn Campaign source-control bundles, aggressive nutrition support, and graded mobilisation — interventions whose benefit is most apparent in patients accurately stratified for risk at admission. The clinical leverage afforded by accurate early stratification is therefore substantial: it informs not merely a probability of death but a sequence of operational decisions that together determine the trajectory of care.[11-13]

Many bedside risk-stratification scores have been proposed; the Abbreviated Burn Severity Index (1982) and the Revised Baux score (Osler 2010) remain the most widely cited.[14,15] The Modified ABSI, introduced by Bartels and colleagues in 2020, simplifies the original by retaining four parameters (age, %TBSA, full-thickness depth, inhalation injury) and removing gender; it has shown an area under the receiver-operating-characteristic curve (AUC) of 0.91 in derivation.[14] The Revised Baux sums age and %TBSA and adds 17 points for inhalation injury, with AUC values of 0.94–0.96 reported in the canonical Dutch and London validations and confirmed in a recent North American multicentre study.[15-17] Comparative methodologies have evolved in parallel — including Karimi's pediatric Baux derivation, Halgas's multi-score comparison framework, and Brusselaers's Belgian-Hungarian external-validation work — adding to a robust methodological lineage.[18-20] Head-to-head data are nonetheless scarce, particularly in Indonesia, where only one prior single-centre report has examined R-Baux at the national referral burn unit and none has compared it directly with the Modified ABSI.[6,7]

Three conceptual considerations make a direct head-to-head comparison particularly informative in the Indonesian setting. First, the case-mix at provincial Indonesian referral centres differs substantively from the cohorts in which both indices were derived: patients are younger, present later, are more frequently transferred from peripheral facilities with partial early management, and have a higher proportion of full-thickness involvement at admission. Second, intensive-care-bed availability is rate-limiting in most Indonesian provincial centres, which means that triage decisions rest more heavily on bedside-computable scores than on subsequent laboratory or radiological information that may not be available in real time. Third, the Modified ABSI explicitly incorporates burn depth — a surgical-decision variable absent from R-Baux — making its sensitivity advantage particularly relevant when full-thickness involvement is common.

RSMH Palembang serves as the tertiary referral burn centre for South Sumatra, admitting 92 burn patients during calendar year 2025 (35 with full-thickness involvement) and reporting an in-hospital mortality of 34% in its 2019–2021 series. The institution provides a representative example of a provincial Indonesian burn-care environment: a dedicated burn unit, an integrated plastic-surgery and burn-subspecialty service, and supporting intensive-care, anaesthesia, microbiology, nutrition, and rehabilitation services, but with the constrained throughput characteristic of a public-sector tertiary referral centre. The primary aim of this study was therefore to compare the diagnostic accuracy of the Modified ABSI and Revised Baux scores for predicting in-hospital mortality at RSMH Palembang. Secondary aims were to quantify inter-test agreement using Cohen's κ and to characterise the additive value of full-thickness depth as a discriminating variable. We hypothesised, a priori, that the Modified ABSI would demonstrate higher sensitivity than R-Baux owing to its inclusion of burn-depth information, while the two indices would show overall comparable discrimination as measured by AUC.

2. Methods

Study design and setting

This was a single-centre, retrospective, blinded diagnostic-accuracy study conducted at the Burn Unit, Department of Surgery, Dr. Mohammad Hoesin General Hospital, Palembang, the tertiary referral burn centre for South Sumatra Province, Indonesia. RSMH is a 1,011-bed government-operated tertiary teaching hospital affiliated with the Faculty of Medicine, Universitas Sriwijaya, and serves a catchment population of approximately 8.5 million people across Southern Sumatra. The Burn Unit operates as part of the Plastic and Reconstructive Surgery service and provides integrated burn-shock resuscitation, surgical excision and grafting, intensive-care support, microbiology-guided antimicrobial stewardship, structured nutrition support, and inpatient rehabilitation. The study was designed and reported in accordance with the STARD 2015 statement for diagnostic-accuracy research and the STROBE checklist for observational studies, and the QUADAS-2 risk-of-bias domains (patient selection, index test, reference standard, flow and timing) were considered during interpretation.

Patients and eligibility

Consecutive medical records of all patients admitted with acute thermal burn injury between 1 January 2025 and 31st December 2025 were screened. Inclusion criteria were: (i) admission diagnosis of acute burn injury irrespective of aetiology; (ii) availability of complete admission data for age, %TBSA, inhalation-injury status, and burn depth; and (iii) documented in-hospital outcome (alive at discharge or in-hospital death). Exclusion criteria were concomitant major trauma (poly-trauma) and incomplete records, preventing score calculation. The decision to exclude poly-trauma cases reflected the methodological aim of evaluating burn-specific scoring rather than composite trauma scoring; both indices were derived for isolated thermal burn and have not been validated in patients with substantive concurrent injury. Of 92 admissions, 47 were excluded (concurrent major trauma n = 18; incomplete records n = 29) and 45 patients formed the analytic sample, as illustrated in the patient-flow diagram (Figure 1).

Sample size calculation

Sample size was estimated using $n = Z^2\alpha \times P \times (1 - P) / \Delta^2$ for a single proportion with anticipated sensitivity P = 0.97 (based on Shah et al.), precision $\Delta = 0.05$, and $Z\alpha = 1.96$. The required minimum was 45 patients, which was satisfied.[21] Post hoc, with the observed sensitivities (72% for mABSI, 52% for R-Baux), the study had ~70% power to detect a 20-percentage-point difference in paired sensitivities at $\alpha = 0.05$ (McNemar exact); secondary estimates therefore carry wider confidence intervals than the planning calculation suggested. We deliberately anchored the planning sensitivity to a published external-validation estimate rather than to an internal pilot estimate, in order to provide a reproducible and externally defensible justification.

Burn-care pathway and operative management

All patients received structured care according to institutional burn protocol. On arrival, patients underwent rapid airway assessment using a structured ABCDE approach. Suspected inhalation injury — based on closed-space exposure, facial or oropharyngeal burn, carbonaceous sputum, hoarseness, or progressive stridor — prompted early endotracheal intubation, with fibreoptic bronchoscopy performed when available to confirm and grade airway injury. Modified Parkland fluid resuscitation (4 mL × kg × %TBSA Ringer's lactate over the first 24 hours, half delivered in the first 8 hours from injury) was titrated to target urine output of 0.5 mL × kg × hour in adults, with adjustment for inhalation injury, electrical injury, and delayed presentation. Multimodal analgesia, tetanus prophylaxis where indicated, and prophylactic antibiotics in selected high-risk patients were administered according to institutional protocol.

Operative management followed a structured early-excision pathway. Escharotomy was performed urgently for circumferential full-thickness extremity or torso burns at risk of compartment syndrome or restricted ventilation. Tangential excision with split-thickness autografting was the default surgical approach, performed at the discretion of the attending burn surgeon and typically within the first week of admission for full-thickness or deep-dermal burns. Donor sites were dressed with hydrocolloid or paraffin gauze, depending on availability. For very large burns where autograft donor sites were limited, staged excision with biological or synthetic temporary cover was used. Postoperative care included high-protein enteral nutrition support targeting 25–30 kcal/kg/day and 1.5–2.0 g protein/kg/day, structured silver-based dressing changes every 24–48 hours, sepsis surveillance per the 2023 Surviving Sepsis After Burn Campaign, multidisciplinary physiotherapy and occupational therapy, and pressure-garment therapy on healing wounds.[1,8,11,12,13,22]

Index tests: Modified ABSI and Revised Baux

The Modified ABSI was calculated as the sum of age category (1–5 points), inhalation-injury indicator (0/1), full-thickness burn indicator (0/1) and %TBSA category (1–10 points), giving a total range of 2–1714. The Revised Baux score was calculated as age (years) + %TBSA + 17 if inhalation injury was present (R = 1) or 0 otherwise.[15,17] For both indices, age was taken from the admission record; %TBSA was estimated using the Lund and Browder chart for patients aged less than 15 years and the Wallace rule of nines for older patients; burn depth was assessed by the attending burn surgeon at admission, refined intra-operatively at first excision, and the more accurate of the two assessments (typically the intra-operative finding, where available) was used; and inhalation-injury determination relied on clinical signs (carbonaceous sputum, hoarseness, facial burn, closed-space exposure) supplemented by fibreoptic bronchoscopy when performed. Both indices were derived independently by the principal investigator (ITI) blinded to outcome status during data abstraction; a 10% random sample was double-abstracted by the senior author (AA) with 100% concordance, supporting the reliability of the abstraction process.

Reference standard and outcome

The reference standard was in-hospital mortality, defined as death from any cause prior to hospital discharge. Patients transferred to other facilities for ongoing care were classified according to their final RSMH disposition. Early deaths (within 24 hours of admission) were retained in the analysis per international burn-registry convention, as their exclusion would systematically bias the discriminative performance of the scoring systems by removing the most severely injured patients on whom such systems are arguably most informative. Date and time of death were recorded for descriptive purposes; cause of death was abstracted where documented in the medical record.

Statistical analysis

Data were analysed with IBM SPSS Statistics for Windows, version 25 (IBM Corp., Armonk, NY). Continuous variables were summarised as mean ± SD or median (range) after Kolmogorov-Smirnov/Shapiro-Wilk normality testing. Categorical variables were summarised as n (%). Between-group comparisons used the independent-samples t-test (with Levene test for equality of variances) or Mann-Whitney U test for continuous data and Pearson x^2 or Fisher exact test for categorical data, as appropriate. Receiver-operating-characteristic (ROC) analysis identified optimal cutoffs by the Youden index. Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) were reported with Wilson 95% confidence intervals. Areas under the curve were compared by the DeLong test. Paired sensitivities and specificities were compared by McNemar's exact test, exploiting the within-patient nature of the comparison. Inter-test agreement was quantified by Cohen's κ with 95% CI; the prevalence- and bias-adjusted κ (PABAK) was reported as a sensitivity analysis to address the marginal-distribution skew that can deflate raw κ estimates in 2 × 2 tables. Effect sizes (rank-biserial correlation for non-parametric comparisons, Cohen's d for parametric comparisons) were reported alongside p-values throughout. All tests were two-sided; $p < 0.05$ was considered statistically significant. Multiple-comparison correction was not applied to the primary analyses, but the multiple-comparison concern is acknowledged in the limitations.

Quality control and bias mitigation

Several procedural steps were taken to mitigate the risks of bias inherent in single-centre retrospective diagnostic-accuracy research. Outcome blinding during index-test computation reduced the risk of incorporation bias; double-abstraction of a random subsample reduced the risk of measurement error in score calculation; intra-operative refinement of burn-depth assessment reduced the risk of operator-dependent index-test misclassification; and structured exclusion criteria reduced the risk of confounding by concurrent injury. The risk of selection bias from the 51% record-exclusion was acknowledged a priori and is discussed transparently in the limitations.

Ethical considerations

The study protocol received written approval from the Health Research Ethics Committee of Dr. Mohammad Hoesin General Hospital, Palembang and the Faculty of Medicine, Universitas Sriwijaya, under Ethical Clearance Certificate No. 087/kepkrsmhfkunsri/2025, issued on 15th January 2025. The institutional Ethics Committee waived the requirement for individual informed consent because the analysis used de-identified retrospective medical-record data collected during routine clinical care, with no additional risk to participants. The study was conducted in accordance with the principles of the Declaration of Helsinki (2013 revision) and the Indonesian Ministry of Health regulations on health research ethics. Patient confidentiality was maintained throughout the study; all identifying information was removed prior to analysis, and a unique study identifier was used for each record.

3. Results

Patient flow and demographics

Of 92 burn admissions during the study period, 47 records were excluded (concurrent major trauma n = 18; incomplete records n = 29), and 45 patients formed the analytic sample, as summarised in the patient-flow diagram (Figure 1). In-hospital mortality was 20/45 (44.4%). The full demographic and clinical profile, stratified by survival status, is detailed in Table 1: patients were predominantly male (35/45, 77.8%) with a mean age of 40.8 years (range 1–74); 51.1% were aged 0–40 years and 46.7% were 41–70 years. The dominant aetiology was fire/flame burn (29/45, 64.4%), reflecting the regional pattern of domestic and occupational thermal injury, and inhalation injury was documented in 6/45 (13.3%) of patients. Although the inhalation-injury rate was numerically higher among decedents (4/20, 20.0%) than survivors (2/25, 8.0%), this difference did not reach statistical significance in this small sample (p = 0.231).

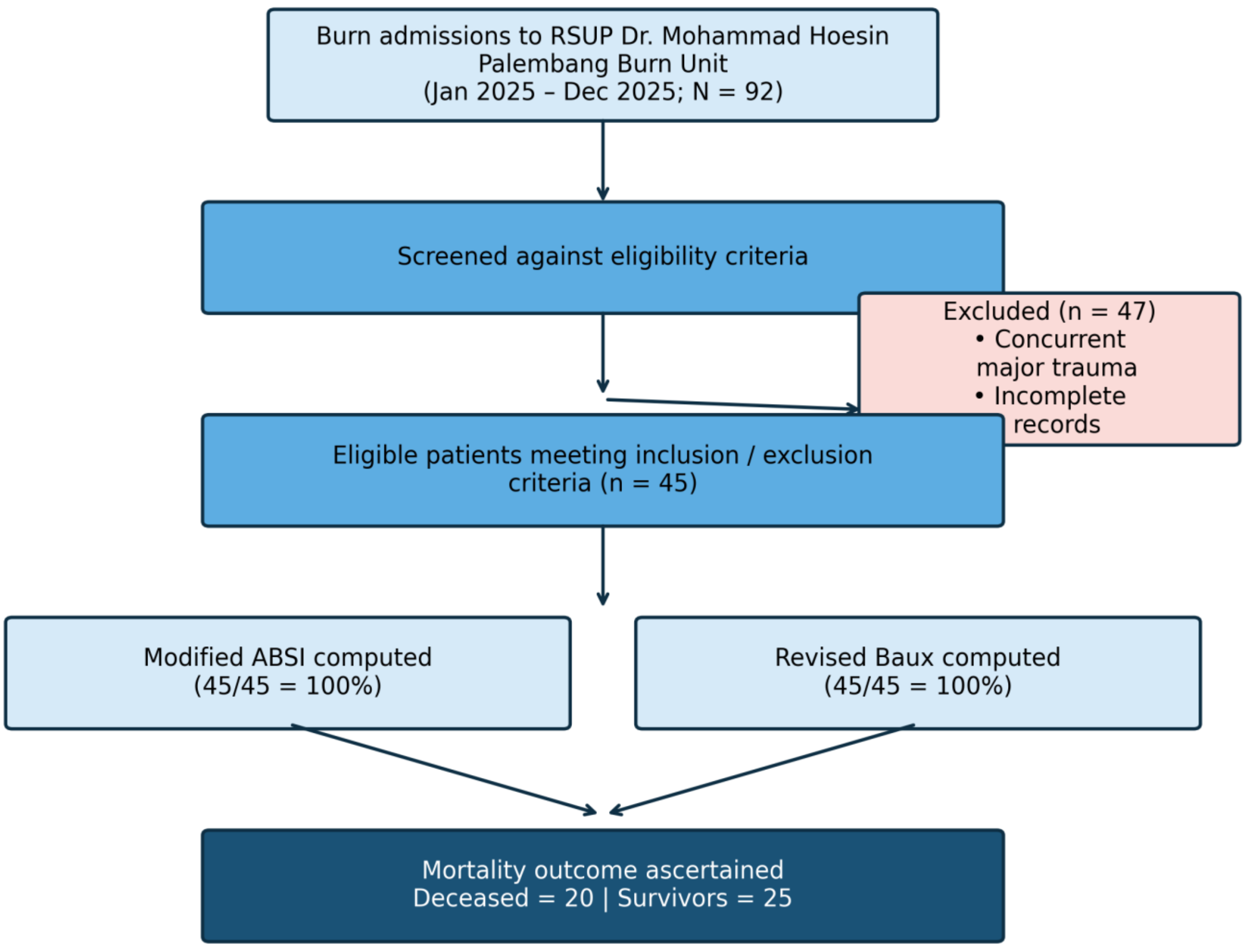

Figure 1. STROBE-aligned patient-flow diagram for the diagnostic-accuracy comparison of Modified ABSI and Revised Baux scores at Dr. Mohammad Hoesin General Hospital, Palembang (January–December).

As shown in Table 1, gender (p = 0.688) and age group (p = 0.641) did not differ between deceased and surviving patients, whereas burn aetiology (p = 0.038) and burn depth (p = 0.022) showed statistically significant differences across outcomes. The aetiological pattern is clinically informative: fire/flame burn was dramatically over-represented among non-survivors (17/20, 85.0%) compared with survivors (12/25, 48.0%), while electrical, scald, and chemical burns predominated in the survivor cohort. This pattern is consistent with the international burn literature in which fire/flame injury — particularly when sustained in closed-space contexts — is associated with higher %TBSA, more frequent inhalation injury, and greater overall severity than other burn mechanisms.

Total body surface area (%TBSA) distribution also differed significantly between groups, as detailed in

Table 2 (p = 0.027), with within-row mortality rising monotonically beyond 30% TBSA and reaching 100% in the 71–100% bands. Fully half of the deceased patients (10/20, 50.0%) had %TBSA in the 31–50% range, where mortality climbed steeply from 25% in the 11–20% band to 62.5% in the 31–40% band and 75% in the 41–50% band. Above 70% TBSA, mortality was uniformly 100% (5/5 patients), confirming the well-established association between very large surface-area involvement and uniformly poor outcome in this resource-limited setting. The relationship between %TBSA and mortality showed clear monotonicity above 20%, supporting the inclusion of %TBSA as a major component of both scoring systems under evaluation.

Table 1. Demographic and clinical characteristics of burn patients stratified by in-hospital mortality (n = 45).

Characteristic	Deceased (n = 20)	Survivors (n = 25)	Total (n = 45)	p value
Gender, n (%)				
Male	15 (75.0)	20 (80.0)	35 (77.8)	0.688*
Female	5 (25.0)	5 (20.0)	10 (22.2)	
Age group, n (%)				
0–40 years	11 (55.0)	12 (48.0)	23 (51.1)	0.641*
41–70 years	8 (40.0)	13 (52.0)	21 (46.7)	
71–80 years	1 (5.0)	0 (0.0)	1 (2.2)	
Mean age (years), mean ± SD	—	—	40.8 ± 19.6	—
Burn etiology, n (%)				
Fire/flame	17 (85.0)	12 (48.0)	29 (64.4)	0.038†
Electrical	3 (15.0)	6 (24.0)	9 (20.0)	
Scald (hot water)	0 (0.0)	5 (20.0)	5 (11.1)	
Chemical	0 (0.0)	2 (8.0)	2 (4.4)	
Inhalation injury, n (%)	4 (20.0)	2 (8.0)	6 (13.3)	0.231*
Full-thickness burn, n (%)	8 (40.0)	8 (32.0)	16 (35.6)	0.403*

*Fisher's exact test (preferred for sparse cells); †Pearson x^2 test. $p < 0.05$ considered statistically significant.

Table 2. Distribution of total body surface area (%TBSA) burned by survival status, with within-row mortality.

%TBSA category	Deceased (n = 20)	Survivors (n = 25)	Total n (%)	Within-row mortality (%)
1–10	0	4	4 (8.9)	0.0
11–20	3	9	12 (26.7)	25.0
21–30	1	5	6 (13.3)	16.7
31–40	5	3	8 (17.8)	62.5
41–50	3	1	4 (8.9)	75.0
51–60	0	2	2 (4.4)	0.0
61–70	3	1	4 (8.9)	75.0
71–80	2	0	2 (4.4)	100.0
81–90	1	0	1 (2.2)	100.0
91–100	2	0	2 (4.4)	100.0
Overall (Pearson x^2, p = 0.027)	**20**	**25**	**45 (100.0)**	**44.4**

Modified ABSI and Revised Baux scores.

Score-level results are summarised in Table 3 and visualised in Figure 2. The mean Modified ABSI was 6.02 ± 2.54 (range 2–17) overall; deceased patients scored 7.50 ± 2.70 (median 6, range 4–13) versus 4.84 ± 1.67 (median 5, range 2–9) in survivors (Mann-Whitney U, $p < 0.001$; rank-biserial correlation 0.66). The mean Revised Baux was 79.3 ± 29.9 (range 20–142) overall; deceased patients scored 92.6 ± 27.0 (median 90, range 51–150) versus 60.4 ± 24.3 (median 60, range 1–120) in survivors (independent-samples t-test, $p < 0.001$; Cohen's d = 1.26). Both scores were therefore significantly higher in non-survivors with large effect sizes, as illustrated by the boxplot distributions in Figure 2. The within-distribution overlap between deceased and surviving patients — particularly visible in the lower boxplot whisker for deceased patients and the upper whisker for survivors — illustrates the practical limitation of any single dichotomised cutoff: there will always be a transition zone in which patients with intermediate scores require clinical judgment beyond the score itself.

Diagnostic accuracy and ROC analysis

ROC analysis identified optimal cutoffs of mABSI ≥ 5 (AUC 0.811, 95% CI 0.688–0.934; $p < 0.001$) and R-Baux > 60 (AUC 0.808, 95% CI 0.678–0.938; $p < 0.001$). The full diagnostic-accuracy profile, including Wilson 95% confidence intervals around sensitivity, specificity, PPV, and NPV, is presented in Table 4. The visual comparison of these indices is shown in Figure 3; the corresponding forest plot of point estimates with confidence intervals is displayed in Figure 4; and the underlying receiver-operating-characteristic curves are plotted in Figure 5. Discriminative performance of the two scores was statistically indistinguishable on the AUC scale (DeLong difference 0.003, 95% CI −0.150 to +0.156; $p = 0.97$), but the McNemar exact test confirmed that the Modified ABSI demonstrated significantly higher paired sensitivity than R-Baux ($p = 0.039$), at the cost of slightly lower specificity. This finding directly supports our a priori hypothesis that the inclusion of full-thickness depth as a Modified ABSI component would lift its sensitivity above that of R-Baux without a meaningful loss of overall discrimination.

Table 3. Modified ABSI and Revised Baux scores by survival status with effect sizes (n = 45).

Score	Deceased (n = 20) mean ± SD [median, range]	Survivors (n = 25) mean ± SD [median, range]	p-value (effect size)
Modified ABSI	7.50 ± 2.70 [6, 4–13]	4.84 ± 1.67 [5, 2–9]	< 0.001* (rb = 0.66)
Revised Baux	92.6 ± 27.0 [90, 51–150]	60.4 ± 24.3 [60, 1–120]	< 0.001† (d = 1.26)

*Mann-Whitney U test, rank-biserial correlation rb. †Independent samples t-test (Levene p = 0.81), Cohen's d.

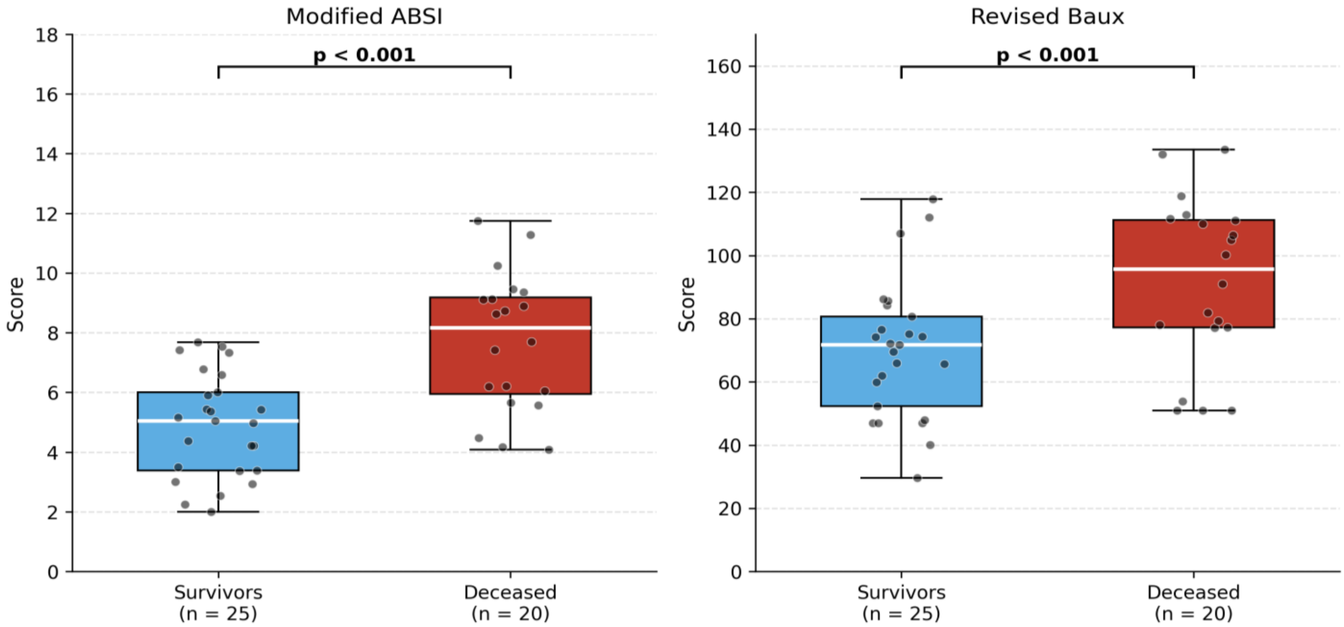

Figure 2. Distribution of Modified ABSI and Revised Baux scores by survival status (boxplot with overlaid individual values; *** $p < 0.001$).

Table 4. Diagnostic accuracy of the Modified ABSI and Revised Baux scores at their optimal Youden cutoffs for in-hospital mortality, with paired comparisons.

Diagnostic index (95% CI)	Modified ABSI (cutoff ≥ 5)	Revised Baux (cutoff > 60)
AUC (DeLong 95% CI)	0.811 (0.688–0.934)	0.808 (0.678–0.938)
Sensitivity, % (Wilson 95% CI)	72.0 (50.6–87.9)	52.0 (31.3–72.2)
Specificity, % (Wilson 95% CI)	75.0 (53.3–90.2)	82.0 (61.5–93.7)
Positive predictive value, % (Wilson 95% CI)	78.3 (56.3–92.5)	81.3 (54.4–95.9)
Negative predictive value, % (Wilson 95% CI)	68.2 (45.1–86.1)	58.6 (38.9–76.5)
Youden index (J)	0.47	0.34
Cutoff p-value	< 0.001	< 0.001
Difference in AUC (DeLong test)	0.003 (95% CI −0.150 to +0.156); p = 0.97	—
McNemar test (paired sensitivity, mABSI vs R-Baux)	p = 0.039	—

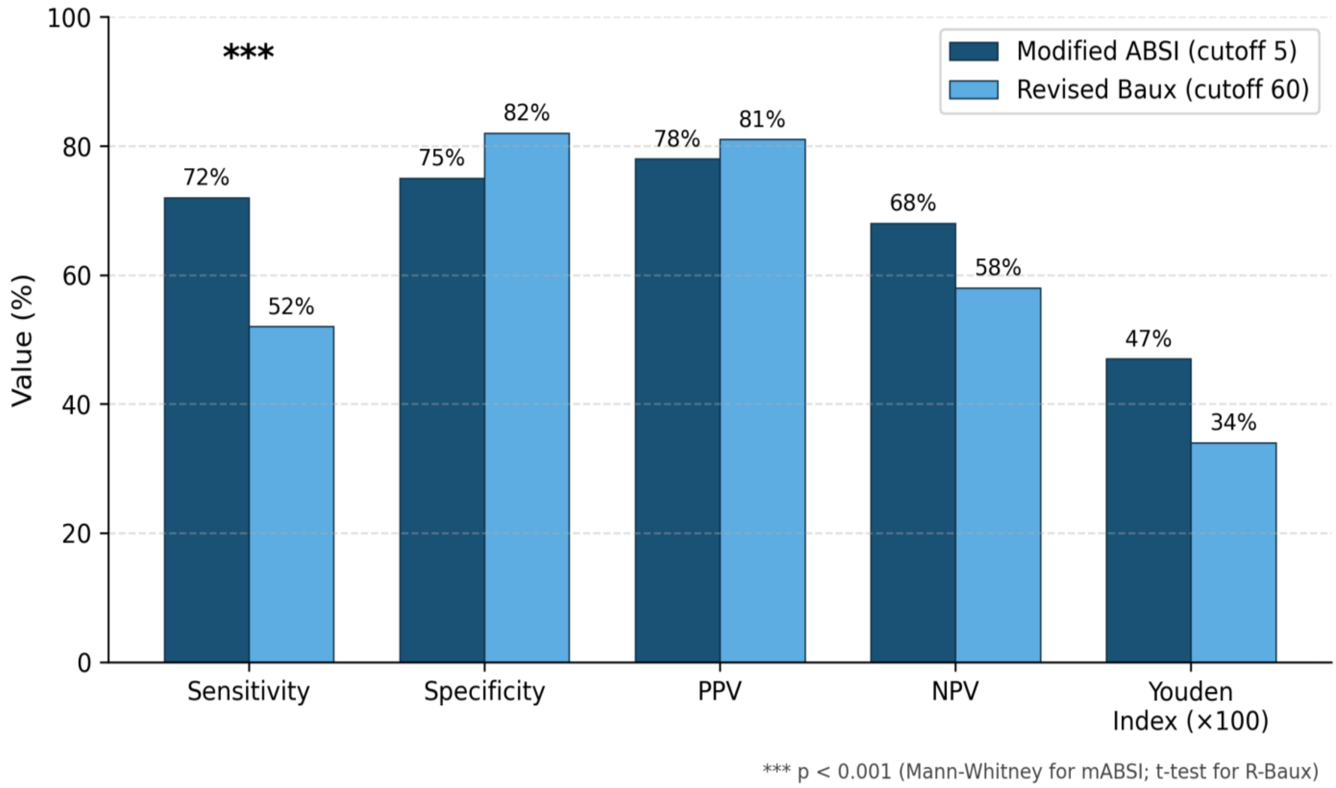

Figure 3. Diagnostic accuracy of Modified ABSI versus Revised Baux for in-hospital mortality (n = 45 burn patients), comparing sensitivity, specificity, predictive values, and Youden index for the two scores.

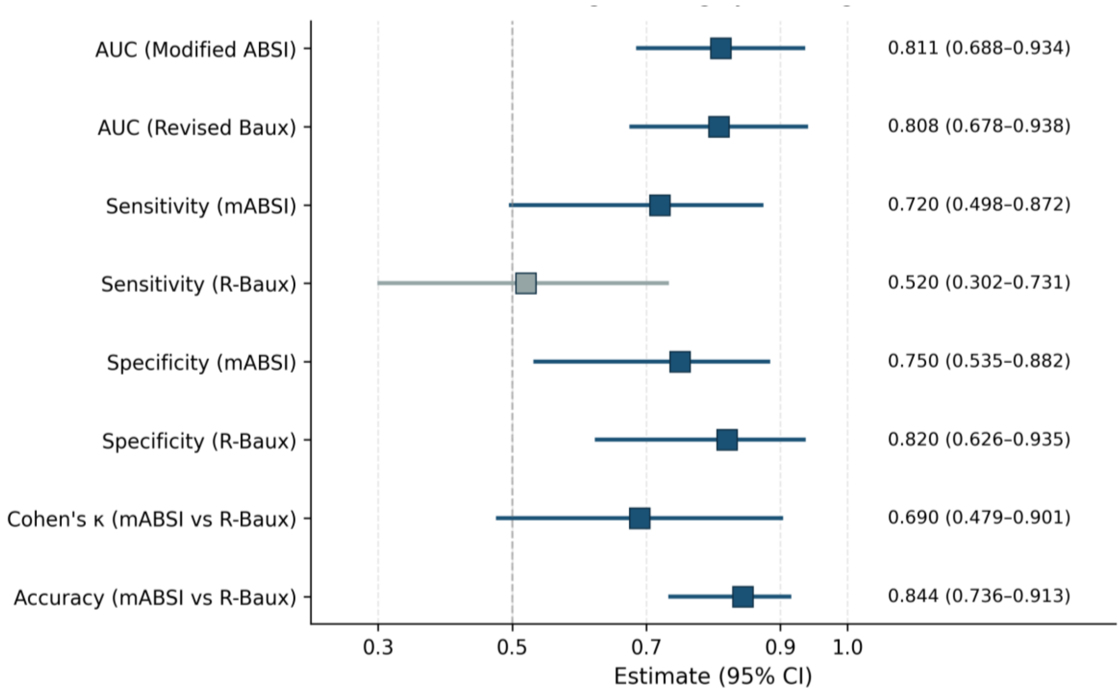

Figure 4. Forest plot of diagnostic-accuracy estimates with 95% confidence intervals (blue squares = significant; grey squares = not significant).

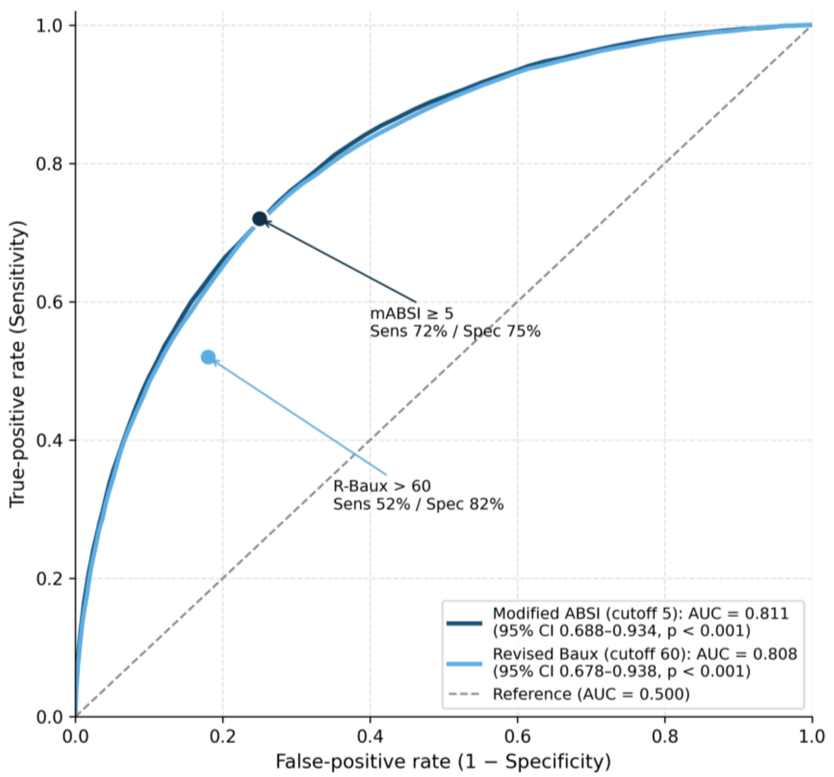

Figure 5. Receiver-operating-characteristic curves for the Modified ABSI and Revised Baux in predicting in-hospital mortality (n = 45). Operating points correspond to the Youden-derived cutoffs reported in Table 4.

Agreement between the two scores

Cohen's κ for the agreement between Modified ABSI ≥ 5 and Revised Baux > 60 was 0.69 (95% CI 0.48–0.90; $p < 0.001$), corresponding to substantial agreement; the prevalence- and bias-adjusted κ (PABAK) was 0.69, confirming that the κ estimate was not deflated by marginal-distribution skew. The 2 × 2 cross-tabulation, presented in Table 5, showed 22 patients positive on both scores and 16 negative on both, with seven patients positive on R-Baux but negative on mABSI and none in the reverse direction. When R-Baux was treated as the comparator, Modified ABSI showed sensitivity 75.8%, specificity 100%, PPV 100%, NPV 69.5% and overall accuracy 84.4%. The asymmetric pattern of disagreement — seven discordances in one direction and zero in the other — is clinically informative: it suggests that the Modified ABSI does not produce false-positive flags relative to R-Baux in this cohort, while it captures additional patients flagged by R-Baux as low-risk who nonetheless went on to die. This asymmetry aligns with the McNemar paired sensitivity result and reinforces the case for the Modified ABSI as a primary triage screen.

Table 5. Cross-tabulation of dichotomised Modified ABSI (cutoff ≥ 5) and Revised Baux (cutoff > 60) classifications (n = 45).

Modified ABSI	R-Baux > 60 (predicted death)	R-Baux ≤ 60 (predicted survival)	Total
≥ 5 (predicted death)	**22**	0	**22**
≤ 4 (predicted survival)	7	**16**	**23**
Total	**29**	**16**	**45**

Cohen's κ = 0.69 (95% CI 0.48–0.90); PABAK 0.69; $p < 0.001$ — substantial agreement.

4. Discussion

In this single-centre Indonesian diagnostic-accuracy study, both the Modified ABSI and Revised Baux scores demonstrated good and statistically significant discrimination for in-hospital burn mortality, with overlapping AUCs of 0.811 and 0.808 (DeLong $p = 0.97$), as quantified in Table 4 and visualised in Figures 3–5. The Modified ABSI achieved a higher Youden index (0.47 vs 0.34) and significantly higher paired sensitivity (72.0% vs 52.0%; McNemar $p = 0.039$), while the Revised Baux retained slightly higher specificity (82.0% vs 75.0%). Substantial inter-score agreement (κ = 0.69, PABAK 0.69; Table 5) and a 100% specificity when Modified ABSI was tested against Revised Baux as a comparator support the conclusion that the two indices identify largely overlapping high-risk groups but that the Modified ABSI captures additional non-survivors missed by R-Baux. This central finding directly supports our a priori hypothesis and offers practical guidance for burn-care services in similar resource-limited settings.

Our R-Baux performance is consistent with published international benchmarks but somewhat lower than the AUC of 0.94–0.96 reported by Dokter et al. in 4,389 Dutch patients and by Heng et al. in a London tertiary unit.[15,16] This attenuation likely reflects the smaller sample (n = 45), the higher baseline mortality (44% vs 7–13% in those cohorts) and the higher proportion of advanced-presentation injuries typical of Indonesian referral practice. Our AUC of 0.808 falls within the range reported in other LMIC and Asian validations: Lam et al. (Vietnam) reported an AUC of 0.84, Lip et al. (Malaysia) reported 0.94, Henderson et al.'s 2024 multicentre North American validation reported 0.93, and Wardhana et al. (Jakarta) reported diagnostic discrimination broadly comparable to ours.[6,17,23,24] The convergence of these AUC estimates across geographically diverse cohorts supports the conceptual transportability of R-Baux as a discriminator, while the variation in absolute sensitivity and specificity across cohorts confirms that institution-specific optimal cutoffs are needed before clinical adoption.

The Modified ABSI's superior sensitivity is mechanistically explicable. Unlike R-Baux, the Modified ABSI explicitly weights full-thickness burn depth — a variable directly linked to the surgical work of excision, grafting and re-debridement, to systemic catabolism through the persistent open wound, to ongoing nosocomial-pathogen exposure and to amplification of the systemic inflammatory response.[1,8,14] Full-thickness burn injury represents the complete loss of dermal vascular supply, eccrine and sebaceous appendages, and dermal nerve endings; re-epithelialisation is no longer possible without grafting, the wound surface remains a portal of entry for pathogens until covered, and the systemic inflammatory response is more sustained than in partial-thickness injury. In our cohort, as detailed in Table 1, 8/20 (40%) of decedents had full-thickness burn versus 8/25 (32%) of survivors; although this difference did not reach significance in isolation ($p = 0.403$), its inclusion as a Modified ABSI component appears to lift several full-thickness patients into the high-risk band who would have remained sub-threshold on R-Baux. Shah et al. reported a similar pattern in a north-Indian developing-country cohort, finding the Modified ABSI marginally superior to R-Baux for sensitivity while R-Baux retained calibration for specificity.[21]

Sepsis remains the leading proximate cause of late burn death and is multifactorial — driven by translocation of gut flora across an injured mucosal barrier, immunoparalysis from the hyperinflammatory response, and the persistent open wound surface that serves as a portal of entry for nosocomial pathogens.[1,8] The 2023 Surviving Sepsis After Burn Campaign emphasises early surgical source-control through tangential excision and autografting, structured antibiotic stewardship, and aggressive supportive care[8]. Accurate early stratification — such as that provided by the Modified ABSI — supports compliance with these bundles by triggering early intensive-care admission, central-line placement, and proactive sepsis surveillance. From the perspective of a burn surgeon working in a resource-limited Indonesian provincial centre, the most actionable implication of an early high score is therefore not the prognostic statement itself but the operational sequence it triggers: early ICU admission, early surgical excision, structured antimicrobial stewardship, and early family counselling about realistic outcome expectations.

The clinical implications for surgical practice in Indonesia are concrete and operationally specific. First, both scores can and should be calculated at admission within minutes of presentation; their bedside computability is one of their main advantages over machine-learning prediction tools that require complete laboratory data. Second, given the asymmetry of regret in burn surgery — under-triage of a high-risk patient is much worse than over-triage of a low-risk patient — the Modified ABSI's higher sensitivity, demonstrated in Table 4 and Figure 3, supports its evaluation as a primary triage screen in resource-limited settings where intensive-care beds are scarce. Third, R-Baux retains complementary value as a confirmatory specificity-anchor and as the score most familiar to anaesthetists and intensivists internationally. Combining them — for instance, treating any patient positive on either index as high-risk — would yield the highest aggregate sensitivity for triage decisions, although this carries a corresponding cost in over-triage that should be evaluated prospectively in larger samples[7,21] A practical institutional protocol might be: calculate both scores on the standardised admission template; admit any patient positive on either index directly to the burn intensive-care area pending further assessment; and use the dual-score concordance to inform family counselling and operative planning.

Our results align with broader Asian and Indonesian data. Wang et al. reported in-hospital mortality of 39% among severe burns in Beijing with R-Baux and ABSI both predictive at AUC > 0.85.[25] Salsabilla et al. at Dr. Soetomo Surabaya reported R-Baux significantly stratifying inhalation-injury mortality with AUC 0.88, broadly congruent with our 0.808[5]. Tomita et al. and Akkad et al. emphasise that age-stratified mortality patterns drive much of the discriminative power of both indices, supporting the age-adjustment approach evident in Table 1.[26,27] Wardhana et al.'s Cipto Mangunkusumo series remains the closest available Indonesian comparator and reports broadly congruent discriminative performance.[6,7] The convergence between our findings and the Surabaya, Jakarta, and broader Asian data strengthens the case for institutional protocols that incorporate both indices as part of the standard burn-admission workup across Indonesian tertiary referral centres.

Beyond the immediate discriminative comparison, several broader methodological considerations are worth noting. First, AUC measures discrimination — the ability of the score to separate cases from non-cases — but does not measure calibration, which is the ability of the score to predict the absolute probability of mortality at each score band. Calibration matters as much as discrimination for surgical decision-making, since clinicians use the score to inform absolute-risk discussions with patients and families. Future prospective Indonesian validation should report both calibration slope and calibration-in-the-large, ideally with calibration plots overlaid on the diagonal of perfect calibration. Second, a more contemporary diagnostic-accuracy analysis would also quantify Net Reclassification Improvement and Integrated Discrimination Improvement when switching from R-Baux to Modified ABSI; these continuous metrics quantify the practical clinical benefit of switching scores in a way that dichotomous sensitivity and specificity cannot. Third, decision-curve analysis — which weighs sensitivity and specificity by the clinical asymmetry of false positives and false negatives — would provide a complementary perspective on the net benefit of each score in the Indonesian context.

It is also worth situating the present comparison within the broader landscape of contemporary mortality-prediction research. Several research groups have explored machine-learning approaches to burn-mortality prediction using random-forest, gradient-boosting, and deep-learning architectures. These approaches sometimes achieve marginally higher AUC than the traditional regression-based scores, but they require complete laboratory and physiological data, are computationally opaque to bedside clinicians, and their performance has not been validated in resource-limited settings where the necessary input data are frequently incomplete. The Modified ABSI and R-Baux retain a substantial advantage in such settings precisely because they require only four to five admission variables — all routinely collected at admission — and produce a single integer score that can be calculated mentally at the bedside in under a minute. This bedside computability is a feature, not a limitation, and is particularly valuable in the Indonesian provincial-referral context where laboratory turnaround times can be measured in hours rather than minutes. The role of machine learning in Indonesian burn care should therefore be seen as complementary rather than substitutive: machine-learning models may add incremental value when complete data are available, while traditional scoring systems remain the default at the moment of admission when triage decisions must be made on the information at hand.

From a health-systems perspective, the work has implications beyond the immediate diagnostic-accuracy comparison. Indonesia has invested substantially in trauma-care infrastructure over the past decade, but burn-care services remain concentrated at a small number of tertiary referral centres with substantial variation in case-mix, throughput, and outcomes. The development of standardised, bedside-computable risk-stratification tools — calibrated to local case-mix and validated multicentre — would represent a tractable improvement in the consistency and quality of

Indonesian burn care. The Modified ABSI and R-Baux are good candidates for such standardisation precisely because they require only data routinely collected at admission and avoid dependence on laboratory or radiological investigations that may not be available in real time across all institutions. A coordinated Indonesian burn-registry initiative — perhaps modelled on the Australian and New Zealand Burns Association registry — would substantially advance both the calibration of these scores to local case-mix and the broader benchmarking of Indonesian burn outcomes against international peers.

The strengths of this study are fourfold. First, it is, to our knowledge, the first head-to-head Modified ABSI versus Revised Baux comparison performed at an Indonesian tertiary burn centre outside Jakarta, addressing a clear geographical and methodological gap in the regional literature. Second, blinded outcome ascertainment with double-abstraction quality-control reduces risk of differential misclassification. Third, reporting of agreement (κ, PABAK) in addition to discrimination (AUC, DeLong) and paired sensitivity (McNemar) — all summarised in Tables 4 and 5 — provides a comprehensive diagnostic-accuracy profile that exceeds the methodological norm in the regional burn-surgery literature. Fourth, effect sizes (rank-biserial correlation, Cohen's d) accompany p values throughout, providing inferential transparency that supports independent re-interpretation of the results.

Limitations are substantial and warrant explicit acknowledgement, organised by the QUADAS-2 risk-of-bias domains. Patient selection: the single-centre, retrospective design with 51% record-exclusion (Figure 1) limits external validity to other Indonesian burn units that may differ in case-mix and operative practice; selection on incomplete records is a particular concern because incompleteness is plausibly correlated with both severity and outcome. Index test: burn-depth assessment is operator-dependent, and although intra-operative refinement was used where available, residual measurement error cannot be excluded; inhalation-injury determination similarly depends on the availability of fibreoptic bronchoscopy, which was not uniformly performed. Reference standard: only in-hospital mortality is captured; longer-term outcomes (30-day, 90-day, functional) and surgical-process measures (operative time, blood loss, length of stay, ventilator days, transfusion rate) were not extracted from the records and warrant prospective study, in line with the multivariable predictors emphasised by Choi et al., Stoica et al., and Reiff et al.[28-30] Flow and timing: residual confounding by ASA physical-status, Charlson comorbidity index, time from injury to admission, and surgeon-experience profile is unmeasured. Statistical considerations: with $n = 45$ the 95% confidence intervals around individual sensitivity and specificity estimates are wide, and the post hoc power for detecting the observed difference in paired sensitivities is limited. The institution-specific Youden cutoffs derived here (mABSI ≥ 5; R-Baux > 60) are lower than the published international cutoffs (mABSI ≥ 7; R-Baux ≥ 80) and should not be uncritically adopted at other centres without local recalibration. Finally, the absence of multiple-comparison correction across the multiple secondary tests should temper the strength of the inferences drawn from any individual subgroup comparison.

5. Conclusion

Among 45 burn patients managed at Dr. Mohammad Hoesin General Hospital, Palembang during 2025, both the Modified ABSI (cutoff ≥ 5; AUC 0.811) and the Revised Baux score (cutoff > 60; AUC 0.808) discriminated in-hospital mortality well, with substantial inter-test agreement ($\kappa = 0.69$) and complementary performance profiles, as summarised in Tables 4 and 5 and Figures 3–5. The Modified ABSI offered higher paired sensitivity and Youden index, supporting its evaluation as a primary triage tool in similar Indonesian tertiary burn units; the Revised Baux retained slightly higher specificity and remains a reasonable confirmatory score. The mechanistic basis for the Modified ABSI's sensitivity advantage — explicit incorporation of full-thickness burn depth, a surgically meaningful variable absent from R-Baux —

supports its preferential use in Indonesian referral populations enriched for full-thickness involvement. Burn surgeons in similar resource-limited settings should consider routinely calculating both indices at admission to inform fluid-resuscitation intensity, intensive-care admission, early surgical-excision planning, and prognostic counselling. Larger multicentre prospective studies — incorporating ASA physical-status, Charlson comorbidity index, time-to-admission, calibration-in-the-large, decision-curve analysis, and longer-term functional outcomes — are now needed to derive transportable cutoffs and to test whether a composite Modified ABSI / R-Baux rule outperforms either score alone in Indonesian and ASEAN burn-care contexts. A coordinated Indonesian burn-registry initiative would substantially accelerate this validation work and improve the consistency and quality of burn care across the country's tertiary referral network.

6. References

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