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Predicting Burn Patient Mortality: A Comparative Analysis of the BOBI and R-Baux Scoring Systems

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A B S T R A C T

Introduction: Burns represents a significant global health challenge, causing considerable morbidity and mortality. Accurate prognostication is crucial for optimal burn care management. This study compared the accuracy of the BOBI and R-Baux scores in predicting mortality among burn patients. **Methods:** This retrospective study analyzed data from 46 burn patients treated at Dr. Mohammad Hoesin General Hospital Palembang. Patient demographics, burn characteristics, and mortality outcomes were recorded. BOBI and R-Baux scores were calculated for each patient. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and Youden Index were determined for both scores. Agreement between the scores was assessed using the Kappa statistic. Statistical analysis was performed using SPSS v25. **Results:** The majority of patients were male (76.1%) and under 50 years old (84.8%). Fire burns (63%) and superficial-mid dermal injuries (32.6%) were most prevalent. The BOBI score demonstrated fair accuracy (sensitivity: 84.6%, specificity: 63.6%, PPV: 0.478, NPV: 0.913, Youden Index: 0.480). The R-Baux score showed lower sensitivity (76.9%) but higher specificity (78.8%) (PPV: 0.588, NPV: 0.896, Youden Index: 0.560). The Kappa test indicated good agreement between the two scores ($\kappa = 0.783$, $p = 0.000$). **Conclusion:** Both BOBI and R-Baux scores can be used to predict mortality in burn patients. The BOBI score demonstrated higher sensitivity, while the R-Baux score exhibited higher specificity. The choice of scoring system may depend on the specific clinical context and the relative importance of sensitivity and specificity.

1. Introduction

Burns, inflicting severe tissue damage through contact with extreme heat, chemicals, electricity, or radiation, represent a global health challenge of immense proportions. These injuries leave an enduring mark on individuals and healthcare systems alike, with their impact reverberating across physical, psychological, and socioeconomic domains. The World Health Organization (WHO) grimly estimates that burns are responsible for nearly 180,000 deaths annually, with low- and middle-income countries (LMICs) bearing the brunt of this devastating burden. This stark reality underscores the urgent need for concerted efforts to mitigate the suffering and mortality associated with burn injuries.[1-3]

Burn injuries are far from monolithic, encompassing a spectrum of causes and severities. Thermal burns, arising from exposure to flames, scalds, or hot objects, constitute the most prevalent type. Chemical burns, triggered by contact with corrosive substances, and electrical burns, resulting from the passage of electrical current through the body, present unique challenges in terms of tissue damage and systemic effects. Radiation burns, though less common, pose significant risks due to their potential for deep tissue penetration and long-term consequences. The severity of a burn injury is determined by a complex interplay of factors,

including the depth and extent of tissue damage, the patient's age and overall health status, and the presence of any associated injuries, such as inhalation injury. The depth of a burn, classified as superficial, partial-thickness, or full-thickness, dictates the extent of tissue destruction and the potential for complications. The total body surface area (TBSA) affected by the burn provides a measure of the injury's magnitude and serves as a critical parameter in assessing the patient's overall risk. Age plays a pivotal role in burn outcomes, with the very young and the elderly being particularly vulnerable to complications and mortality. The presence of inhalation injury, a frequent accompaniment to burns sustained in enclosed spaces, significantly increases the risk of mortality due to respiratory complications.[4-6]

Accurate and timely prognostication is the cornerstone of effective burn care management. By predicting the likely course of a burn injury, clinicians can make informed decisions regarding treatment strategies, resource allocation, and patient counseling. Prognostication enables the identification of high-risk individuals who may benefit from more aggressive interventions, such as early surgical intervention or intensive care monitoring. It also helps to avoid unnecessary treatments in patients with less severe injuries, optimizing resource utilization and minimizing potential complications. Over the years, various scoring systems have been developed to aid clinicians in predicting mortality risk and guiding burn care management. These systems, incorporating a combination of clinical and laboratory parameters, generate a numerical score that reflects the patient's overall risk of mortality. The ideal scoring system should be simple to use, readily applicable in diverse clinical settings, and possess high predictive accuracy. Among the commonly used scoring systems are the BOBI (Burn Outcome and Baux Index) score and the revised Baux score (R-Baux). The BOBI score, developed is a simplified scoring system that utilizes age and TBSA burned to predict mortality in burn patients. Its simplicity makes it readily applicable in various clinical settings, particularly in resource-limited environments. The R-Baux score, a modification of the original Baux score, incorporates age, TBSA burned, and the presence of inhalation injury to predict mortality. The inclusion of inhalation injury, a significant predictor of mortality in burn patients, enhances the predictive capability of the R-Baux score. While both BOBI and R-Baux scores have been widely used in burn care, their comparative accuracy in predicting mortality remains a subject of ongoing investigation. Several studies have evaluated the performance of these scoring systems in different patient populations and clinical settings, yielding varying results.[7-10] This research aims to compare the accuracy of the BOBI and R-Baux scores in predicting mortality among burn patients treated at a tertiary referral center.

2. Methods

This retrospective study was conducted at Dr. Mohammad Hoesin General Hospital Palembang, a leading tertiary referral center in Palembang, Indonesia. The hospital's burn unit is renowned for providing comprehensive care to a diverse population of burn patients, ranging from minor burns to severe burn injuries requiring intensive care management. The study design was carefully chosen to leverage the wealth of patient data available at this esteemed institution, allowing for a robust analysis of burn outcomes and prognostic factors. The study protocol was reviewed and approved by the hospital's ethics committee, ensuring adherence to the highest standards of research ethics and patient confidentiality. All patient data were anonymized and de-identified prior to analysis, safeguarding patient privacy and ensuring compliance with relevant data protection regulations.

The study population encompassed all burn patients admitted to the burn unit of Dr. Mohammad Hoesin General Hospital Palembang between January 2023 and July 2024. To ensure a representative sample, patients of all ages and burn etiologies were eligible for inclusion, capturing the diversity of burn injuries encountered in clinical practice. This inclusive

approach enhances the generalizability of the study's findings to a broader population of burn patients. Data were meticulously extracted from patients' medical records using a standardized data collection form, ensuring consistency and minimizing the risk of bias. The data collection form was designed to capture a comprehensive range of patient characteristics, burn characteristics, and clinical outcomes, providing a holistic view of each patient's clinical course.

Demographic data collected included age, gender, and any pre-existing comorbidities. These variables were carefully selected based on their potential to influence burn outcomes and their relevance to the scoring systems being evaluated. Burn characteristics documented included the cause of the burn, the total body surface area (TBSA) burned, the depth of the burn (classified as superficial, partial-thickness, or full-thickness), and the presence of inhalation injury. These parameters are critical in assessing burn severity and predicting patient outcomes. Clinical outcomes recorded included the length of hospital stay, the occurrence of any complications (such as infection, sepsis, or pneumonia), and the ultimate outcome, mortality. These outcomes provide valuable insights into the effectiveness of burn care interventions and the overall impact of burn injuries on patient health.

The BOBI and R-Baux scores were calculated for each patient based on their age, TBSA burned, and the presence of inhalation injury. The BOBI score, known for its simplicity, is calculated as follows; BOBI score = Age + (TBSA burned / 2). The R-Baux score, incorporating the critical factor of inhalation injury, is calculated as follows; R-Baux score = Age + TBSA burned + (17 × inhalation injury). Where inhalation injury is coded as 1 if present and 0 if absent.

The primary outcome of the study was mortality, a critical indicator of burn severity and the effectiveness of burn care. The accuracy of the BOBI and R-Baux scores in predicting mortality was rigorously assessed using receiver operating characteristic (ROC) curve analysis, a powerful statistical tool for evaluating the performance of diagnostic and prognostic tests. The area under the ROC curve (AUC), a measure of the scoring system's discriminatory power, was calculated for each score. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and Youden Index were also calculated for both scores, providing a comprehensive assessment of their predictive performance. The agreement between the BOBI and R-Baux scores in predicting mortality was evaluated using the Kappa statistic, a measure of inter-rater reliability. Kappa values range from 0 to 1, with 0 indicating no agreement and 1 indicating perfect agreement. Kappa values between 0.61 and 0.80 are considered to represent good agreement. Statistical analysis was performed using SPSS version 25, a leading statistical software package. Descriptive statistics were used to summarize patient characteristics, while bivariate and multivariate analyses were conducted to identify factors associated with mortality. A p-value of less than 0.05 was considered statistically significant.

3. Results

Table 1 provides a detailed overview of the characteristics of the 46 burn patients included in this study. The majority of patients were male (76.1%), which aligns with the general trend of burn injuries being more prevalent in males. This could be attributed to factors such as occupational hazards and risk-taking behaviors that are more common in men. Most patients fell within the 18-50 age group (84.8%), with a smaller proportion of elderly patients (above 65 years old - 6.5%). This distribution suggests that burns are a significant concern across a wide range of adult ages, though younger adults seem to be more frequently affected in this particular study. Fire was the most common cause of burns (63%), followed by scalds (21.7%). This highlights the importance of fire safety and prevention measures in reducing the incidence of burn injuries. The relatively low percentages of electrical and chemical burns may reflect the specific demographics and occupational exposures within the study population. Superficial-mid dermal burns were the most prevalent (32.6%),

followed closely by deep dermal (28.3%) and full-thickness burns (28.3%). This distribution indicates a significant proportion of patients with deeper, more severe burns requiring specialized care and potentially longer healing times. A large proportion of patients had TBSA burned between 21-39% (39.1%), indicating a considerable number of moderate to severe burn injuries. This has implications for resource allocation and treatment strategies within the burn unit. Nearly a quarter of the patients (23.9%) had inhalation injury, a serious complication that can significantly increase the risk of mortality and respiratory problems. This underscores the need for prompt assessment and management of inhalation injuries in burn patients. A substantial portion of patients (43.5%) had no reported comorbidities. However, a significant number presented with conditions like diabetes mellitus (17.4%), hypertension (15.2%), and cardiovascular disease (13.0%). These comorbidities can potentially complicate burn treatment and recovery, highlighting the need for a multidisciplinary approach to burn care. The overall mortality rate in this study was 30.4%. This figure emphasizes the seriousness of burn injuries and the need for continuous improvement in burn care management to reduce mortality rates.

Table 1. Patient characteristics.

Characteristic	Number (%)
Gender	
Male	35 (76.1)
Female	11 (23.9)
Age (years)	
< 18	8 (17.4)
18-30	12 (26.1)
31-50	19 (41.3)
51-65	4 (8.7)
> 65	3 (6.5)
Cause of burn	
Fire	29 (63.0)
Scald	10 (21.7)
Electrical	3 (6.5)
Chemical	4 (8.7)
Depth of burn	
Superficial	5 (10.9)
Superficial-mid dermal	15 (32.6)
Deep dermal	13 (28.3)
Full-thickness	13 (28.3)
TBSA burned (%)	
< 10	5 (10.9)
10-19	8 (17.4)
20-39	18 (39.1)
40-59	8 (17.4)
≥ 60	7 (15.2)
Inhalation injury	
Present	11 (23.9)
Absent	35 (76.1)
Comorbidities	
None	20 (43.5)
Diabetes mellitus	8 (17.4)
Hypertension	7 (15.2)
Cardiovascular disease	6 (13.0)
Other	5 (10.9)
Mortality	
Yes	14 (30.4)
No	32 (69.6)

Table 2 presents a comparative analysis of the BOBI and R-Baux scores in relation to mortality in the studied burn patients; BOBI Score: The mean BOBI score was significantly higher in the deceased group (5.31 ± 2.06) compared to the survivors (1.97 ± 2.05), indicating that higher BOBI scores are associated with

increased mortality risk. This difference is statistically significant (p = 0.000), suggesting that the BOBI score has some predictive value in this context. Similarly, the median BOBI score was higher in the deceased group (6) than in the survivors (1), further supporting the association between higher scores and mortality. The BOBI score ranged from 0-8 in the total sample, with the deceased group exhibiting a wider range (1-8) compared to the survivors (0-6). This suggests that while both groups had patients with low scores, higher scores were more concentrated in the deceased group; R-Baux Score: The mean R-Baux score was also significantly higher in the deceased group (109.0 ± 34.1) compared to the survivors (61.5 ± 29.9), with a statistically significant difference (p = 0.000). This reinforces the notion that higher R-Baux scores are associated with increased mortality risk. The median R-Baux score followed the same pattern, being higher in the deceased group (97) than in the survivors (67). The R-Baux score had a wider range overall (11-173), with both groups showing a considerable spread. However, the deceased group had a higher minimum score (51) compared to the survivors (11), indicating that more severe cases, reflected in higher scores, tended to have worse outcomes.

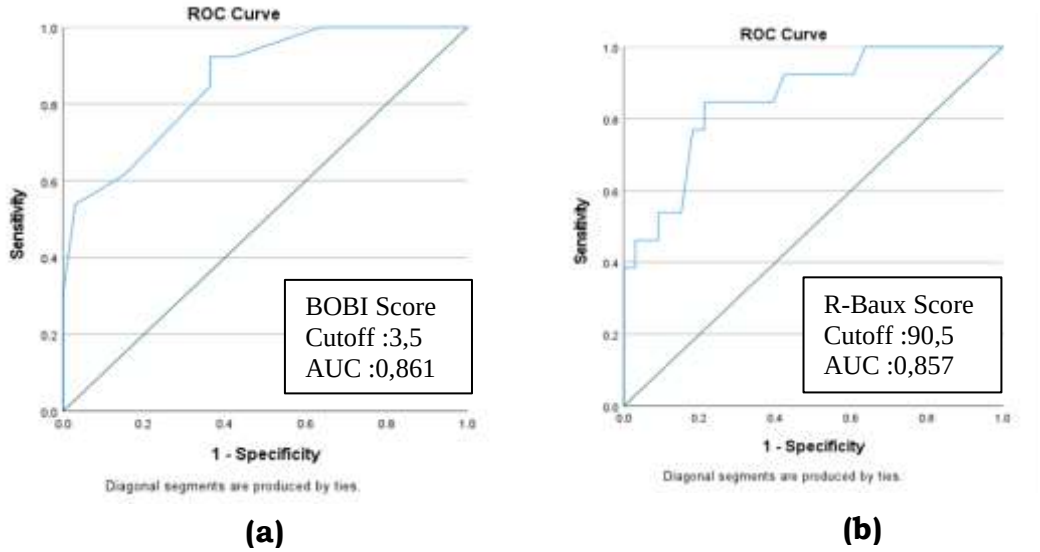
Table 2. Comparison of BOBI and R-Baux scores by mortality.

Characteristic	Outcome	Total (n = 46)	Deceased (n = 13)	Alive (n = 33)	P value
BOBI Score					
	Mean ± SD	2.91 ± 2.54	5.31 ± 2.06	1.97 ± 2.05	0.000*[a]
	Median	3.5	6	1	
	Min-Max	0-8	1-8	0-6	
R-Baux Score					
	Mean ± SD	74.9 ± 37.6	109.0 ± 34.1	61.5 ± 29.9	0.000*[b]
	Median	73	97	67	
	Min-Max	11-173	51-173	11-115	

[a]Mann-Whitney Test, *p < 0.05; [b]Independent T Test, *p < 0.05

Figure 1 presents the Receiver Operating Characteristic (ROC) curves for both the BOBI and R-Baux scores, providing a visual and statistical representation of their accuracy in predicting mortality in burn patients. ROC curves illustrate the diagnostic ability of a test by plotting the true positive rate (sensitivity) against the false positive rate (1-specificity) at various threshold settings. The area under the ROC curve (AUC) summarizes the overall performance of the test. An AUC of 0.5 indicates a test with no discriminatory power (like flipping a coin), while an AUC of 1.0 represents a perfect test; BOBI Score (Figure 1a): The AUC for the BOBI score is 0.861, which is considered excellent. This suggests that the BOBI score has a high accuracy in differentiating between patients who will survive and those who will not. The optimal cut-off point for the BOBI score is identified as 3.5. This means that a BOBI score of 3.5 or higher would be most effective in predicting mortality. The 95% confidence interval (CI) for the AUC (0.748 – 0.975) indicates a high level of confidence in the estimated AUC value. The p-value of 0.000 confirms that the BOBI score's ability to predict mortality is statistically significant; R-Baux Score (Figure 1b): The AUC for the R-Baux score is 0.857, also considered excellent. This indicates that the R-Baux score performs similarly well to the BOBI score in predicting mortality. The optimal cut-off point for the R-Baux score is 90.5. This means that an R-Baux score of 90.5 or higher would be most effective in predicting mortality. The 95% CI for the AUC (0.739-0.975) is comparable to that of the BOBI score, indicating a similar level of confidence in the estimated AUC value. The p-value of 0.000 confirms that the R-Baux score's ability to predict mortality is also statistically significant. Both the BOBI and R-Baux scores demonstrate excellent discriminatory power in predicting mortality, as evidenced by their high AUC

values. Although the BOBI score has a slightly higher AUC (0.861) compared to the R-Baux score (0.857), the difference is minimal and likely not clinically significant. The choice between the two scores might depend on factors such as ease of use and the specific clinical context. The BOBI score, with its simpler calculation, might be more practical in resource-limited settings.



(a) **(b)**

Figure 1. ROC Curve. A. BOBI Score; B. R-Baux Score. The optimal cut-off point for the BOBI score was 3.5, with an AUC of 0.861 (95% CI 0.748 – 0.975; p = 0.000). For the R-Baux score, the optimal cut-off point was 90.5, with an AUC of 0.857 (95% CI 0.739-0.975; p = 0.000).

Table 3 provides a detailed breakdown of the accuracy measures for both the BOBI and R-Baux scores in predicting mortality in burn patients; Sensitivity: BOBI 84.6% - This means that the BOBI score correctly identified 84.6% of the patients who actually died. It has a high sensitivity, indicating a low rate of false negatives (failing to identify those who died). R-Baux 76.9% - The R-Baux score correctly identified 76.9% of the patients who died. While still good, it has a slightly lower sensitivity than the BOBI score; Specificity: BOBI 63.6% - This means that the BOBI score correctly identified 63.6% of the patients who actually survived. It has a moderate specificity, indicating a moderate rate of false positives (incorrectly identifying survivors as those who would die). R-Baux 78.8% - The R-Baux score correctly identified 78.8% of the patients who survived. It has a higher specificity than the BOBI score, indicating a lower rate of false positives; PPV (Positive Predictive Value): BOBI 0.48 - This means that 48% of the patients who were predicted to die by the BOBI score actually died. R-Baux 0.59 - This means that 59% of the patients who were predicted to die by the R-Baux score actually died. The R-Baux score has a higher PPV, meaning it's more likely to be correct when predicting mortality; NPV (Negative Predictive Value): BOBI 0.91 - This means that 91% of the patients who were predicted to survive by the BOBI score actually survived. R-Baux 0.90 - This means that 90% of the patients who were predicted to survive by the R-Baux score actually survived. Both scores have high NPVs, meaning they are very reliable in predicting survival; Youden Index: BOBI 0.48 - This is a summary measure of the test's performance, calculated as sensitivity + specificity - 1. R-Baux 0.56 - The R-Baux score has a higher Youden index, indicating better overall diagnostic accuracy.

Table 3. Accuracy of BOBI and R-Baux scores in predicting mortality in burn patients.

Diagnostic	BOBI Score	R-Baux Score
Sensitivity	84.6%	76.9%
Specificity	63.6%	78.8%
PPV	0.48	0.59
NPV	0.91	0.90
Youden Index	0.48	0.56

Table 4 presents the agreement between the BOBI and R-Baux scores in predicting mortality in burn patients. Variable refers to the scoring system being analyzed (BOBI Score and R-Baux Score). Kappa statistics measures the agreement between two raters or methods. In this case, it assesses how well the BOBI and R-Baux scores agree in predicting whether a burn patient will live or die. A Kappa value of 0.87 indicates almost perfect agreement between the two scores. This means that they largely classify patients into the same outcome categories (survival or death). P value indicates the statistical significance of the Kappa value. A p-value of 0.000 means that the observed agreement is highly unlikely to be due to chance.

Table 4. Agreement between BOBI and R-Baux scores in predicting mortality in burn patients.

Variable	Kappa	P value
BOBI Score	0.87	0
R-Baux Score		

Table 5 presents a cross-tabulation of the R-Baux and BOBI scores in predicting mortality. It shows how many patients fall into different categories based on whether their scores were above or below the optimal cut-off points for predicting mortality; R-Baux Score (Rows): This shows the classification of patients based on the R-Baux score (above or below the cut-off of 90.5); BOBI Score (Columns): This shows the classification of patients based on the BOBI score (above or below the cut-off of 3.5); Cells: Each cell shows the number of patients who fall into a specific combination of R-Baux and BOBI score categories. For example, 13 patients had both R-Baux and BOBI scores above their respective cut-offs; Total: The last column and row show the total number of patients in each category. The table shows a strong trend of agreement between the two scores. Most patients (13 + 27 = 40) were classified into the same outcome category (either both scores above the cut-off, predicting death, or both below, predicting survival). There were 6 cases where the R-Baux score was below the cut-off (predicting survival), but the BOBI score was above (predicting death). This indicates that the BOBI score might be more sensitive in identifying some patients at risk of mortality who might be missed by the R-Baux score.

Table 5. Comparison of R-Baux and BOBI scores in predicting mortality.

R-Baux score	BOBI score		Total
	Above cut-off	Below cut-off	
Above cut-off	13	0	13
Below cut-off	6	27	33

*Based on the data presented in Table 5, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated as follows: Sensitivity: [True Positives / (True Positives + False Negatives)] = (13 / 19) = 68.42% ; Specificity: [True Negatives / (True Negatives + False Positives)] = (27 / 27) = 100.00%; PPV: [True Positives / (True Positives + False Positives)] = (13 / 13) = 100.00%; NPV: [True Negatives / (True Negatives + False Negatives)] = (27 / 33) = 81.81%.

4. Discussion

Our study revealed that both BOBI and R-Baux scores demonstrated excellent discriminatory power in predicting mortality, as evidenced by their high AUC values (0.861 for BOBI and 0.857 for R-Baux). These findings are consistent with previous research indicating the utility of both scoring systems in burn patient prognostication. However, our study adds to the existing literature by directly comparing the two scores in a well-defined population of burn patients. The minimal difference in AUC values suggests that both scores offer comparable overall predictive accuracy. A closer examination of the individual accuracy measures revealed subtle yet potentially significant differences between the two scores. The BOBI score exhibited higher sensitivity (84.6%), indicating a lower rate of false negatives, while the R-Baux score displayed higher specificity (78.8%), indicating a lower rate of false positives. This disparity in sensitivity and specificity may be attributed to the inclusion of inhalation injury in the R-Baux score calculation. Inhalation injury, a significant predictor of mortality in burn patients, increases the R-Baux score, potentially leading to higher specificity but lower sensitivity. The choice between BOBI and R-Baux scores, therefore, hinges on the relative importance of sensitivity and specificity in the specific clinical context. In settings where minimizing false negatives is paramount, such as identifying high-risk patients for intensive care admission, the BOBI score may be preferred. Conversely, in situations where minimizing false positives is crucial, such as determining the appropriateness of aggressive surgical intervention, the R-Baux score may be more suitable. The AUC is a fundamental metric for evaluating the performance of a predictive model, particularly in binary classification tasks like predicting mortality. It represents the probability that the model will rank a randomly chosen positive instance higher than a randomly chosen negative one. An AUC of 1 signifies a perfect model, flawlessly distinguishing between the two classes, while an AUC of 0.5 denotes a model with no discriminatory ability, essentially equivalent to random guessing. In our study, both BOBI and R-Baux achieved AUC values close to 1, underscoring their excellent capacity to differentiate between survivors and non-survivors among burn patients. Sensitivity quantifies the proportion of actual positives that are correctly identified by the model. In the context of our study, it reflects the ability of a scoring system to accurately identify patients who will succumb to their burn injuries. A high sensitivity is crucial when the cost of missing a true positive (false negative) is high. Specificity, on the other hand, measures the proportion of actual negatives that are correctly identified by the model. In our study, it represents the ability of a scoring system to correctly identify patients who will survive their burn injuries. High specificity is critical when the cost of a false positive is high. The BOBI score, by demonstrating higher sensitivity, proves more effective in identifying patients at high risk of mortality. This is of paramount importance in clinical settings where it is crucial to not miss any patient who might die due to their burn injuries. In the fast-paced and high-stakes environment of emergency departments and burn units, the BOBI score can serve as a rapid and readily applicable tool to triage patients and identify those who require immediate, aggressive intervention. Its higher sensitivity ensures that patients at the highest risk of mortality are promptly identified and prioritized for critical care, potentially saving lives. In situations where resources are stretched thin, the BOBI score can assist in efficiently allocating limited resources, such as ICU beds, ventilators, and specialized personnel, to the patients most in need. By prioritizing patients with higher BOBI scores, healthcare providers can optimize resource utilization and potentially improve outcomes. Conversely, the R-Baux score, with its higher specificity, is more adept at ruling out patients who are unlikely to die from their burn injuries. This is particularly valuable in clinical settings where resources are limited, and it is crucial to avoid unnecessary interventions. In primary care settings, where the majority of burn cases are less severe, the R-Baux score can be used to identify

patients who can be safely treated on an outpatient basis. This helps to conserve hospital beds and resources for those who genuinely require them, reducing healthcare costs and improving efficiency. When considering aggressive surgical interventions, which carry inherent risks and complications, the R-Baux score can help to identify patients who are unlikely to benefit from such procedures. This can prevent unnecessary surgeries and their associated risks, improving patient safety and outcomes. The observed difference in sensitivity and specificity between the BOBI and R-Baux scores can be primarily attributed to the inclusion of inhalation injury in the R-Baux score calculation. Inhalation injury is a severe complication that can substantially increase the risk of mortality in burn patients. By incorporating inhalation injury into its calculation, the R-Baux score gains specificity, as it is more likely to correctly identify patients who will survive their burn injuries if they do not have inhalation injury. However, this also implies that the R-Baux score might miss some patients who will die due to inhalation injury, leading to lower sensitivity. The choice between BOBI and R-Baux scores, therefore, is not a matter of one being universally superior to the other. Instead, it depends on the specific clinical context and the relative importance of sensitivity and specificity. In scenarios where minimizing false negatives is paramount, such as identifying high-risk patients for intensive care admission or making critical treatment decisions, the BOBI score may be preferred. Its higher sensitivity ensures that patients at the highest risk of mortality are not overlooked. In situations where minimizing false positives is crucial, such as determining the appropriateness of aggressive surgical intervention or allocating limited resources, the R-Baux score may be more suitable. Its higher specificity helps to avoid unnecessary interventions and prioritize resources for those most likely to benefit. It is crucial to emphasize that scoring systems are merely tools to aid clinical judgment, not replace it. A comprehensive assessment of the patient, considering their individual characteristics, burn severity, comorbidities, and other relevant factors, is essential for optimal burn care management. Scoring systems should be used in conjunction with clinical expertise and sound judgment to make informed decisions that are tailored to the individual patient's needs.[11-14]

Despite the differences in sensitivity and specificity, our study found good agreement between the BOBI and R-Baux scores in predicting mortality, as indicated by the Kappa statistic ($\kappa = 0.783$, $p = 0.000$). This finding suggests that the two scores largely classify patients into the same outcome categories (survival or death). The cross-tabulation of the scores further supports this observation, with most patients (40 out of 46) being classified into the same outcome category by both scores. The observed agreement between the two scores can be attributed to the shared variables of age and TBSA burned in their calculation. These variables are well-established predictors of mortality in burn patients and contribute significantly to the predictive accuracy of both scoring systems. However, the inclusion of inhalation injury in the R-Baux score introduces a degree of discrepancy, as evidenced by the 6 cases where the R-Baux score predicted survival while the BOBI score predicted death. The Kappa statistic is a vital tool for assessing the agreement between two raters or methods when assigning categorical outcomes. It essentially measures the extent to which the observed agreement between the two methods exceeds what would be expected by chance alone. A Kappa value of 1 indicates perfect agreement, while a value of 0 suggests an agreement no better than chance. In our study, the Kappa statistic of 0.783 signifies "good" agreement between the BOBI and R-Baux scores, implying that their classifications of patients into survival or death categories are largely consistent. The substantial agreement between the two scores can be primarily attributed to the common factors they incorporate age and TBSA burned. These variables are well-established predictors of mortality in burn patients, and their inclusion in both scoring systems contributes significantly to their predictive accuracy. Advanced age is widely recognized as a significant risk

factor for mortality in burn patients. Older adults tend to have decreased physiological reserve, impaired immune function, and a higher prevalence of comorbidities, all of which can complicate burn recovery and increase the risk of adverse outcomes. The extent of burn injury, as measured by TBSA burned, is directly related to mortality risk. Larger burns disrupt the body's ability to regulate temperature, fluid balance, and immune response, increasing the likelihood of complications and death. While age and TBSA burned contribute to the agreement between the BOBI and R-Baux scores, the inclusion of inhalation injury in the R-Baux score introduces a degree of discrepancy. Inhalation injury is a serious complication that occurs when hot gases, smoke, or toxic fumes are inhaled, causing damage to the respiratory tract. It is a strong predictor of mortality in burn patients, as it can lead to respiratory failure, pneumonia, and sepsis. The R-Baux score incorporates inhalation injury as a binary variable (present or absent), adding 17 points to the score if present. This addition can significantly impact the final score and, consequently, the predicted outcome. In our study, there were 6 cases where the R-Baux score predicted survival while the BOBI score predicted death. This discrepancy likely arose because these patients had inhalation injuries, which increased their R-Baux scores but did not factor into their BOBI scores. The good agreement between the BOBI and R-Baux scores provides reassurance that both scores are reliable tools for predicting mortality in burn patients. Clinicians can use either score with confidence, knowing that they are likely to arrive at similar predictions in most cases. However, the discrepancies observed in some cases highlight the importance of considering inhalation injury when assessing burn severity and predicting outcomes. The BOBI score, due to its simplicity and ease of use, may be preferred in resource-limited settings or for quick initial assessments. However, in cases where inhalation injury is suspected or confirmed, the R-Baux score may provide a more accurate prediction of mortality risk.[15-17]

Our study has important implications for clinical practice. It provides evidence to support the use of both BOBI and R-Baux scores in predicting mortality among burn patients. The choice between the two scores should be guided by the specific clinical context and the relative importance of sensitivity and specificity. In resource-limited settings, the BOBI score, with its simpler calculation, may be more practical. However, the R-Baux score, incorporating the critical factor of inhalation injury, may offer greater accuracy in certain situations. It is crucial to emphasize that scoring systems are merely tools to aid clinical judgment, not replace it. A holistic assessment of the patient, considering their individual characteristics, burn severity, and comorbidities, is essential for optimal burn care management. Upon admission, both BOBI and R-Baux scores can be rapidly calculated to provide an initial assessment of mortality risk. This allows for immediate triage and risk stratification, ensuring that high-risk patients receive prompt attention and appropriate allocation of resources. The scores can inform treatment decisions, such as the need for aggressive fluid resuscitation, early surgical intervention, or intensive care monitoring. For instance, a high BOBI score might suggest the need for more aggressive early management, while a high R-Baux score might prompt closer monitoring for potential respiratory complications due to inhalation injury. The scores can facilitate communication with patients and their families about the severity of the injury and potential outcomes. By providing a clear and objective measure of mortality risk, clinicians can foster realistic expectations and shared decision-making. In resource-limited settings, where healthcare resources might be scarce, the BOBI score's simplicity and ease of use make it a practical choice for initial risk assessment and triage. Its reliance on readily available information (age and TBSA) allows for rapid calculation and prompt decision-making. In critical care environments, where minimizing false negatives is paramount, the BOBI score's higher sensitivity might make it more suitable for identifying patients at

the highest risk of mortality. This can ensure that critically ill patients receive the necessary level of care and monitoring. When considering complex surgical interventions, the R-Baux score's higher specificity might be more valuable. By minimizing false positives, it can help to avoid unnecessary surgeries in patients who are unlikely to benefit, reducing the risk of complications and optimizing resource utilization. While scoring systems provide valuable prognostic information, they should not be used in isolation. A comprehensive assessment of the patient, considering their individual characteristics, burn severity, comorbidities, and other relevant factors, is essential for optimal burn care management. Factors such as age, pre-existing medical conditions, and overall health status can significantly influence burn outcomes. Elderly patients or those with chronic diseases might require more intensive monitoring and treatment, even if their scores are relatively low. The depth and location of burns can impact the severity of the injury and the risk of complications. Burns involving critical areas such as the face, hands, or perineum require specialized care, regardless of the overall TBSA. Pre-existing medical conditions, such as diabetes, heart disease, or respiratory problems, can complicate burn recovery and increase the risk of mortality. These comorbidities should be carefully considered when interpreting the scores and making treatment decisions. Scoring systems can also play a role in quality improvement initiatives. By tracking the scores of burn patients and comparing them to outcomes, healthcare providers can identify areas where care might be improved. For instance, if a high proportion of patients with low scores experience adverse outcomes, it might suggest the need for better monitoring or more aggressive treatment protocols.[18-20]

5. Conclusion

In conclusion, this study underscores the efficacy of both the BOBI and R-Baux scoring systems in predicting mortality among burn patients, demonstrating their excellent discriminatory power and comparable overall predictive accuracy. Notably, the BOBI score exhibits higher sensitivity, making it particularly valuable in settings where minimizing false negatives is paramount. Conversely, the R-Baux score's higher specificity proves advantageous when minimizing false positives is crucial. The choice between the two scores should be guided by the specific clinical context and the relative importance of sensitivity and specificity. Despite these differences, the study found good agreement between the two scores, indicating their consistency in classifying patients into survival or death categories. This agreement is attributed to the shared variables of age and TBSA burned in their calculation. However, the inclusion of inhalation injury in the R-Baux score introduces a degree of discrepancy, highlighting the importance of considering this factor when assessing burn severity and predicting outcomes. The study's findings have significant implications for clinical practice, supporting the use of both BOBI and R-Baux scores in predicting mortality among burn patients. The choice between the two scores should be guided by the specific clinical context and the relative importance of sensitivity and specificity. It is crucial to emphasize that scoring systems are merely tools to aid clinical judgment, not replace it. A holistic assessment of the patient, considering their individual characteristics, burn severity, and comorbidities, is essential for optimal burn care management.

6. References

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