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ACCURACY OF S REMS AS COMPARED TO RAPS IN PREDICTING THE PROGNOSIS IN NON-SURGICAL PATIENTS PRESENTING TO EMERGENCY DEPARTMENT IN A TERTIARY CARE HOSPITAL

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ABSTRACT

Early identification of non-surgical emergency patients at high risk of deterioration and death remains a major challenge, particularly in resource-constrained emergency departments. We prospectively evaluated and compared the prognostic performance of the Rapid Emergency Medicine Score (REMS) and Rapid Acute Physiology Score (RAPS) for predicting in-hospital mortality in 700 adults presenting with heterogeneous non-surgical emergencies at a tertiary care hospital in India. Both scores were calculated at initial emergency assessment and evaluated using risk stratification and receiver operating characteristic analysis. Overall, in-hospital mortality was 12.4%. Mortality increased progressively across REMS risk categories, from 0% in low-risk patients to 16.0% in those classified as high risk, while corresponding mortality with RAPS increased from 6.6% to 25.0%. Non-survivors had significantly higher REMS and RAPS scores than survivors (10.86 ± 2.48 vs. 8.08 ± 2.82 and 5.03 ± 2.03 vs. 4.02 ± 1.91, respectively; both $P < 0.001$). Importantly, REMS demonstrated superior discriminatory performance compared with RAPS (AUC 0.77 vs. 0.64). These findings indicate that incorporating age and oxygenation into physiological risk assessment provides additional prognostic information. REMS may therefore offer a simple, rapid, and clinically applicable approach for early mortality risk stratification and prioritization of monitoring and critical care resources in heterogeneous non-surgical emergency population.

KEYWORDS: Emergency departments, non-surgical emergency, Rapid Emergency Medicine Score (REMS), and Rapid Acute Physiology Score (RAPS)

INTRODUCTION

Emergency departments (EDs) are increasingly confronted with a heterogeneous population of patients with acute medical conditions that can deteriorate rapidly despite limited abnormalities at initial presentation[1]. Non-surgical emergencies including acute coronary syndromes, sepsis, stroke, acute exacerbations of chronic respiratory disease, and gastrointestinal bleeding- represent a particularly challenging spectrum because their clinical trajectories are diverse and their early manifestations may not reliably reflect the severity of underlying physiological derangement[2,3]. Timely identification of patients at increased risk of death is therefore fundamental to emergency care, enabling early escalation of treatment, appropriate monitoring, and prioritization of limited critical care resources[4].The need for accurate early prognostication is particularly acute in tertiary care hospitals, where emergency departments manage high patient volumes and frequently operate under constrained intensive care capacity[5,6]. In these settings, clinicians must make rapid decisions regarding disposition, intensity of monitoring, and escalation of organ support using information available at the time of presentation[7,8]. Although clinical judgment remains central to these decisions, its performance can vary with clinical experience, workload, and the complexity of acute illness[9]. Simple and reproducible physiological scoring systems may therefore provide an important adjunct to clinical assessment by transforming routinely available bedside variables into an objective estimate of short-term risk[10,11].

Several prognostic models have been developed to quantify the severity of acute illness. The Acute Physiology and Chronic Health Evaluation (APACHE) and Simplified Acute Physiology Score (SAPS) systems have demonstrated prognostic value in critically ill populations but generally require multiple physiological and laboratory measurements and were primarily developed for ICU settings[12,13]. Their complexity may limit their utility during the early phase of emergency assessment, when rapid risk stratification is required and complete laboratory information may not yet be available[14]. This has led to increasing interest in simpler emergency-specific scores that can be calculated rapidly using routinely measured clinical variables[15]. The Rapid Acute Physiology Score (RAPS) was developed as a simplified physiological assessment tool incorporating heart rate, systolic blood pressure, respiratory rate, and Glasgow Coma Scale (GCS) score15. Its simplicity enables rapid bedside assessment without reliance on laboratory investigations and has supported its use in acute and emergency populations[16,17]. However, RAPS captures a relatively limited range of determinants of clinical risk and does not incorporate age or oxygenation status18. These factors may be particularly relevant among older adults and patients with cardiopulmonary or systemic acute illnesses, in whom baseline vulnerability and impaired oxygenation may substantially influence outcomes19. The Rapid Emergency Medicine Score (REMS) was developed to extend this physiological framework by incorporating age and peripheral oxygen saturation (SpO_2), in addition to heart rate, mean arterial pressure, respiratory rate, and GCS score[18,20]. By combining measures of acute physiological disturbance with age-related vulnerability and oxygenation, REMS may provide a more comprehensive assessment of risk at the time of emergency presentation[21]. Previous studies have reported associations between REMS and mortality across heterogeneous emergency populations, raising the possibility that the additional information incorporated into REMS may improve prognostic discrimination compared with simpler physiological scores[14,21]. However, the extent to which this potential advantage translates into clinically meaningful improvement over RAPS may depend on the characteristics of the population being assessed[21,22].

This question is particularly important in non-surgical emergency populations, which encompass patients with markedly different disease processes and trajectories[23]. In such patients, physiological instability may arise from cardiovascular, infectious, respiratory, neurological, or metabolic causes, and the prognostic relevance of individual clinical variables may vary substantially across these conditions[24–27]. The challenge is further amplified in older populations, who frequently present with multiple comorbidities and reduced physiological reserve[28]. A scoring system that can reliably distinguish patients at low risk from those requiring intensive monitoring or early critical care intervention could therefore have substantial clinical value[29]. The Indian tertiary care setting provides an important context in which to evaluate these tools. Emergency departments in resource-constrained environments frequently manage a high burden of acute medical illness while facing limitations in ICU beds, monitoring capacity, and healthcare resources[5,30]. In such circumstances, prognostic scores must not only demonstrate statistical association with adverse outcomes but also provide meaningful discrimination across a heterogeneous patient population[31,32]. Furthermore, differences in demographic characteristics, disease patterns, comorbidity burden, healthcare access, and delays in presentation may influence the performance of scoring systems developed or validated in other healthcare settings[33,34]. Consequently, evidence generated from local populations is essential before routine implementation of prognostic tools in clinical practice. Despite the widespread use of physiological scoring systems in emergency and critical care, the comparative performance of REMS and RAPS in predicting in-hospital mortality among non-surgical emergency patients remains insufficiently characterized, particularly in the Indian tertiary care context[35]. Importantly, it is not enough for a score to be statistically associated with mortality; its clinical value depends on its ability to discriminate between survivors and non-survivors across a broad spectrum of illness severity[36]. Direct comparison of REMS and RAPS within the same patient population can therefore clarify whether incorporating age and oxygenation into a broader physiological framework provides meaningful additional prognostic information[24,37].

In the present study, we evaluated the prognostic performance of REMS and RAPS in 700 non-surgical patients presenting to the emergency department of a tertiary care hospital, using in-hospital mortality as the primary outcome[38]. The study population represented a clinically diverse cohort with substantial representation of older adults and major acute cardiovascular, infectious, neurological, respiratory, and gastrointestinal conditions[39–42]. We specifically examined the association of each score with in-hospital mortality and compared their discriminatory performance using receiver operating characteristic analysis. By directly evaluating these two readily applicable bedside tools in a large, heterogeneous non-surgical emergency population, this study seeks to determine whether REMS provides superior prognostic discrimination compared with RAPS and to assess its potential utility for early risk stratification in resource-constrained emergency care settings.

METHODOLOGY

Study design and setting: This longitudinal observational study was conducted in the Department of Emergency Medicine, Sri Siddhartha Medical College Hospital and Research Centre, Tumakuru, India, a tertiary care teaching hospital serving both urban and rural populations. The study was carried out over a period of 18 months to evaluate and compare the prognostic performance of the Rapid Emergency Medicine Score (REMS) and Rapid Acute Physiology Score (RAPS) in predicting clinical outcomes among adult non-surgical patients presenting to the emergency department.

Study participants: Adult patients (≥18 years) presenting to the emergency department with non-surgical medical conditions during the study period were consecutively enrolled using purposive sampling. Patients with surgical conditions, those younger than 18 years of age, and pregnant women were excluded from the study.

Sample size: The minimum required sample size was estimated using the standard formula for diagnostic accuracy studies:

$$n = Z_{1-\alpha/2}^{2} \times \frac{S(1-S)}{d^2} \times \text{Prevalence}$$

Where: $Z1-\alpha/2=1.96$; S= Specificity (76.0%); P= Mortality as per REMS (assumed to be 50%); d= Precision of estimate (5%). Based on this calculation, the minimum sample size required was 561 patients. Total Sample collected was 700.

Data collection: Eligible patients were assessed immediately upon presentation to the emergency department. Demographic information, including age and sex, together with clinical and physiological parameters, were prospectively recorded using a standardized data collection form. Physiological variables included pulse rate, systolic blood pressure, respiratory rate, peripheral oxygen saturation (SpO_2), and level of consciousness. Glasgow Coma Scale (GCS) scores were documented for all participants at the time of presentation.
REMS and RAPS assessment: The Rapid Emergency Medicine Score (REMS) was calculated using patient age, mean arterial pressure, respiratory rate, peripheral oxygen saturation, and neurological status assessed by the Glasgow Coma Scale. The Rapid Acute Physiology Score (RAPS) was determined using pulse rate, blood pressure, respiratory rate, and Glasgow Coma Scale. Both scoring systems were calculated at the initial emergency department assessment before initiation of definitive treatment.

Outcome measures: Participants were prospectively followed throughout their hospital stay until discharge or in-hospital death. The primary outcome was in-hospital mortality, while survival to hospital discharge was considered a favorable outcome. REMS and RAPS were evaluated for their ability to predict patient prognosis based on these clinical outcomes.

Statistical analysis: Statistical analyses were performed using Epi Info software (version 3.4.3). Continuous variables are presented as descriptive statistics, whereas categorical variables are expressed as frequencies and percentages. The prognostic performance of REMS and RAPS was evaluated using receiver operating characteristic (ROC) curve analysis, and the area under the ROC curve (AUC) was calculated for each scoring system. Sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and overall diagnostic accuracy were determined to assess predictive performance. Comparative analyses were performed to identify the scoring system with superior prognostic discrimination.

Ethical approval: The study protocol was reviewed and approved by the Institutional Ethics Committee of Sri Siddhartha Medical College Hospital and Research Centre before commencement of the study. Written informed consent was obtained from all participants or their legally authorized representatives prior to enrolment. All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki and institutional guidelines. Participant confidentiality was maintained throughout the study, and no additional interventions beyond routine clinical management were performed.

RESULTS

Age and six distributions of study participants: The study population was predominantly elderly, with 39.3% of patients aged above 60 years, followed by 33.3% in the 46–60 years group. Together, these two older age groups constituted 72.6% of the total sample, indicating that emergency department presentations were largely driven by middle-aged and elderly patients. Younger adults (18–30 years) represented the smallest proportion (8.1%), suggesting lower acute emergency utilization in this age bracket (Table 1).

Table 1. age category distribution of study participants (n = 700)

Age Category	Frequency	Percentage (%)
18–30 years	57	8.1%
31–45 years	135	19.3%
46–60 years	233	33.3%
> 60 years	275	39.3%
Total	700	100.0%

Male patients constituted the majority of the study population (60.7%), indicating a male predominance in emergency department attendance. Females accounted for 39.3%, reflecting a moderately lower utilization of emergency services compared to males (Table 2).

Table 2 Sex Distribution of Study Participants (N = 700)

Sex	Frequency	Percentage (%)
Female	275	39.3%
Male	425	60.7%
Total	700	100.0%

Chief complaints of the participants: As showed in the Figure 1, abdominal pain was the most frequent presenting complaint (22.6%), followed by fever (20.7%) and altered sensorium (19.3%). Cardiopulmonary symptoms such as breathlessness and chest pain together constituted 37.5%, highlighting the significant burden of respiratory and cardiac emergencies within the study population.

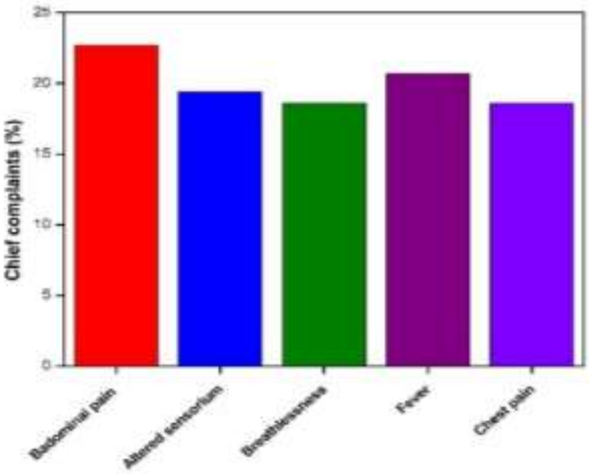

Figure 1. Distribution of Chief Complaints of the participants (N=700)

Co-Morbidities of the participants: Hypertension was the most prevalent comorbidity (22.7%), followed by diabetes mellitus (14.7%). Nearly 43.3% of patients had no documented comorbidities, indicating a substantial proportion of acute presentations in previously healthy individuals. Combined comorbid states, although less frequent, represent high-risk groups with greater prognostic implications (Table 3).

Table 3. Co-morbidities of the participants (N=700)

Co-Morbid Condition	Frequency	Percentage (%)
CAD	42	6.0%
DM	103	14.7%
DM + CAD	6	0.9%
HTN	159	22.7%
HTN + CAD	22	3.1%
HTN + DM	61	8.7%
HTN + DM + CAD	4	0.6%
None	303	43.3%
Total	700	100.0%

Distribution of provisional diagnoses: Acute coronary syndrome (ACS) was the most common provisional diagnosis (21.6%), closely followed by sepsis (20.9%) and stroke (20.7%). This reflects a high burden of cardiovascular, infectious, and neurological emergencies in the study cohort. Such diagnostic diversity supports the relevance of physiological scoring systems like REMS and RAPS across heterogeneous acute medical conditions (Table 4).

Table 4. Distribution of Provisional Diagnoses (N = 700)

Provisional Diagnosis	Frequency	Percentage (%)
ACS	151	21.6%
COPD Exacerbation	134	19.1%
GI Bleed	124	17.7%
Sepsis	146	20.9%
Stroke	145	20.7%
Total	700	100.0%

In-hospital mortality status: The overall in-hospital mortality rate was 12.4%, indicating that approximately one in eight patients admitted through the emergency department succumbed during hospitalization. This outcome variable forms the primary endpoint for evaluating the prognostic performance of REMS and RAPS scoring systems (Figure 2).

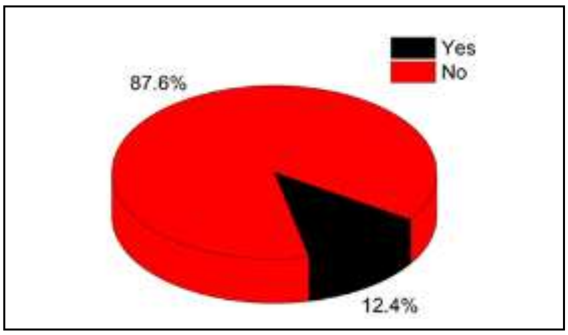

Figure 2. In-Hospital Mortality Status (N = 700)

Patient disposition following emergency department admission: Most patients (71.9%) were discharged after stabilization and management. However, 23.8% required either ward or ICU admission, reflecting a considerable burden of moderate-to-severe illness. ICU admissions (9.7%) represent critically ill patients who are most relevant to mortality prediction models such as REMS and RAPS (Table 5).

Table 5: Patient Disposition Following Emergency Department Admission (N = 700)

Disposition	Frequency	Percentage (%)
DAMA	14	2.0%
Discharged	503	71.9%
ICU	68	9.7%
Transferred	16	2.3%
Ward	99	14.1%
Total	700	100.0%

Length of hospital stay (days): The average hospital stay was 7.22±4.30 days (Mean ± SD), indicating prolonged inpatient care for a significant proportion of patients. This reflects moderate-to-severe disease severity and resource utilization associated with emergency admissions.
Rems and raps score distribution: The mean REMS score of 8.43 ± 2.93 places the average patient in the moderate-to-high risk category, whereas the mean RAPS score of 4.14 ± 2.93 reflects moderate physiological derangement. These baseline score distributions form the foundation for comparative prognostic accuracy analysis.
Rems risk category distribution: A striking 75.1% of patients were categorized as high risk by REMS (Table 6), indicating a predominance of severe physiological derangement at presentation. Only 2.6% were classified as low risk, emphasizing the critical nature of the emergency department population included in this study.

Table 6: REMS Risk Category Distribution (N = 700)

REMS Category	Frequency	Percentage (%)
Low Risk	18	2.6%
Moderate Risk	156	22.3%
High Risk	526	75.1%
Total	700	100.0%

Raps risk category distribution: Unlike REMS, RAPS classified the majority of patients into the moderate-risk category (65.7%), with fewer patients categorized as high risk (12.6%) . This contrast highlights the broader risk stratification capability of REMS and sets the basis for comparative prognostic performance analysis (Table 7).

Table 7: RAPS Risk Category Distribution (N = 700)

RAPS Category	Frequency	Percentage (%)
Low Risk	152	21.7%
Moderate Risk	460	65.7%
High Risk	88	12.6%
Total	700	100.0%

Association between rems risk category and in-hospital mortality: A statistically significant association was observed between REMS risk category and in-hospital mortality ($\chi^2 = 24.433$, df = 2, $p < 0.001$), indicating that mortality risk varied significantly across REMS stratification groups (Table 8). Patients classified as low risk demonstrated 100.0% survival, with no recorded mortality, confirming the strong negative predictive ability of REMS in identifying patients with favorable outcomes. In the moderate-risk group, mortality remained low at 1.9%, with 98.1% of patients surviving (Table 8), suggesting that this category largely represents patients with stable physiological status and lower immediate mortality risk. In contrast, the high-risk REMS category exhibited a markedly elevated mortality rate of 16.0%, with 84 deaths among 526 patients (Table 8). This progressive increase in mortality across REMS categories demonstrates a clear dose–response relationship between REMS severity and in-hospital death, validating REMS as a reliable prognostic tool for early risk stratification in emergency department settings. Overall, these findings confirm that higher REMS scores are strongly associated with worse clinical outcomes, supporting the clinical utility of REMS in identifying critically ill non-surgical patients who require aggressive monitoring and early intervention.

Table 8: Association Between REMS Risk Category and In-Hospital Mortality (N = 700)

REMS Category	No (Survived) n (%)	Yes (Died) n (%)	Total n (%)
Low risk	18 (100.0%)	0 (0.0%)	18 (100.0%)
Moderate risk	153 (98.1%)	3 (1.9%)	156 (100.0%)
High risk	442 (84.0%)	84 (16.0%)	526 (100.0%)
Total	613 (87.6%)	87 (12.4%)	700 (100.0%)
$\chi^2 = 24.433$, df = 2, p < 0.001			

Association between raps risk category and in-hospital mortality: A statistically significant association was observed between RAPS risk category and in-hospital mortality ($\chi^2 = 17.651$, df = 2, $p < 0.001$), indicating that mortality outcomes varied significantly across different RAPS severity groups (Table 9). Among patients categorized as low risk, the mortality rate was 6.6%, with the majority (93.4%) surviving hospitalization. This suggests that RAPS effectively identifies patients with relatively favorable short-term outcomes. In the moderate-risk group, mortality increased to 12.0%, reflecting a progressive rise in adverse outcomes with increasing physiological derangement (Table 9). The high-risk RAPS category demonstrated the highest mortality rate at 25.0%, with one in four patients succumbing during hospitalization. This substantial increase highlights the strong prognostic gradient associated with rising RAPS scores (Table 9). Overall, the stepwise increase in mortality from low to high RAPS categories demonstrates a clear risk stratification pattern, confirming that higher RAPS scores are associated with significantly worse in-hospital outcomes. These findings support the clinical utility of RAPS in early identification of high-risk non-surgical emergency patients who may benefit from prompt intensive monitoring and aggressive management.

Table 9: Association Between RAPS Risk Category and In-Hospital Mortality (N = 700)

RAPS Category	No (Survived) n (%)	Yes (Died) n (%)	Total n (%)
Low risk	142 (93.4%)	10 (6.6%)	152 (100.0%)
Moderate risk	405 (88.0%)	55 (12.0%)	460 (100.0%)
High risk	66 (75.0%)	22 (25.0%)	88 (100.0%)
Total	613 (87.6%)	87 (12.4%)	700 (100.0%)
$\chi^2 = 17.651$, df = 2, $p < 0.001$			

Association between sex and in-hospital mortality: The association between sex and in-hospital mortality was not statistically significant ($\chi^2 = 2.101$, df = 1, $p = 0.147$), indicating that mortality outcomes did not differ significantly between male and female patients in this study population (Table 10). Although males demonstrated a numerically higher mortality rate (13.9%) compared to females (10.2%), this difference did not reach statistical significance. This suggests that sex alone was not an independent determinant of in-hospital mortality in the present cohort (Table 10). Overall, the findings indicate that mortality in non-surgical emergency patients was more strongly influenced by physiological severity and clinical status (as reflected by REMS and RAPS scores) rather than by gender differences.

Table 10: Association Between Sex and In-Hospital Mortality (N = 700)

Sex	Yes (Died) n (%)	No (Survived) n (%)	Total n (%)
Female	28 (10.2%)	247 (89.8%)	275 (100.0%)
Male	59 (13.9%)	366 (86.1%)	425 (100.0%)
Total	87 (12.4%)	613 (87.6%)	700 (100.0%)
$\chi^2 = 2.101$, df = 1, $p = 0.147$			

Comparison of rems and raps scores between survivors and non-survivors: A highly significant difference was observed in both REMS and RAPS scores between survivors and non-survivors, demonstrating the strong prognostic value of these scoring systems in predicting in-hospital mortality (Figure 3). The mean REMS score among patients who survived was 8.08 ± 2.82, whereas non-survivors had a substantially higher mean score of 10.86 ± 2.48. This difference was statistically highly significant ($t = 8.709$, $p < 0.001$), indicating that patients who died during hospitalization presented with markedly worse physiological derangements at admission. The mean difference of 2.78 points further highlights the strong discriminative capacity of REMS in separating high-risk from low-risk patients (Figure 3). Similarly, the mean RAPS score was significantly lower in survivors (4.02 ± 1.91) compared to non-survivors (5.03 ± 2.03), with this difference also achieving strong statistical significance ($t = 4.608$, $p < 0.001$). Although the magnitude of difference was smaller than that observed for REMS, the consistent increase in RAPS scores among non-survivors confirms its relevance as a mortality prediction tool (Figure 3).

The narrow confidence intervals for both REMS and RAPS score differences indicate robust statistical reliability. Overall, these findings demonstrate that higher REMS and RAPS scores are strongly associated with increased in-hospital mortality, with REMS showing a larger effect size and greater discriminatory strength. This supports the superior prognostic performance of REMS compared to RAPS in non-surgical emergency patients, aligning with the primary objective of the present study.

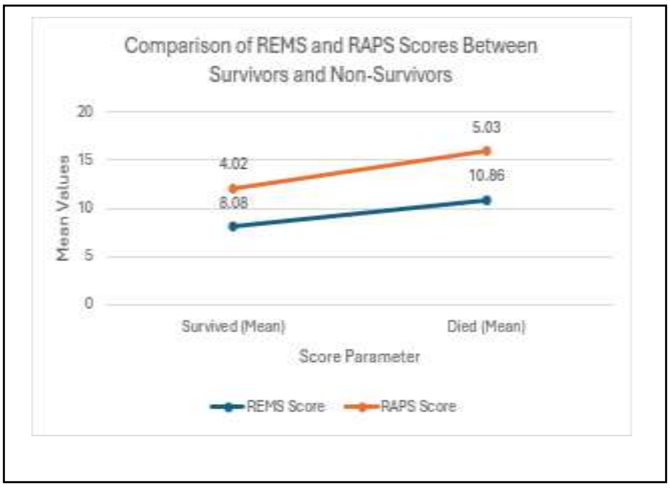

Figure 3. Comparison of REMS and RAPS Scores Between Survivors and Non-Survivors (N=700)

Diagnostic performance of rems and raps categories in predicting in-hospital mortality: Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the discriminatory ability of REMS and RAPS categories in predicting in-hospital mortality among non-surgical emergency patients. The diagnostic performance of each score was assessed using the Area Under the Curve (AUC), along with standard error, 95% confidence interval (CI), and p-value (Table 11). The REMS category demonstrated an AUC of 0.77 (SE = 0.027), indicating good discriminative ability. The 95% confidence interval ranged from 0.569 to 0.676, and the association was statistically significant ($p < 0.001$). This suggests that REMS is a reliable scoring system for distinguishing between patients with and without the outcome of interest (Table 11).

In comparison, the RAPS category showed an AUC of 0.64 (SE = 0.033), reflecting moderate discriminatory ability. The 95% confidence interval ranged from 0.544 to 0.672, with a statistically significant p-value ($p = 0.001$). Although RAPS was able to predict the outcome better than chance, its predictive performance was inferior to that of REMS (Table 11).

Overall, REMS outperformed RAPS, demonstrating superior accuracy and better diagnostic discrimination. Hence, REMS may be considered a more effective clinical scoring system for outcome prediction in the present study population.

Table 11. Diagnostic Performance of REMS and RAPS Categories in Predicting In-Hospital Mortality (ROC Analysis, N = 700)

Scoring System	Area Under Curve	Std. Error	95% CI (Lower–Upper)	p-value
REMS Category	0.77	0.027	0.569 – 0.676	< 0.001
RAPS Category	0.64	0.033	0.544 – 0.672	0.001

Coordinates of the roc curve for rems and raps categories: Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the diagnostic performance of REMS and RAPS categories. Sensitivity represents the ability of the score to correctly identify true positive cases, while specificity indicates the ability to correctly identify true negative cases (Figure 4.). For REMS, at a cut-off value of ≥1.5, sensitivity remained 100%, indicating excellent ability to detect all true positive cases; however, specificity was low (2.9%), suggesting a high false-positive rate. Increasing the cut-off to ≥2.5 resulted in a slight reduction in sensitivity (96.6%) with an improvement in specificity (27.9%), indicating a more balanced diagnostic performance. At the highest cut-off (≥4.0), sensitivity dropped to zero with perfect specificity, reflecting failure to detect positive cases (Figure 4). For RAPS, a cut-off of ≥1.5 showed moderate sensitivity (88.5%) with low specificity (23.2%). At ≥2.5, sensitivity markedly decreased (25.3%) while specificity increased substantially (89.2%), indicating better discrimination of negative cases at the expense of missing positives. Similar to REMS, the highest cut-off demonstrated zero sensitivity with maximum specificity (Figure 4). Overall, lower cut-off values favored sensitivity, making them useful for screening purposes, whereas higher cut-off values improved specificity, making them suitable for confirmatory diagnosis.

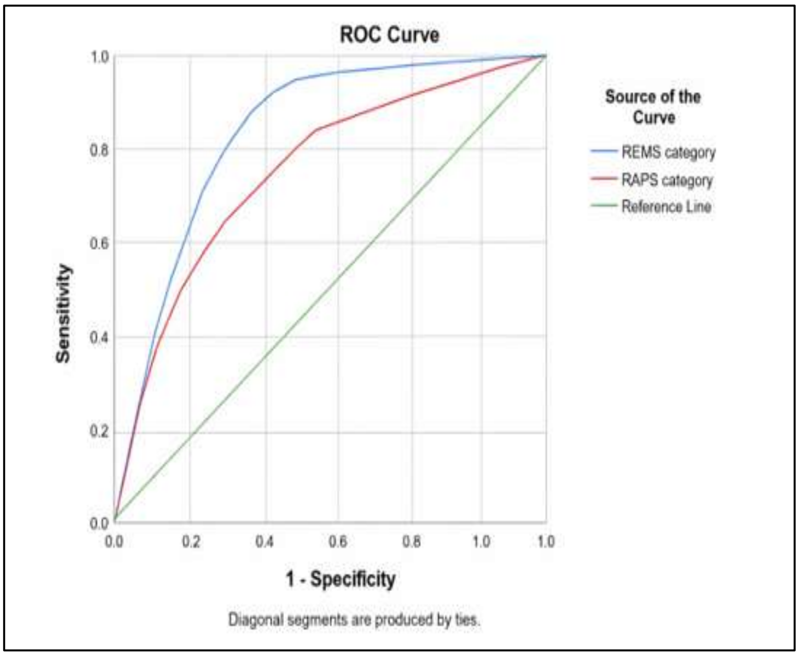

Figure 4. ROC Curve for REMS and RAPS Categories

DISCUSSION

The present study demonstrated that both the Rapid Emergency Medicine Score (REMS) and Rapid Acute Physiology Score (RAPS) were significantly associated with in-hospital mortality among non-surgical emergency patients; however, REMS showed superior prognostic performance. This finding is supported by the significantly higher mean REMS score among non-survivors compared with survivors (10.86 ± 2.48 vs. 8.08 ± 2.82), with a greater separation between outcome groups than observed with RAPS43. Although both scores increased with mortality risk, the stronger discrimination observed with REMS suggests that it provides more comprehensive early risk assessment in a heterogeneous emergency population44.

The superior performance of REMS may be explained by the inclusion of age and peripheral oxygen saturation (SpO_2), in addition to acute physiological variables[14,45]. This is particularly relevant to the present cohort, in which 72.6% of patients were aged ≥46 years and the clinical spectrum included acute coronary syndrome, sepsis, stroke, COPD exacerbation, and gastrointestinal bleeding46. Older age reflects reduced physiological reserve, while impaired oxygenation may indicate cardiopulmonary or systemic disease severity. These factors are not incorporated into RAPS and may therefore account, at least partly, for its lower prognostic discrimination[23,47]. The findings are consistent with previous studies demonstrating better mortality prediction with REMS than RAPS in emergency populations.

The risk-category analysis further supports the clinical value of REMS. Mortality increased from 0% in the low-risk group to 1.9% in the moderate-risk group and 16.0% in the high-risk group, demonstrating a clear stepwise relationship between increasing REMS severity and mortality. In comparison, RAPS showed mortality rates of 6.6%, 12.0%, and 25.0% across low-, moderate-, and high-risk groups, respectively[48,49]. Although RAPS also demonstrated a significant risk gradient, the presence of mortality in its low-risk category suggests that it may underestimate risk in a proportion of patients. Thus, REMS may offer better early identification of patients at low risk as well as those requiring closer monitoring and escalation[10,50].

Importantly, ROC analysis demonstrated better discrimination with REMS than RAPS, with an AUC of 0.77 versus 0.64, respectively. This difference indicates that REMS has a greater ability to distinguish survivors from non-survivors51. These findings are comparable with previous work by Garkaz et al., who reported AUCs of 0.72 for REMS and 0.62 for RAPS, supporting the reproducible superiority of REMS over RAPS in non-trauma emergency populations[52]. The present findings therefore suggest that the addition of age and SpO_2 provides meaningful prognostic information beyond the physiological variables included in RAPS.

The high proportion of older patients and the heterogeneous disease profile in this study highlight the potential practical value of REMS in tertiary emergency care. A simple score that uses routinely available bedside variables may assist clinicians in early identification of patients at increased risk of deterioration and mortality, particularly where ICU and monitoring resources are limited53. However, REMS should complement rather than replace clinical judgment, as disease-specific factors, comorbidities, treatment response, and clinical trajectory may also influence outcomes.

Implications: The findings of this study have important clinical and operational implications for emergency department practice. The superior prognostic performance of REMS suggests that it may serve as a more reliable tool for early risk stratification of non-surgical patients at triage. Effective identification of high-risk patients at presentation can facilitate timely clinical decision-making, including prioritization for monitoring, early escalation of care, and appropriate allocation of intensive care resources. The ability of REMS to demonstrate a clear mortality gradient across risk categories supports its potential role in standardizing triage processes and reducing subjectivity in early patient assessment. Additionally, the strong negative predictive capacity observed in lower REMS categories highlights its usefulness in identifying patients with favorable outcomes who may be suitable for less intensive management. At an institutional level, integration of REMS into emergency department workflows could contribute to improved patient flow, optimized bed utilization, and more efficient deployment of limited critical care resources. The study also reinforces the value of physiology-based scoring systems over demographic factors alone, emphasizing the importance of objective, measurable clinical parameters in prognostication. Overall, the results support the incorporation of REMS into routine emergency department assessment protocols for non-surgical patients.

Recommendations: Based on the findings of the present study, routine use of the Rapid Emergency Medicine Score is recommended for initial assessment and risk stratification of non-surgical patients presenting to the emergency department. REMS may be employed as a primary triage tool to identify patients at high risk of in-hospital mortality who require closer monitoring, early intervention, or intensive care unit admission. Training of emergency department personnel in accurate and consistent measurement of REMS parameters may enhance the effectiveness of its implementation. Incorporation of REMS into electronic medical record systems and triage algorithms could further streamline workflow and support real-time clinical decision-making. While RAPS demonstrated prognostic value, its comparatively lower discriminative performance suggests that it may be better suited as an adjunct rather than a standalone triage score in general medical emergency populations. Institutional protocols may consider REMS-based thresholds to guide escalation of care and resource allocation. Continuous audit and periodic evaluation of scoring system performance in local settings are recommended to ensure sustained accuracy and relevance. Adoption of standardized scoring systems such as REMS may also facilitate interdepartmental communication and improve consistency in patient assessment across healthcare providers.

Limitations: Despite its strengths, this study has several limitations that should be acknowledged. The study was conducted at a single tertiary care center, which may limit the generalizability of findings to other healthcare settings with different patient demographics or resource availability. The observational design precludes causal inference, and associations identified between scores and outcomes cannot establish direct cause–effect relationships. Only in-hospital mortality was assessed, and longer-term outcomes such as 30-day or 90-day mortality were not evaluated. Potential confounding factors, including variations in treatment strategies and clinician decision-making, were not controlled for in the analysis. Additionally, comorbidity burden was not quantified using standardized indices, which may have provided further insight into outcome determinants. Physiological parameters were recorded at presentation only, and changes in scores over time were not assessed. These limitations should be considered when interpreting the results, although they do not detract from the overall conclusion regarding the comparative prognostic performance of REMS and RAPS.

CONCLUSION

In conclusion, both REMS and RAPS were useful predictors of in-hospital mortality, but REMS demonstrated superior prognostic discrimination in this non-surgical emergency population. The higher separation between survivors and non-survivors, clearer mortality gradient, and greater AUC support REMS as a more effective tool for early mortality risk stratification. Its superior performance may be related to the additional prognostic information provided by age and SpO_2, making REMS particularly suitable for heterogeneous and predominantly older emergency populations.

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Conflict of interest statement. The authors declare that they have no conflict of interest related to this study or its publication.

Ethical declarations: The study protocol was reviewed and approved by the Institutional Ethics Committee of Sri Siddhartha Medical College Hospital and Research Centre before commencement of the study. Written informed consent was obtained from all participants or their legally authorized representatives prior to enrolment. All procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki and institutional guidelines. Participant confidentiality was maintained throughout the study, and no additional interventions beyond routine clinical management were performed.

Clinical trial information: This was a longitudinal observational study and was not a clinical trial. Therefore, clinical trial registration was not applicable.

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