

External Validation of the Methicillin-Resistant *Staphylococcus aureus* Bacteremia Score

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Background

- Methicillin Resistant *Staphylococcus aureus* bacteremia (MRSAB) is a common healthcare-associated infection with mortality rates up to 30%.
- Scoring systems, such as the Pitt Bacteremia Score (PBS) and Acute Physiology and Chronic Health Evaluation II (APACHE-II) score, can optimize clinical decisions and provide adjustment for confounding among patients with Methicillin-Resistant *Staphylococcus aureus* bacteremia (MRSAB).
- The recently introduced MRSAB score, comprised of 6 variables, demonstrated superior discriminatory ability in mortality prediction compared to APACHE-II and PBS in a previous study but has not yet been externally validated.
- The objective of this study was to externally validate the discriminatory ability of the MRSAB score and compare the discriminatory ability of the MRSAB score to APACHE-II and Pitt Bacteremia Scores.

Methods

- Single center, retrospective cohort study of adult patients admitted to University of Colorado Hospital from 2013–2020 with initial episode of MRSAB were considered for inclusion.
- Patients were included if they had ≥ 1 positive MRSA blood culture, and were initiated on MRSA active antibiotics within 48 hours of index culture.
- Exclusion criteria were age < 18 or > 89 years, incarceration, pregnancy, presence of polymicrobial bacteremia, expiration or pursuit of comfort care within 24 hours of blood culture, leaving against medical advice, and transfer from outside hospital.
- The primary outcome was 30-day all-cause mortality, measured from day of index blood culture.
- The discriminatory abilities of MRSAB, APACHE II and PBS scores, calculated using the most abnormal biochemical/physiological measurement within 24 of index culture were compared using receiver operating characteristic (ROC) analysis.
- The sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were analyzed, and optimal MRSAB score was identified by Youden Index.

Results

Table 1. Baseline Characteristics

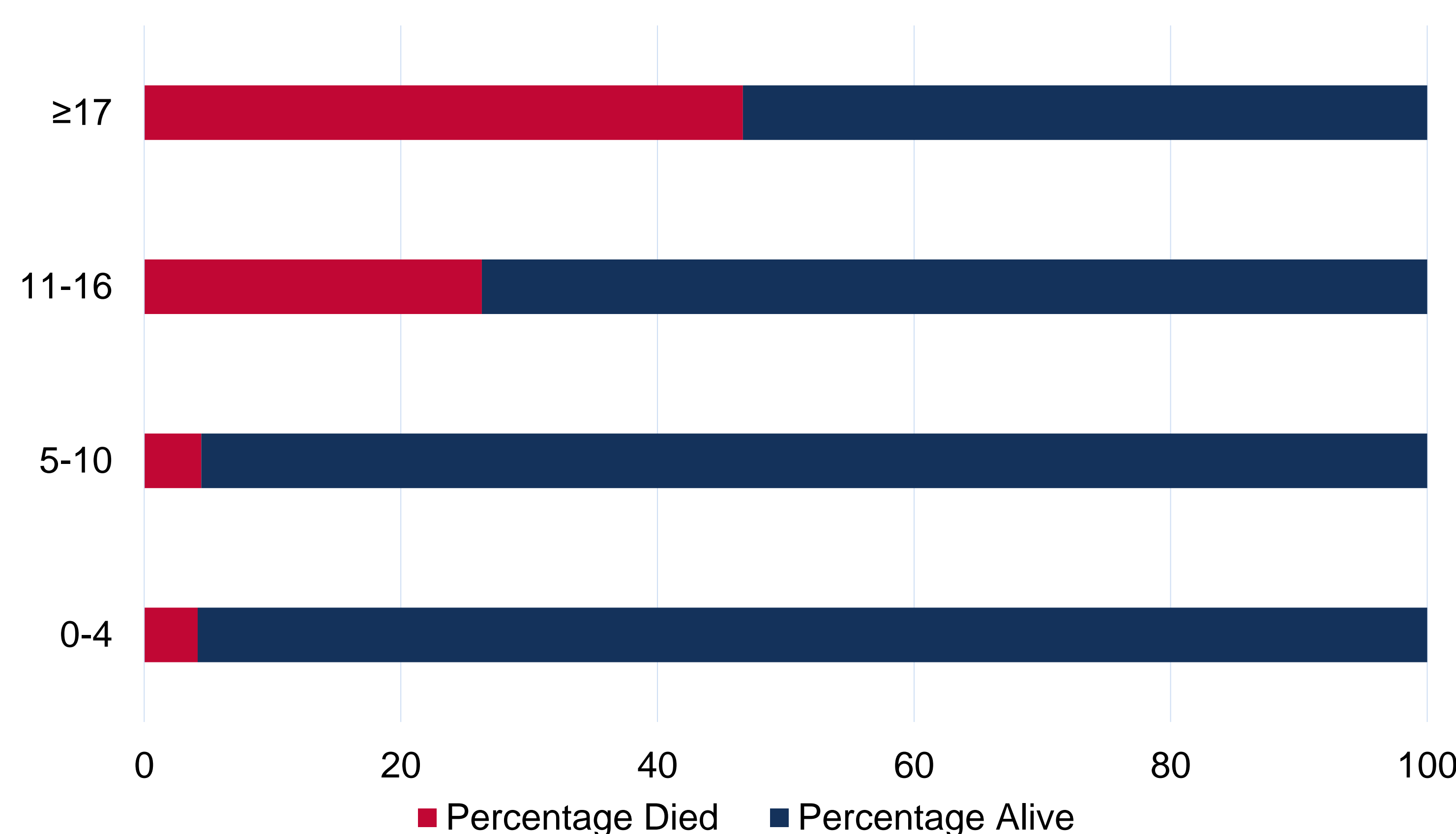
Characteristics	Results (N = 170)
Age, years	56 \pm 16
Male Sex	116 (69%)
Weight, kg	86 \pm 28
Height, cm	173 \pm 13
Comorbidities	
Diabetes	65 (38%)
Chronic Kidney Disease	38 (22%)
Malignancy	34 (20%)
Heart Failure	27 (16%)
IV Drug Use	21 (12%)
Cirrhosis	18 (11%)
Charlson Comorbidity Index ^a	4 (4)
Immunosuppressed	
Solid Organ Transplantation	7 (4.1%)
Hematopoietic Stem Cell Transplantation	2 (1.2%)
HIV with CD4 < 200	2 (1.2%)
Absolute Neutrophil Count < 1000	3 (1.8%)
Functional/Surgical Splenectomy	2 (1.8%)
Chemotherapy Within 90 Days of Admission	12 (7.1%)
Chronic Steroid Use	9 (5.3%)

Variables reported as mean \pm standard deviation or number (percentage) unless otherwise specified. ^aPresented as median (interquartile range).

Table 2. Infection Characteristics

Site of Infection	
Endocarditis	11 (6.4%)
Left-Sided	8 (73%)
Right-Sided	3 (27%)
Prosthetic Valve Involvement	7 (63%)
Intracardiac Device	4 (36%)
Embolic Events	4 (36%)
Other Endovascular	13 (7.6%)
Pneumonia	30 (18%)
Skin and Soft Tissue Infection	69 (41%)
Musculoskeletal Infection	39 (23%)
Urinary	12 (7.1%)
Meningitis	1 (0.6%)
Abdominal	9 (5.3%)
Line-related	32 (19%)
Other	12 (7.1%)

Figure 1. 30-day mortality stratified by MRSAB score



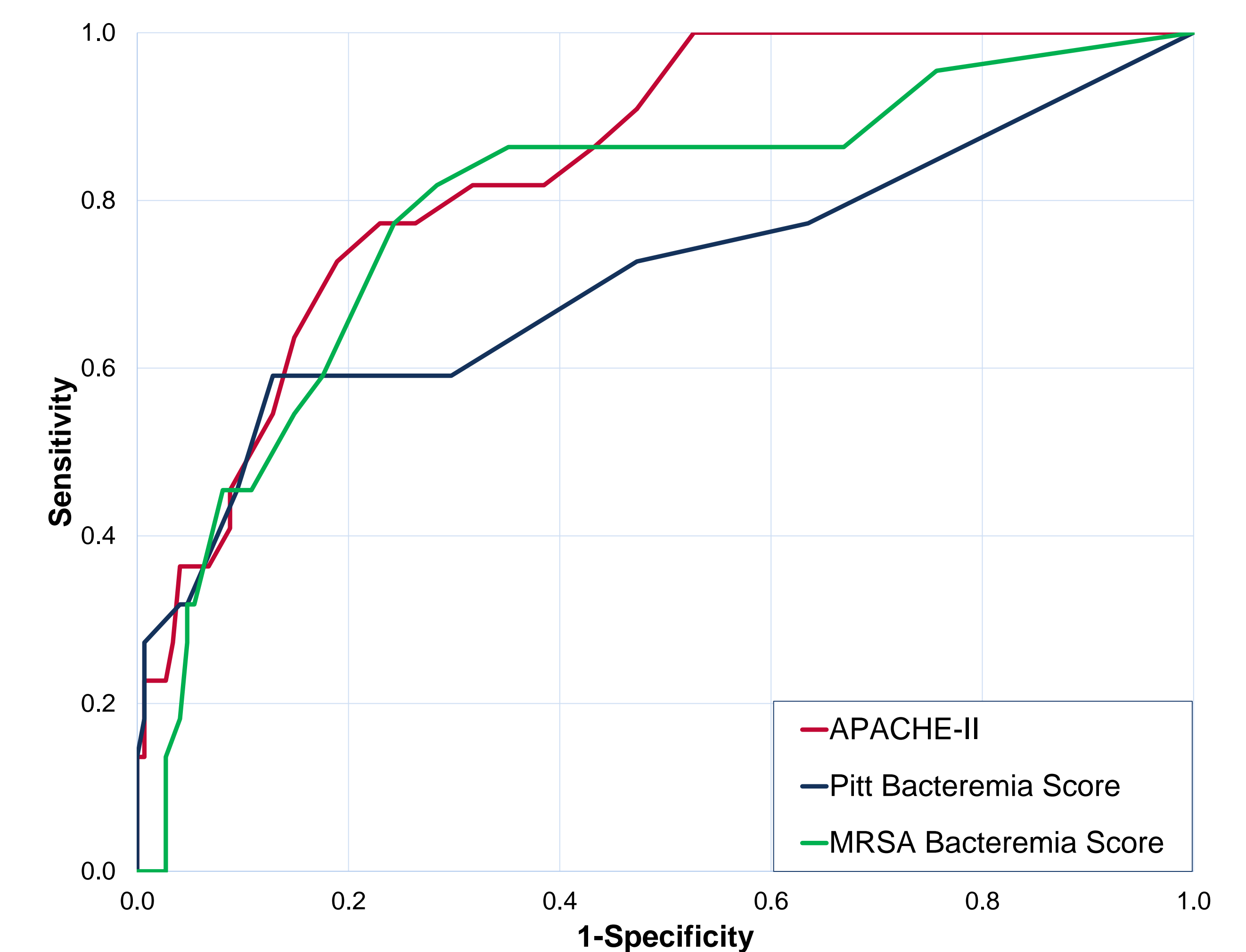
- Overall, 30-day mortality in this cohort was 12.4% (n = 21/170).
- A threshold MRSAB score of ≥ 10 was identified, whereby mortality was 3.6% with MRSAB < 10 , and 30% with MRSAB ≥ 10 .

Table 3. Test characteristics of MRSAB score at threshold of ≥ 10

	Value (95%CI)
Sensitivity	0.82 (0.63-0.94)
Specificity	0.72 (0.68-0.79)
Positive Predictive Value	0.30 (0.19-0.42)
Negative Predictive Value	0.96 (0.92-0.99)

Results

Figure 2. Comparative Receiver Operator Characteristic curves of predictive scoring systems for 30-day mortality



- ROC curve analysis revealed an area (95% CI) for the APACHE-II, PBS, and MRSAB scores of 0.84 (0.77-0.92), 0.71 (0.57-0.85), 0.79 (0.68-0.90), respectively.

Conclusions and Limitations

- The MRSAB Score is a generally valid score for prediction of risk of all-cause death at 30 days.
- The MRSAB score demonstrated better performance than the PBS, and was comparable to APACHE-II.
- The MRSAB score remains unvalidated in select populations:
 - Outside hospital transfers (15% of total population excluded)
 - Age > 89 years (excluded in this study but included in original population)
- The score can be used for risk stratification during clinical practice or adjustment of confounding in research using the 30-day all-cause mortality in patients with MRSA bacteremia.
- Future studies should evaluate the performance of the score on other clinically valid endpoints such as 60-day all-cause mortality and infection recurrence.

References

- Jorgensen SC, et al. Eur J Clin Microbiol Infect Dis. 2019;38(5):843-850.

Disclosures: None