

The Simple and Novel SAS Score to Predict Mortality at Presentation in 2541 Hospitalized COVID-19 Patients



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Rapid assessment of potential high risk patients with COVID-19 disease is essential
Application of a simple scoring system at presentation (Sex, Age, and SpO2) was a good predictor of mortality in hospitalized patients

Introduction

- The clinical spectrum of the novel corona virus disease 2019 (COVID-19) ranges from mild to severe disease and death.
- We aim to construct a simple and novel scoring model using easily available parameters at time of initial presentation that would predict mortality events in hospitalized COVID-19 patients.

Methods

- We established a retrospective cohort of 2541 patients admitted with COVID-19 from February 19, 2020 to April 28, 2020 to Henry Ford Health System, MI.
- Sociodemographic data, comorbidities, and clinical data were collected (Table 1).
- Our novel SAS score was constructed using 3 easily available parameters, namely Sex, Age, and Oxygen Saturation at presentation (Table 2).
- Primary endpoint was mortality.
- Multivariate analysis with logistic regression was done and the model was assessed using receiver operating characteristic (ROC) with area under ROC (AUROC) to determine the optimal cutoff for sensitivity, specificity, and positive and negative predictive values.

Results

- 51.1% were men.
- Multivariate analysis of the SAS score adjusted for mSOFA showed that age (OR 2.4, 95% CI 2.04-2.72, p<0.0001) and oxygen saturation (OR 1.6, 95% CI 1.27-1.98) were the most significant predictors of mortality in the model.
- The SAS score had an AUROC of 0.78 (95% CI 0.77-0.81) (Table 3).
- A cutoff score of 3 offered the most sensitivity for predicting mortality while maintaining a negative predictive value of 95% (Figure 1).
- Comparison of AUROC shows that SAS score adjusted to mSOFA has better diagnostic information compared to either SAS score or mSOFA alone (Figure 2).

Table 2. The SAS score points calculator

Variable	Points
Sex	
Female	0
Male	1
Age in years	
≤ 60	0
61-70	1
71-80	2
>80	3
SpO2 %	
>94	0
90-94	1
<90	2

Abbreviations: SpO2, oxygen saturation.

Table 3. Accuracy of the SAS score for predicting mortality in COVID-19 patients

SAS score and Variables	Performance
AUROC	0.78 (0.77-0.81)
SAS score 3 (95% CI)	
Sensitivity, %	86.5 (83.1-89.5)
Specificity, %	54.3 (52.1-56.4)
Positive predictive value, %	29.5 (28.3-30.7)
Negative predictive value, %	94.8 (52.1-56.4)
SAS score 4 (95% CI)	
Sensitivity, %	64.6 (60.0-68.9)
Specificity, %	77.9 (76.1-79.7)
Positive predictive value, %	39.2 (36.8-48.9)
Negative predictive value, %	90.9 (89.8-91.9)

Abbreviations: AUROC, area under ROC curve; ROC, receiver operating characteristic; SAS, sex, age, and oxygen saturation score, CI, confidence interval.

Figure 1. Probability of Different SAS Score Cutpoints to Predict Mortality

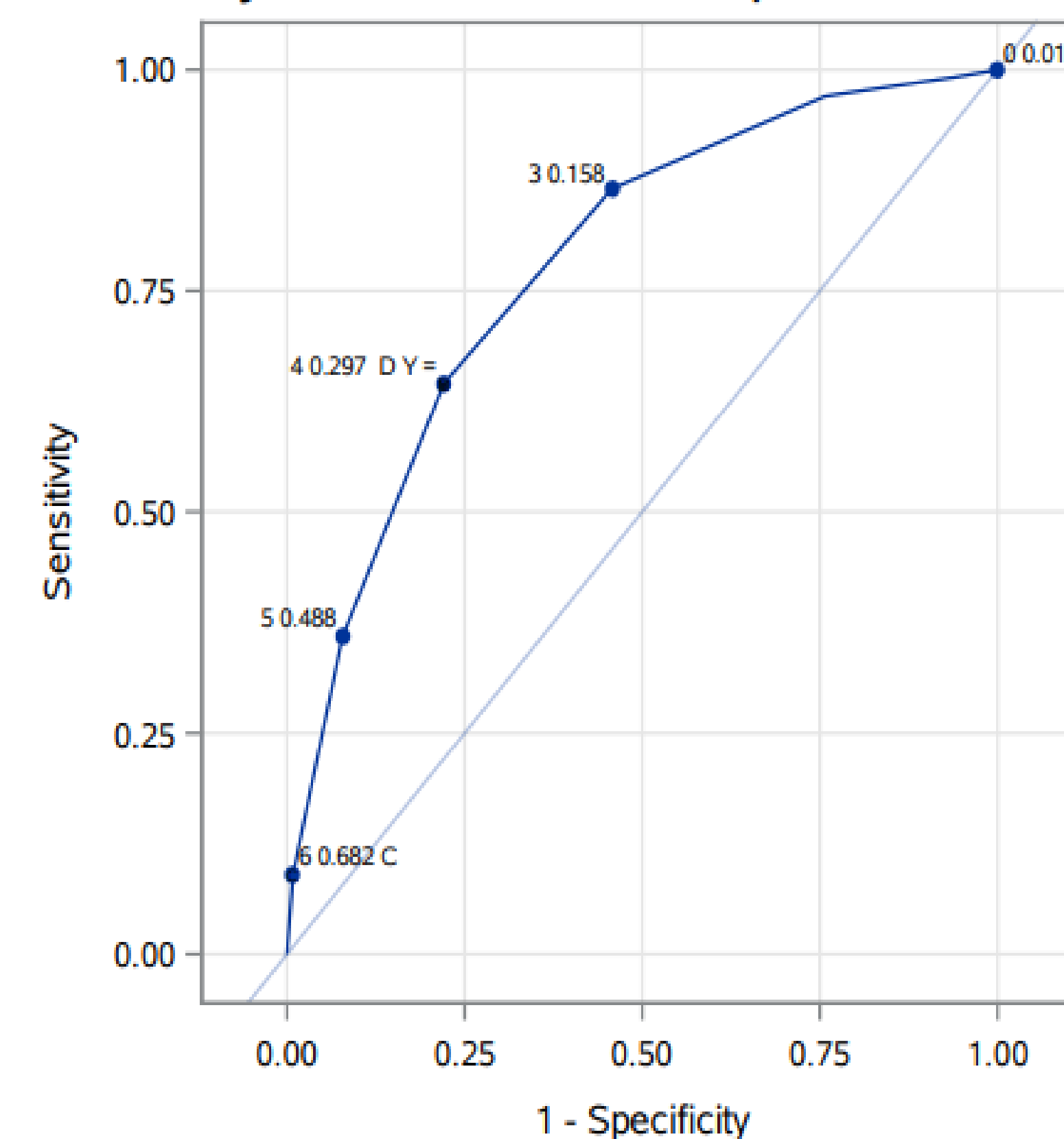
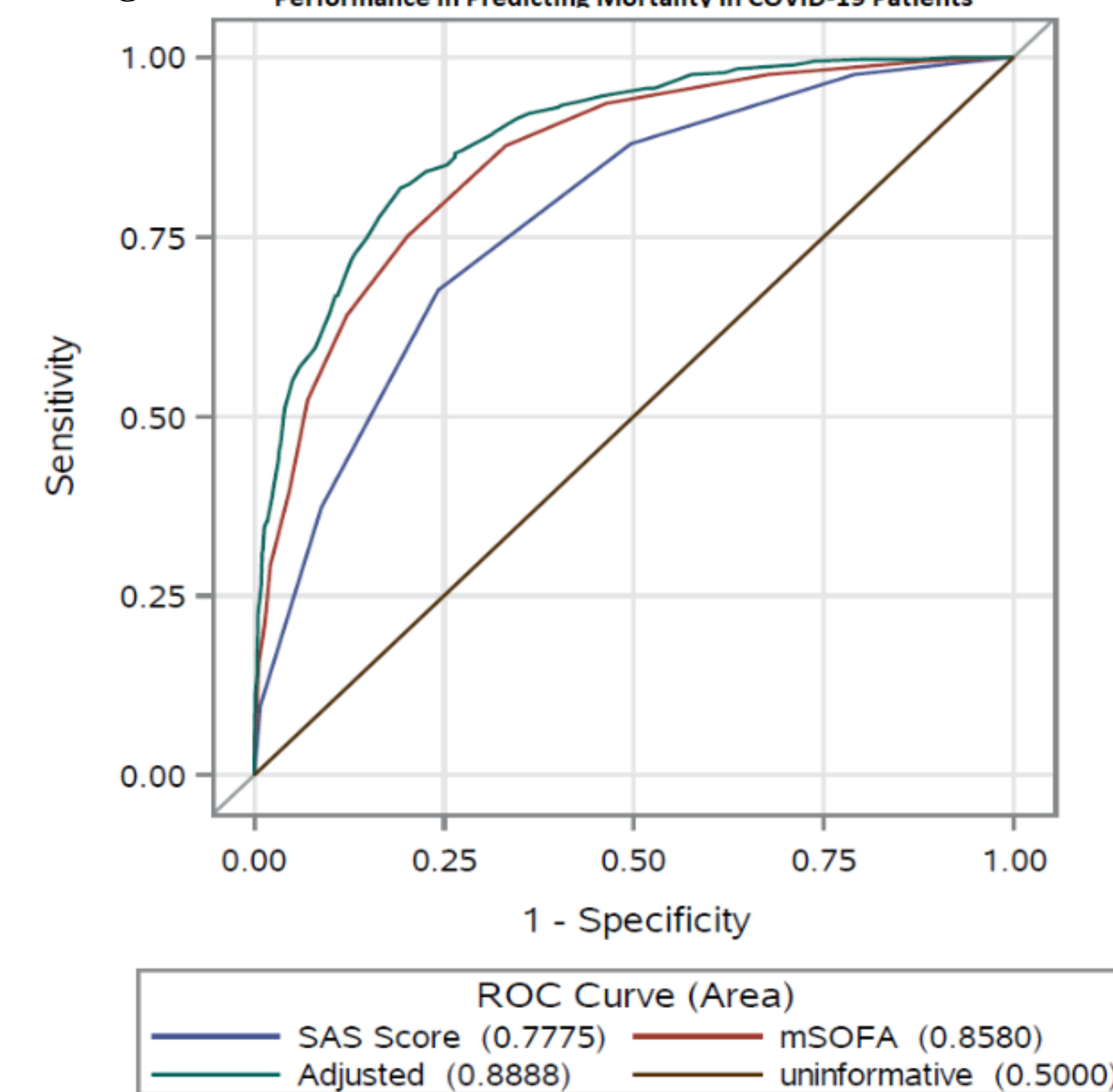


Figure 2. Comparison of SAS Score, mSOFA, and Fully Adjusted Models Performance in Predicting Mortality in COVID-19 Patients



Conclusion

- The easy to use SAS score at time of presentation identified hospitalized COVID-19 patients at high risk for mortality.
- Application of the SAS score in the emergency department may help triage patients to inpatient versus outpatient care.

Results

Table 1: Clinical characteristics of 2541 hospitalized patients with COVID-19

Characteristic	Survivors N=2081	Non-survivors N=460	P value
Age Mean (SD)	61.2 (16)	75 (13.8)	<0.0001
Age ≥ 65 N (%)	892 (42.9)	371 (80.7)	<0.0001
Black	1198 (57.6)	213 (46.3)	<0.0001
White	645 (31)	207 (45)	
Asian	43 (2.1)	4 (0.9)	
Other	195 (9.4)	36 (7.8)	
BMI median (IQR)	N=1966 31 (26.5-36.7)	N=424 31 (26.5-36.7)	<0.0001
BMI ≥ 30 N (%)	1099 (52.8)	151 (32.8)	<0.0001
Comorbidities N (%)			
Lung	1330 (63.9)	289 (62.8)	0.661
Immunodeficiency	24 (1.2)	6 (1.3)	0.786
Cardiac disease	156 (7.5)	66 (14.4)	<0.0001
CKD	800 (38.4)	299 (65)	<0.0001
COPD	299 (11)	96 (20.9)	<0.0001
Hypertension	1343 (64.5)	320 (69.6)	0.040
Asthma	216 (10.4)	35 (7.6)	0.072
Cancer	285 (13.7)	95 (20.7)	0.0002
Diabetes	771 (37.1)	184 (40)	0.237
Max mSOFA score median (IQR)	2 (1-4)	7 (5-9)	<0.0001
SOFA category N (%)			
0-1	488 (32.4)	9 (2.4)	<0.0001
2-4	715 (47.5)	84 (22.5)	
≥ 5	304 (20.2)	280 (75.1)	
Maximum pulse oximetry media (IQR) Saturation categories			
≥95	92 (90-94)	89 (82-92)	<0.0001
90-94	463 (22.3)	41 (8.9)	<0.0001
86-89	1099 (52.8)	176 (38.3)	
≤85	232 (15.5)	85 (18.5)	
196 (9.4)	158 (34.4)		
Treatments N (%)			
Hydroxychloroquine	1666 (80.1)	319 (69.4)	<0.0001
Azithromycin	740 (35.6)	190 (41.3)	0.021
Methylprednisolone	1135 (54.5)	321 (69.8)	<0.0001
Prednisone	547 (26.3)	85 (18.5)	0.001
Tocilizumab	62 (2.98)	52 (11.3)	<0.0001
ICU admission N (%)	333 (16)	281 (69.4)	<0.0001
ICU days median (IQR)	7 (4-12)	9 (5-14)	0.001
Mechanical ventilation N (%)	193 (9.3)	255 (55.4)	<0.0001
Ventilators days median (IQR)	8 (4-12)	9 (4-13)	0.207

Abbreviations: SD, standard deviation; BMI, body mass index; IQR, interquartile range; CKD, chronic kidney disease; COPD, chronic obstructive pulmonary disease; mSOFA, modified SOFA (Sequential organ failure assessment) score; ICU, intensive care unit.