Comparing Modified DECAF and NEWS-2 Scores in Predicting In-Hospital Mortality in Acute Exacerbations of COPD

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ABSTRACT

Objective: To compare the performance of the modified DECAF and NEWS-2 scores in predicting in-hospital mortality among patients admitted with acute exacerbations of chronic obstructive pulmonary disease (AECOPD).

Study Design: A cross-sectional analytical study.

Place and Duration of the Study: Department of Medicine, Aga Khan University Hospital, Karachi, Pakistan, from November 2023 to May 2024.

Methodology: Seventy-nine patients with AECOPD were enrolled using a consecutive sampling technique. The modified DECAF and NEWS-2 scores were calculated at admission. Diagnostic accuracy was evaluated using sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). Receiver operating characteristic (ROC) analysis was performed to determine discriminatory power.

Results: The modified DECAF showed 100% sensitivity, 19.05% specificity, 77.33% PPV, and 100% NPV. NEWS-2 demonstrated 100% sensitivity, 22.22% specificity, 77.42% PPV, and 100% NPV. AUCs were 0.465 for the DECAF and 0.549 for the NEWS-2, indicating weak discriminative ability in this cohort.

Conclusion: The Modified DECAF and NEWS-2 scores showed high sensitivity but low specificity and weak discriminatory power in predicting in-hospital mortality among patients with AECOPD. These findings suggested limited prognostic accuracy in this population and highlighted the need for larger multicentre studies for validation.

Key Words: *Acute exacerbation, Chronic obstructive pulmonary disease, DECAF score, NEWS-2 score, In-hospital mortality, Predictive accuracy*.

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INTRODUCTION

Chronic Obstructive Pulmonary Disease (COPD) is a progressive respiratory disorder characterised by persistent symptoms and airflow limitation caused by airway and/or alveolar abnormalities. Acute exacerbations of COPD (AECOPD) significantly increase morbidity, mortality, and healthcare costs worldwide.[1,2] COPD currently ranks as the third leading cause of death globally, accounting for more than 3 million deaths annually.[3] This significantly impairs overall health status, with a more pronounced effect on physical than mental health. Severe COPD has also been found to exert a greater negative impact than common comorbidities such as heart disease or diabetes.[4]

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Early risk stratification at the time of hospital admission is crucial to guide clinical management and improve outcomes in patients presenting with AECOPD. Delay in management can lead to prolonged hospital stay and increase the risk of readmission within the first few weeks. Moreover, readmission within 30 days has been shown to be associated with higher mortality in this population.[5]

Several risk factors have been identified,[6,7] and prognostication tools have been proposed to identify patients at higher risk at presentation. Among several prognostic tools, the DECAF score—which evaluates dyspnoea, eosinopenia, consolidation, acidemia, and atrial fibrillation (or hospitalisation frequency in the modified version)—has demonstrated good discriminatory ability in predicting in-hospital mortality in patients with AECOPD.[8] In contrast, the National Early Warning Score 2 (NEWS-2) was originally designed for general hospitalised patients and later applied to COPD,[9] but its performance in this specific population has been inconsistent. Although some studies have shown NEWS-2 to be sensitive for early deterioration, others have reported low specificity and overestimation of risk in AECOPD.

Despite the increasing burden of COPD and other smoking-related illnesses in low- and middle-income countries, including Pakistan, local data directly comparing these two scoring systems for mortality prediction remain scarce.[10] International studies have reported AUC values above 0.8 for DECAF, but real-world performance may differ in local populations with limited healthcare resources.

This study aimed to compare the diagnostic performance of the modified DECAF and NEWS-2 scores in predicting in-hospital mortality among patients admitted with AECOPD. This comparison may help optimise clinical decision-making, enhance triage, and support evidence-based use of scoring systems in resource-limited settings.

METHODOLOGY

This cross-sectional study was conducted at the Department of Medicine, Aga Khan University Hospital, Karachi, Pakistan, from November 2023 to May 2024, following approval from the Institutional Ethics Review Committee and the College of Physicians and Surgeons, Pakistan. Informed consent was obtained from all participants before enrolment. A total of 79 patients were included using a non-probability consecutive sampling technique. The sample size was calculated using MedCalc software, based on an anticipated AUC of 0.83 for the DECAF score in predicting in-hospital mortality, with 80% power and a 95% confidence interval.

Patients aged 30 to 80 years of either gender with a confirmed diagnosis of AECOPD (FEV_1/FVC <0.7) were included. Those with interstitial lung disease, hypersensitivity pneumonitis, acute pulmonary oedema, active malignancy, pregnancy, acute myocardial infarction, heart failure with an ejection fraction <30%, oliguric or anuric acute kidney injury, diabetic ketoacidosis, bedridden status following stroke, or those receiving beta-blockers or centrally acting calcium channel blockers were excluded to minimise confounding factors.

Demographic and clinical data were recorded using a structured proforma. For each patient, the modified DECAF and NEWS-2 scores were calculated. The modified DECAF score was based on dyspnoea severity (eMRCD 5a or 5b), eosinopenia (<0.3%), consolidation on chest X-ray, acidaemia (pH <7.30), and the number of hospitalisations in the past 12 months (≥2). Patients were classified as low risk (score <3) or high risk (score ≥3). The NEWS-2 score was derived from respiratory rate, oxygen saturation, systolic blood pressure, pulse rate, level of consciousness (AVPU scale), and body temperature, with a cut-off value of ≥5 to define high risk in accordance with the Royal College of Physicians guidelines.

All patients were followed during their hospital stay. For those discharged within 20 days, mortality status was recorded at discharge, and no patient was censored or excluded after admission. Data were analysed using SPSS version 19.0. The Shapiro–Wilk test was used to assess normality. Continuous variables were expressed as mean ± standard deviation (SD), and categorical variables as frequencies and percentages. Diagnostic accuracy (sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV)) of both scores was compared using the chi-square or Fisher's exact test. ROC curve analysis was performed to determine discriminatory ability, and $p < 0.05$ was considered statistically significant.

RESULTS

A total of 79 patients were included in the study, with a mean age of 54.03 ± 14.69 years. The mean modified DECAF score was 4.18 ± 1.16, and the mean NEWS-2 score was 8.46 ± 1.94. The mean respiratory rate was 20.57 ± 5.93 breaths per minute, the mean oxygen saturation was 91.19 ± 3.80%, the mean systolic blood pressure was 124.19 ± 19.24 mmHg, and the mean pulse rate was 91.35 ± 24.81 beats per minute. These descriptive characteristics are summarised in Table I.

Table I: Descriptive statistics of the study (n = 79).

Numerical variables	Mean	SD
Age	54.03	14.686
Pack years	25.37	14.524
DECAF score	4.18	1.163
Respiratory rate	20.57	5.933
Oxygen saturation	91.19	3.800
Systolic BP	124.19	19.243
Pulse rate	91.35	24.815
Temperature	37.732	1.1558
NEWS2 score	8.46	1.940

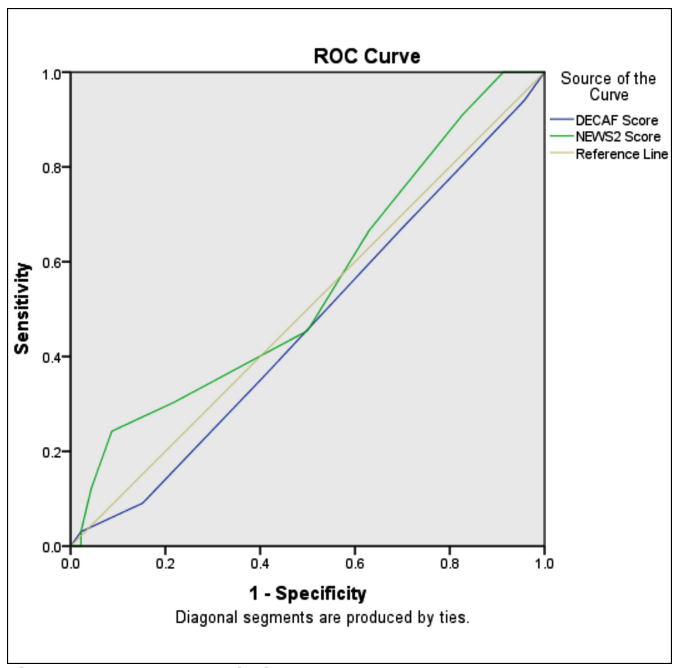

Figure 1: ROC curve analysis.

Table II: Comparison of diagnostic accuracies of the DECAF score risk and NEWS-2 in predicting in-hospital mortality (n = 79).

Mortality			NEWS2 risk		Total	Statistics
			High risk	Low risk		
Yes	DECAF risk	High risk	24	7	31	p-value = 0.017
			100.0%	77.8%	93.9%	Sensitivity = 100.0%
		Low risk	0	2	2	Specificity = 22.22%
			0.0%	22.2%	6.1%	PPV = 77.42%
	Total		24	9	33	NPV = 100.0%
			100.0%	100.0%	100.0%	Accuracy = 78.79%
No	DECAF risk	High risk	34	10	44	p-value = 0.015
			100.0%	83.3%	95.7%	Sensitivity = 100.0%
		Low risk	0	2	2	Specificity = 16.67%
			0.0%	16.7%	4.3%	PPV = 77.27%
	Total		34	12	46	NPV = 100.0%
			100.0%	100.0%	100.0%	Accuracy = 78.26%
Total	DECAF risk	High risk	58	17	75	p-value = 0.001
			100.0%	81.0%	94.9%	Sensitivity = 100.0%
		Low risk	0	4	4	Specificity = 19.05%
			0.0%	19.0%	5.1%	PPV = 77.33%
	Total		58	21	79	NPV = 100.0%
			100.0%	100.0%	100.0%	Accuracy = 78.48%

Table III: Area under the curve (n = 79).

Test result variables (s)	Area	Std. error[a]	Asymptotic sig.[b]	Asymptotic 95% confidence interval	
				Lower Bound	Upper Bound
DECAF score	0.465	0.066	0.595	0.336	0.594
NEWS2 score	0.549	0.066	0.456	0.419	0.680

The test result variable(s): DECAF score and NEWS-2 score have at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased. a. Under the nonparametric assumption. b. Null hypothesis: True area = 0.5.

The comparison between the modified DECAF and NEWS-2 scores revealed high sensitivity but low specificity for both scores in predicting in-hospital mortality. The modified DECAF score demonstrated 100% sensitivity, 19.05% specificity, 77.33% PPV, 100% NPV, and an overall accuracy of 78.48%. The NEWS-2 score showed 100% sensitivity, 22.22% specificity, 77.42% PPV, 100% NPV, and an overall accuracy of 78.79%. These findings indicate that while both scores were sensitive in identifying patients at risk of mortality, their ability to accurately discriminate survivors from non-survivors was limited (Table II).

Receiver operating characteristic (ROC) curve analysis further supported these findings. The area under the curve (AUC) for the modified DECAF score was 0.465 (95% CI: 0.336–0.594, p = 0.595), indicating poor discriminative ability. The AUC for the NEWS-2 score was slightly higher at 0.549 (95% CI: 0.419–0.680, p = 0.456) but remained weak overall (Table III, Figure 1). These results suggest that neither score provided strong predictive performance in this cohort, likely due to the small sample size and the high proportion of patients classified as high risk by both scoring systems.

DISCUSSION

This study compared the modified DECAF and NEWS-2 scores in predicting in-hospital mortality among patients admitted with AECOPD. Although both scores demonstrated high sensitivity and negative predictive value, their specificity was low, and the overall discriminatory performance measured by ROC curve analysis was weak. The AUC was 0.465 for the modified DECAF and 0.549 for the NEWS-2, indicating poor predictive ability (Table III). These findings stand in contrast to several large-scale studies and meta-analyses that have shown the DECAF score to be a strong predictor of short-term mortality in AECOPD, often with AUC values ranging between 0.78 and 0.83.[8,11,12]

The DECAF score was developed and validated in the UK and other settings as a disease-specific tool, outperforming general severity indices in identifying patients at high risk of in-hospital mortality. It incorporates five clinical variables: dyspnoea severity, eosinopenia, consolidation, acidaemia, and atrial fibrillation (or hospitalisation frequency in the modified version)—each of which has independent prognostic significance. The severity of dyspnoea and eMRCD have shown to be better predictors of important clinical outcomes in patients admitted with AECOPD.[13] Patients classified as high risk by the DECAF score often require early intensive monitoring or escalation of care, a finding that has been supported by multiple cohort studies across Europe and Asia. In contrast, the NEWS-2 score was originally designed for general ward patients to detect early clinical deterioration, but its performance in disease-specific contexts, such as AECOPD, has been inconsistent.[14,15] Studies have repeatedly shown that NEWS-2 may overestimate severity, leading to a high false-positive rate and unnecessary clinical escalations, especially in COPD patients who often have chronic hypoxaemia and tachypnoea as baseline findings.[16]

The discrepancy between these results and prior literature can be explained by several factors. First, the sample size in this study was small (n = 79), limiting the statistical power

of the ROC analysis. Previous validation studies of the DECAF score typically included several hundred to several thousand patients, providing more precise estimates of diagnostic accuracy and AUC values. Second, this study population was relatively homogenous, with a large proportion of patients classified as high risk by both scoring systems, thereby reducing variability in risk distribution and flattening the ROC curve. This ceiling effect is well recognised in smaller prognostic studies.[17] Third, the single-centre design may have contributed to this discrepancy. Patient demographics, environmental exposures, and healthcare delivery patterns in this setting differ from those of the populations in which the DECAF score was developed and validated.

Another important consideration is that NEWS-2, despite its popularity as a track-and-trigger system,[18] may not be sufficiently specific for AECOPD, particularly in resource-limited settings where patients present late with severe disease. In such contexts, the disease burden is disproportionately high due to factors such as high occupational exposure, limited preventive measures, and restricted access to effective diagnosis and optimal management.[19] Although its high sensitivity makes NEWS-2 suitable for early warning purposes, its low specificity makes it less reliable for risk stratification in COPD exacerbations compared to disease-specific scoring systems. In this cohort, both DECAF and NEWS-2 classified nearly all patients who eventually died as high risk; however, they also categorised many survivors as high risk, thereby reducing their discriminative performance.

The clinical implications of these findings are significant. High sensitivity and NPV suggest that both scores can be useful tools to rule out low-risk patients, potentially allowing safer step-down care or discharge planning. However, the low specificity and weak ROC performance imply that neither tool can confidently distinguish those who will die from those who will survive. Clinicians should therefore avoid overreliance on scoring systems alone and should integrate these tools with bedside clinical judgment, comorbidity assessment, and other risk indicators.

It is also important to interpret the modified DECAF score cautiously in settings where the sample size is small and disease severity is uniformly high. These findings reinforce the need for larger multicentre studies in Pakistan and other low- and middle-income countries to evaluate how these scores behave in real-world populations with different comorbidity profiles and healthcare access patterns. Integrating biomarkers such as procalcitonin, NT-proBNP, or CRP, as well as AI-based decision support systems, may enhance predictive accuracy beyond conventional scores alone.[20]

This study has several limitations. It was conducted at a single tertiary care centre with a relatively small sample size, which limits external validity and statistical power. Patients were not stratified by exacerbation phenotype (*e.g.*, infectious *vs.* non-infectious triggers), which may have influenced mortality risk and scoring behaviour. Moreover, only clinical scores were used without integrating laboratory biomarkers or composite indices, which may have restricted predictive performance. Nonetheless, this study provides valuable local evidence highlighting the gap between international performance metrics of DECAF/NEWS-2 and their real-world behaviour in a resource-limited setting.

CONCLUSION

In this small single-centre cohort, the modified DECAF score showed high sensitivity but poor specificity, with overall limited discriminative accuracy. Larger multicentre studies are required before confirming superiority over NEWS-2 in AECOPD.

ETHICAL APPROVAL:
The study was approved by the Institutional Ethics Review Committee of Aga Khan University Hospital, Karachi, Pakistan.

PATIENTS' CONSENT:
Informed consent was obtained from all participants prior to enrolment.

COMPETING INTEREST:
The authors declared no conflict of interest.

AUTHORS' CONTRIBUTION:
JY: Contributed to study design, data collection, analysis, interpretation, and manuscript drafting.
MT: Supervised the study, approved the concept, and provided critical revision of the final manuscript.
Both authors approved the final version of the manuscript to be published.

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