



## Early View

Original research article

# Comparison of Two Scores for Short Term Outcomes in Patients with COPD Exacerbation in ED: The Ottawa COPD Risk Scale and the DECAF Score

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**Title:** Comparison of Two Scores for Short Term Outcomes in Patients with COPD Exacerbation in ED: The Ottawa COPD Risk Scale and the DECAF Score

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# Comparison of Two Scores for Short Term Outcomes in Patients with COPD Exacerbation in ED: The Ottawa COPD Risk Scale and the DECAF Score

## Abstract

**Background:** While clinical decision rules have been developed for the evaluation of exacerbations and decisions on hospitalization and discharge in emergency departments (EDs), these rules are not widely used in Eds. In this study, we compare the predictive efficacy of the Ottawa Chronic Obstructive Pulmonary Disease (COPD) Risk Scale (OCRS) and the Dyspnea, Eosinopenia, Consolidation, Acidemia, and Atrial Fibrillation (DECAF) Score in estimating the short-term poor outcome of patients in our ED with exacerbations of COPD (ECOPD).

**Methods:** This single-center prospective observational study was conducted over six months. Patients with AECOPD admitted to the ED during the study period were included in the study. A poor outcome was defined as any of the following: readmission and requiring hospitalization within 14 days of discharge, requiring mechanical ventilation on the first admission, hospitalization for longer than 14 days on the first admission, or death within 30 days. The sensitivity and specificity of the OCRS and the DECAF score for a poor outcome and for mortality were calculated.

**Results:** Of the 385 patients who participated in the study, 85 were excluded based on the exclusion criteria. Sixty-six percent of the patients were male, and the mean age was  $70.15 \pm 10.36$  years. It was observed that 20.7% ( $n = 62$ ) of all patients experienced poor outcomes. The sensitivity of OCRS  $<1$  for predicting a poor outcome in patients was 96.8% (95% CI: 88.8–99.6), and the specificity was 18.5% (95% CI: 13.8–24.0). The sensitivity and specificity of OCRS  $<2$  was – 83.3% (95% CI: 35.9–99.6) and 65.5% (95% CI: 59.6–70.7), respectively. The sensitivity and specificity of the DECAF score  $<1$  was – 88.7% (95% CI: 78.1–95.3) and 34.5% (95% CI: 28.4–40.9), respectively. When the DECAF score was  $<2$ , sensitivity and specificity were 69.3% (95% CI: 56.4–80.4) and 74.8% (95% CI: 68.8–80.2).

**Conclusion:** We observed that our physicians achieved high specificity but low sensitivity in predicting a poor outcome. The OCRS is the more sensitive of the two tools, while the DECAF score is more specific in predicting a poor outcome when all threshold values are evaluated. While both tools may inform unnecessary hospitalization, they can reduce the

incidence of hospital discharge of patients with ECOPD who will develop poor outcomes in the ED.

## **Background**

Chronic obstructive pulmonary disease (COPD) occurs with alveolar damage, airway collapse and air trapping due to damage to small airways and increased respiratory effort after protracted inflammation and constriction of the airways (1). COPD is a major cause of morbidity and mortality, affecting more than 5% of the entire population (2). While its incidence around the world varies between 5% and 20%, according to various sources, the prevalence of COPD in Turkey has been calculated as 19.2%. In 2019, the World Health Organization considered COPD the third most common cause of death in the world. In Turkey, it is ranked as the fourth most common cause of death. The high prevalence of COPD substantially increases the costs of hospital admissions, drugs, and long-term follow-up (3).

COPD is a disease with exacerbations, which are acute episodes requiring treatment regulation and characterized by shortness of breath, cough, and change in sputum purulence (3). Exacerbations of COPD (ECOPD) are one of the common causes of shortness of breath admissions to the emergency departments (EDs). Although there are studies evaluating the long-term prognosis in hospitalized patients (4,5), studies evaluating safe discharge and decisions on hospitalization in the evaluation of patients in the ED are limited (6), and these rules are not widely used in EDs. The Global Initiative for Chronic Obstructive Lung Disease guidelines recommend using the patient's history, the response to the first treatments, physical examination findings, and home care support in determining the need for hospitalization (3). The Ottawa COPD Risk Scale (OCRS) successfully predicts the short-term outcomes of patients admitted to an ED and diagnosed with ECOPD. Validation of the OCRS has recently been completed (7). OCRS has a 3-stage review system and consists of initial assessment, investigations, and re-assessment after ED treatment steps. In the initial assessment step, history of CABG, history of intervention of peripheral vascular disease, history of intubation for respiratory distress, and heart rate (on ED arrival)  $>110/\text{min}$  are evaluated. In the Investigations step, it is evaluated whether ECG has acute ischemic changes, chest x-ray has any pulmonary congestion, hemoglobin  $< 10 \text{ g/L}$ , urea  $> 12\text{mmol/L}$ , serum  $\text{CO}_2 > 35\text{mmol/L}$ . In the last step, after the treatment received in the emergency room, it is evaluated whether  $\text{SaO}_2 < 90\%$  on room air/usual  $\text{O}_2$  or  $\text{HR} > 120/\text{min}$ . Each criterion has a score between 1- 3. As a result of all these, the patient gets a result between 0-16. In the validation study, 0 points

were defined as low risk, 1-2 points as medium risk, 3-4 points as high risk, and 5 and above as very high risk (7). A recent study reported that the Dyspnea, Eosinopenia, Consolidation, Acidemia, and Atrial Fibrillation (DECAF) Score successfully predicts in-hospital mortality for patients hospitalized on a diagnosis of ECOPD (5).

Both the OCRS and the DECAF scores have previously been used to determine the short-term outcomes of patients with COPD. Nevertheless, there is insufficient evidence for their use in decision making geared toward the safe discharge of ECOPD patients from an ED. In this study, we compared the predictive efficacy of the OCRS and the DECAF score in estimating the short-term poor outcome of patients with ECOPD in an ED.

## **Methods**

### **Study design and setting**

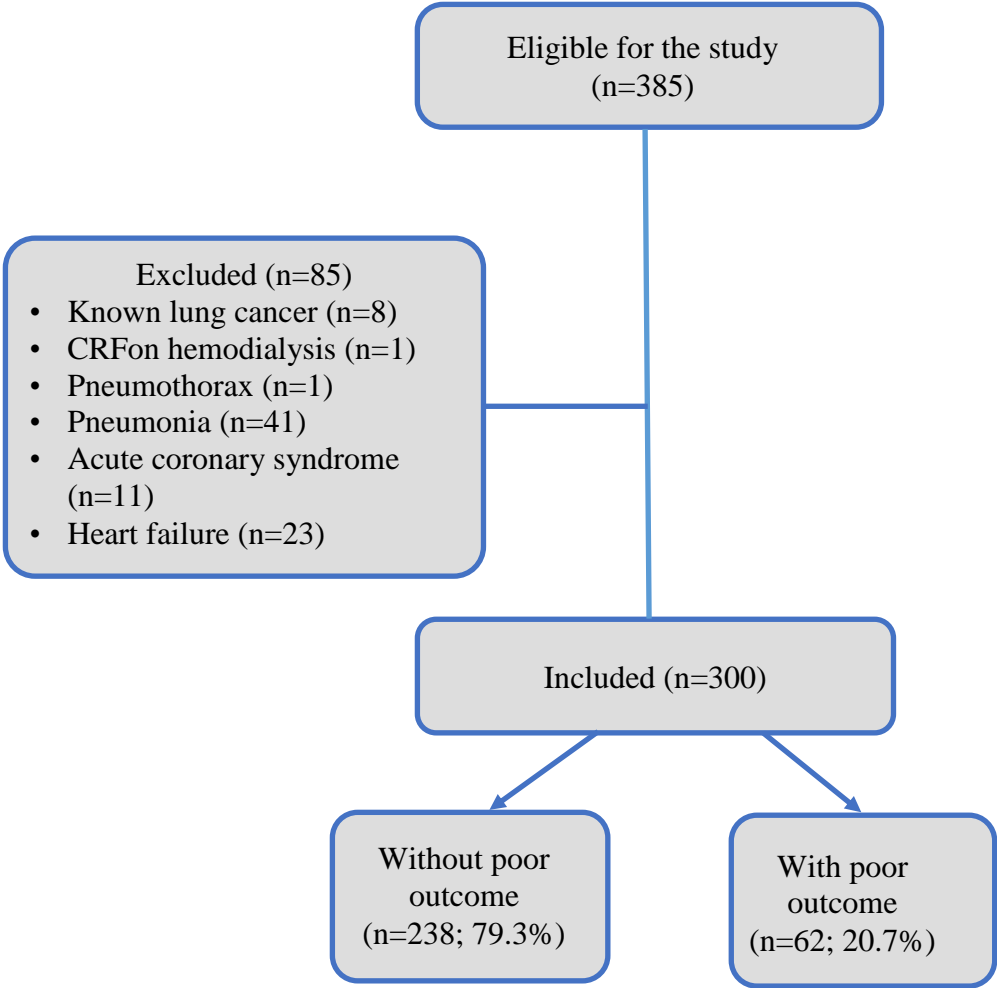
This single-center prospective observational study was conducted between October 20, 2019 and April 20, 2020 at the Dokuz Eylul University Hospital ED, with the approval of the ethics committee of the Dokuz Eylul University School of Medicine (Decision No: 2019/28-41). Written informed consent was obtained from all patients who participated in the study or from their relatives.

### **Study population**

The study included 385 patients, who have been admitted to ED during the specified period with one or more complaints like dyspnea, coughing, sputum, and who have COPD. Individuals among these 385 patients who met the exclusion criteria were excluded from the study (Figure 1). In our study, the exclusion criteria were Stiell, Ian G et al. revised from his work (7), and the patients with the following exclusion criteria were excluded from the study: [1] Having a cognitive impairment, such as confusion, disorientation, or dementia, as this affects the individual's ability to make an informed decision to participate in the study; [2] Patients with lung cancer or lung metastasis; [3] A diagnosis of pneumonia, pneumothorax, heart failure, and pulmonary embolism provoking shortness of breath, excluding ECOPD; [4] The presence of newly developed rhythm disturbance requiring intervention or ischemic changes in the follow-up, excluding sinus tachycardia and multifocal atrial tachycardia, as recorded by an ECG; [5] A diagnosis of terminal stage malignancy; [6] Death expectation in the following weeks due to chronic illness, [7] A diagnosis of unstable angina pectoris or myocardial infarction, which may affect prognosis other than AECOPD in an ED; [8] Chronic kidney failure requiring hemodialysis; [9] Patients who have been included in the study within the last two months; [10] Failing to reach the outcome on the thirtieth day.

Consequently, only 300 patients diagnosed with ECOPD participated in the study. Eight of these 300 patients were included in the study for the second time (as they reapplied between the next two to six months). In our study, we determined the target sample size using a certain power, confidence interval, and margin error. We aimed for this result as the

minimum number of patients. It was determined that a minimum of 240 patients should be included in the study, using an 80% power and 95% confidence interval to show a difference of less than 10% (with a 0.07 margin error) between the two diagnostic tools (6).



**Figure 1:** Patient flowchart

**Data collection**

Information on the patients who met the criteria for inclusion in the study was included in the study data on the first admission using the study data collection form. Demographic information, vital signs, and detailed medical history was obtained, including smoking history, medications, and devices used, history of previous hospitalization, ED admissions and/or non-invasive or invasive mechanical ventilation due to ECOPD, and most recent admission to a chest diseases outpatient clinic. After evaluating the disease histories of the patients, OCRS and DECAF scores were calculated (5,7) by members of the research team. The ED and hospital outcomes of the patients were tracked. The 30-day survival of the



patients was checked either by looking up the hospital records of the patients or calling them by phone if there was no admission within this period.

The primary outcome of this study was the poor outcome. Based on the study by Stiell et al. (7), a poor outcome was defined as any of the following: [I] Readmission to ED and hospitalization within 14 days of discharge, with COPD-associated symptoms; [II] Need for invasive or noninvasive mechanical ventilation on the first admission to the ED; [III] Hospitalization longer than 14 days for non-traumatic reasons; or [IV] death of the patient within 30 days due to reasons other than trauma.

### **Statistical analysis**

The SPSS 22.0 (IBM Corporation, Armonk, New York, United States) program was used to analyze the data, with descriptive statistics for categorical variables are given as numbers and percentages. Pearson's chi-square test was used for the comparison of categorical data, while the Fisher exact test was used along with the results. The normal distribution of continuous variables was evaluated using the Kolmogorov–Smirnov test. Among the variables, those that fit the normal distribution are given as the mean and standard deviation, and those that do not fit the normal distribution are given as median and interval or median and interquartile range (IQR). The sensitivity, specificity, negative and positive predictivity, and accuracy of the OCRS and DECAF scores for poor outcome and survival by the thirtieth day was determined using an online calculator, the MedCalc® diagnostic test evaluation calculator, and all values were applied with a 95% confidence interval. OCRS and DECAF scores were evaluated with the ROC curves in terms of detecting poor outcomes and mortality. Patients discharged from the ED for index visits were evaluated separately, and the same analysis was repeated for both the OCRS and DECAF risk scores. The data were analyzed at a 95% confidence level, and a p-value of less than 0.05 was considered as significant.

## Results

Sixty-six percent of the patients were male ( $n = 197$ ), and the mean age was  $70.15 \pm 10.36$  years (range: 36–94). 22% ( $n = 67$ ) of the patients were active smokers, 39% ( $n$ ) had a history of previous hospitalization due to COPD and 88.3% ( $n$ ) had a history of admission to an ED during the previous year. It was observed that 71.7% of the patients ( $n = 215$ ) did not visit an outpatient clinic during the last year. It was observed that 8 patients (2.7%) had never visited a chest disease outpatient clinic and patients (71.7%) had their last admission to chest diseases outpatient clinic was earlier than three months prior. The median number of ED visits was 2 (IQR: 0–37), and 11% of the patients ( $n = 33$ ) had a history of intensive care unit admission in the preceding year. It was observed that 51% ( $n=153$ ) of the patients used only inhaled medications as the usual medication therapy. (Table 1).

**Table 1. Patient characteristics**

Variable		N (%)
Gender	Male	<b>197</b> <b>(65,7)</b>
	Female	103 (34,3)
Smoking	Current	67 (22,3)
	Ex-smoker	<b>182</b> <b>(60,7)</b>
	Never used	51 (17,0)
ECOPD history in the last year	Any hospitalization	90 (39,0)
	Intensive care unit admission	33 (11,0)
	Noninvasive ventilation	67 (22,3)
	Invasive ventilation	2 (0,7)
	ED visit	<b>265</b> <b>(88,3)</b>
Last visit to	No visit	8 (2,7)

<b>the outpatient clinic</b>	< 1 week	26 (8,7)
	1 week< to <1 month	27 (9,0)
	1 month< to <3 months	24 (8,0)
	<b>&gt; 3 months</b>	<b>215 (71,7)</b>
<b>Usual medications and devices</b>	No	33(11)
	Only Oxygen	10(3,3)
	Only BiPAP	2(0,7)
	<b>Only inhaled medications (LABA or LAMA or ICS)</b>	<b>153(51)</b>
	Oxygen and BiPAP	5(1,7)
	Oxygen and inhaled medications (LABA or LAMA or ICS)	45(15)
	Oxygen, BiPAP, and inhaled medications (LABA or LAMA or ICS)	42(14)
	Oxygen, oral steroid, and inhaled medications (LABA or LAMA or ICS)	8(2,7)
	Oxygen, BiPAP, oral steroid and inhaled medications (LABA or LAMA or ICS)	2(0,7)

Among the patients who were discharged from the ED, one patient (0.40%) died, and 18 patients developed a poor outcome (8.0%). The sensitivity of a poor outcome at OCRS <1 for discharged patients was calculated as 100% (95% CI: 81.47–100) and specificity as 19.9% (95% CI: 14.68–26.02). The sensitivity of OCRS 0–1 was calculated as 66.7% (95% CI: 40.99%–86.66%), and its specificity as 59.7% (95% CI: 52.67%–66.47%). Two patients with a DECAF score of <1 experienced a poor outcome. The sensitivity of a DECAF score <1 for discharged patients was calculated as 88.9% (95% CI: 65.3%–98.6%) and specificity as 37.38% (95% CI: 30.8%–44.4%). The sensitivity of a DECAF score of 0–1 for discharged patients was calculated as 66.7% (95% CI: 41.0–86.7) and the specificity as 76.2% (95% CI: 69.8–81.9) (Table 2).

**Table 2. Results of both risk scores for poor outcome in discharged patients**

	Poor Outcome (N)		Total (N)
	Yes	No	
<b>OCRS Total</b>	<b>0</b>	<b>0</b>	<b>41</b>
	1	6	88
	2	2	32
	3	3	33
	4	2	12
	5	4	3
	6	1	3
<b>DECAF Score</b>	<b>0</b>	<b>2</b>	<b>77</b>
	1	4	80
	2	6	34
	3	5	15
	4	1	0
<b>Current practice of ED</b>	<b>18</b>	<b>206</b>	<b>224</b>

It was observed that 20.7% (n = 62) of the patients experienced poor outcomes. The reasons for the poor outcomes among these patients are presented in Table 3. Because 27 of the patients who received noninvasive ventilation (NIV) treatment in the ED used an NIV device in their everyday lives, these patients were not considered as experiencing a poor outcome. Patients who did not own a personal NIV device and did not benefit from a personal device, and thus needed NIV devices used in the ED, were evaluated as experiencing poor outcomes.

**Table 3. Outcome of patients with poor outcome**

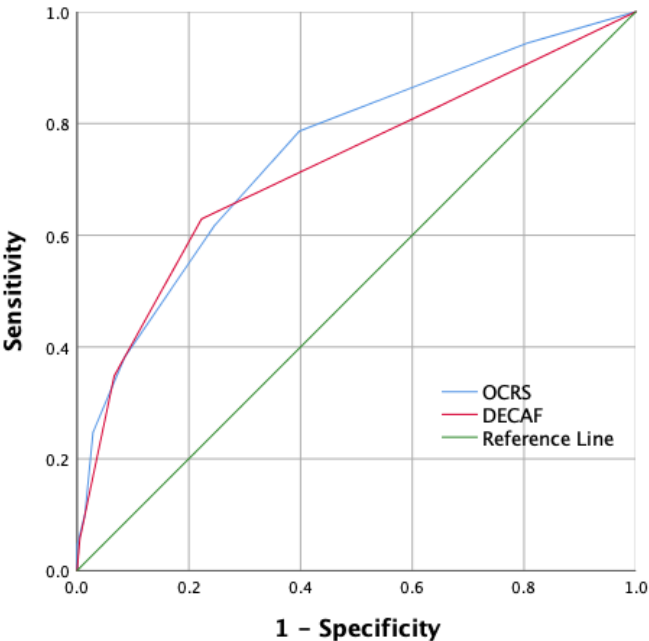
Reason	N (%)
Death within 30 days of hospitalization	5 (8.1)
Death within 30 days after discharge from ED	1 (1.6)
Re-admission to ED and hospitalization within 14 days of discharge	17 (27.4)
Hospitalization longer than 14 days	19 (30.6)
Noninvasive mechanical ventilation	20 (32.2)
Invasive mechanical ventilation	0 (0.0)
TOTAL	62 (100.0)

For all patients, the sensitivity of an OCRS score of <1 in predicting a poor outcome was 96.8% (95% CI: 88.8–99.6), and the specificity was 18.5% (95% CI: 13.8–24.0). For an OCRS score of <2, the sensitivity was 82.3% (95% CI: 70.5–90.8) and the specificity was 56.7% (95% CI: 50.2%–63.1%). The sensitivity and specificity of OCRS <2 was 83.3% (95% CI: 35.9–99.6) and 65.5% (95% CI: 59.6–70.7), respectively.

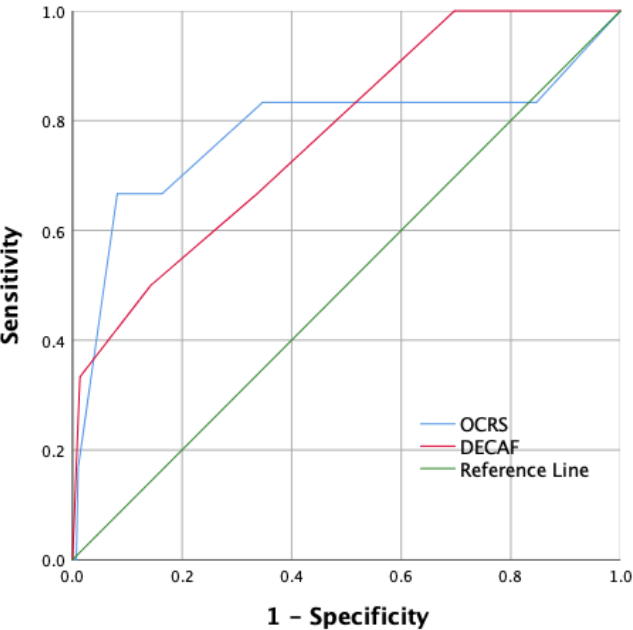
The sensitivity and specificity for a DECAF score of <1 to predict a poor outcome were 88.7% (95% CI: 78.1–95.3) and 34.5% (95% CI: 28.4–40.9), respectively. For a DECAF score of <2, the sensitivity and specificity were 69.3% (95% CI: 56.4–80.4) and 74.8% (95% CI: 68.8–80.2). For predicting 30-day mortality with a DECAF score of <2, the sensitivity was as 66.7% (95% CI: 22.3–95.7) and the specificity as 85.7% (95% CI: 81.2–89.57) (Table 4).

OCRS and DECAF scores were evaluated with the ROC curves in terms of detecting poor outcomes and mortality. The area under the curve (AUC) for poor outcomes was

calculated as 0.750 for OCRS and 0.722 for DECAF (Figure 2), while the AUC for determining mortality was calculated as 0.779 and 0.772, respectively (Figure 3).



**Figure 2.** Comparing ROC curves for poor outcomes



**Figure 3.** Comparing ROC curves for mortality.

**Table 4. Comparison of OCRS, DECAF scores and current practice in predicting poor outcomes**

Method	Sensitivity % (%95 CI)	Specificity % (%95 CI)	NPV % (%95 CI)	PPV % (%95 CI)	Accuracy % (%95 CI)	
<b>Current Practice</b>	71,0 (58,05-81,8)	86,6 (81,6 - 90,6)	92,0 (88,6 - 94,4)	57,9 (78,6 -87,4)	83,3 (78,6 -87,4)	
<b>0</b>	DECAF	88,7 (78,1-95,3)	34,5 (28,4-40,9)	92,1 (85,1-96,0)	26,1 (23,7-28,6)	45,7 (39,9-51,5)
	OCRS	96,8 (88,8-99,6)	18,5 (13,8-24,0)	95,7 (84,6-98,9)	23,6 (22,3-25,0)	34,7 (29,3-40,4)
<b>&lt;2</b>	DECAF	69,3 (56,4-80,4)	74,8 (68,8-80,2)	90,4 (86,5-93,2)	41,8 (35,3-48,5)	73,7 (68,3-78,6)
	OCRS	82,3 (70,5-90,8)	56,7 (50,2-63,1)	92,5 (87,7-95,5)	33,1 (29,1-37,4)	62,0 (56,2-67,5)
<b>&lt;3</b>	DECAF	41,9 (29,5-55,2)	92,0 (87,8-95,1)	85,9 (83,1-88,3)	57,8 (44,8-69,7)	81,7 (76,8-85,9)
	OCRS	71,0 (58,1-81,8)	73,5 (67,4-79,0)	90,7 (86,7-93,5)	41,1 (34,9-47,7)	73,0 (67,6-77,9)

## Discussion

In this prospective observational study, we compared the efficacy of OCRS and DECAF scores in predicting the short-term poor outcome of patients admitted to an ED with ECOPD. We used a modified version of the Stiell et al. to determine a poor outcome in patients (7). We evaluated 300 patients and found that 20.7% of the patients and 8.0% of patients who were discharged experienced a poor outcome. In predicting a poor outcome, we found that the OCRS has a higher sensitivity than the DECAF score despite the low specificity of the OCRS at all threshold values. When we evaluated the patients who were discharged from the ED, we found that having an OCRS score of 0 was predictive of a patient experiencing a poor outcome; however, the specificity was low. The specificity of our current practice was high, but the sensitivity was insufficient. The use of a clinical decision rule along with the clinical decision-making process for discharging patients presenting with ECOPD from the ED may facilitate the achievement of a particularly high sensitivity. However, because of the low specificity of the OCRS and the DECAF score, using these risk tools alone in making decisions on hospitalization will increase the rate of unnecessary hospitalizations.

In Asia, admissions because of dyspnea constitute 5.2% of all ED admissions, 11.4% of all hospital admissions, and 11.9% of intensive care unit admissions, with the most common causes being lower respiratory tract infections, heart failure, and ECOPD (7). More than three million ED visits are made every year in the USA because of dyspnea (8). It has been reported that in Asian and European countries, approximately 16% of patients in an ED are individuals presenting with dyspnea due to AECOPD (9). Furthermore, it has been reported that approximately 16% of patients diagnosed with COPD in the USA made ED visits or were hospitalized within the same year (10). It has been determined that approximately 20% of patients who visited an ED because of ECOPD is hospitalized (11). Patients with lower FEV<sub>1</sub> and PaO<sub>2</sub> have higher exacerbation frequencies (12), and patients with more frequent exacerbations are referred to an ED more often and record higher rates of hospitalization. In our study, we found that approximately 90% of the patients who visited the Dokuz Eylul University Hospital ED because of ECOPD had visited an ED within the last year, and the most frequently admitted patients had visited an ED 37 times within the same one-year period. In the follow-up of this patient, it was determined that the only point of application to the hospital was the ED and he did not apply to outpatient clinics. However, we found that more than 70% of the patients had not visited chest diseases outpatient clinic in the last three months, and that the rate of hospitalization among patients presenting with ECOPD



at our hospital was 25.3%. This information suggests that the patients do not receive regular follow-up and treatment. In Turkey, the prevalence of COPD—standardized by age and gender, based on respiratory function test results—is 5.3%, and less than half of these patients are on regular medication (13). Many strategies, such as standard recommendations for the discharge of patients with COPD, hospital at home care programs, and telemedicine programs, may be recommended to prevent frequent ED and hospital admissions and to reduce health costs. For this reason, the COPD National Action Plan was launched in the USA in 2017 to encourage cooperation between patients, caregivers, doctors, researchers, and policymakers, and to optimize awareness, diagnosis, and treatment of the disease (14). In Turkey, systematic arrangements are urgently needed to reduce ED admissions and the frequency of exacerbations of patients with COPD.

COPD is one of the most common causes of emergency admissions worldwide and is also a major cause of morbidity and mortality. In the multicenter SUPPORT study conducted in the USA, the in-hospital mortality of patients hospitalized because of ECOPD was found to be approximately 10% (15), while in-hospital mortality was reported as 8.3% in Turkey (16), 8% in the Netherlands (17), and 4% in China (18). In our study, we determined the in-hospital mortality of patients hospitalized in our hospital for ECOPD to be 6.5%. As seen above, studies conducted in various countries reported mortality rates close to those found in our study.

For the primary outcome criteria in this study, we adopted the poor outcome criteria used by Stiell et al. in their original study. In the Stiell et al. study, 9.5% of the patients had poor outcomes (7). A retrospective study conducted in England reported that 31% of patients had poor outcomes (19). Kocak et al., in a study conducted using OCRS in Erzurum, compared the integrated pulmonary index with the OCRS and reported that 74% of the patients had poor outcomes—though they had wider exclusion criteria than the original OCRS study (20). In the Kocak et al. study, classifying all secondary admissions to the ED as a poor outcome may have resulted in a high adverse outcome rate. In our study, we found poor outcomes in 20.7% of the patients. The cause, severity, effect, treatment, and period of exacerbations vary from patient to patient and from country to country, in congruence with healthcare facilities and health systems. There is no standard applies to the timing and nature of discharge (7). Developing clinical decision rules that determine the short-term prognosis of patients is important for the standardization of patient care in EDs. Likewise, in this study, we have observed that our current practice was not sensitive enough to predict poor outcomes in

these patients. We believe that our findings suggest the use of two scores for the clinical decision pathway increase sensitivity. Testing these results in new multicenter studies will refine them for effective use in clinical practice.

A study evaluating readmissions of discharged patients with ECOPD symptoms reported a readmission rate of 7.54%. In the same study, when different patient groups were evaluated, the highest readmission rates were seen among health insurance and drug or substance users (21). Stiell et al. reported that 21.8% of patients who were discharged was readmitted to the ED within 14 days, and approximately 40% of these patients who visited the hospital again were hospitalized. Furthermore, when all discharged patients were evaluated, the rate of hospitalization was reported as 8% on the second visit (7). In our study, we found that approximately 20% of the patients who were discharged returned to the ED within 14 days, and approximately 40% of these patients were hospitalized. The rate of hospitalization was 7.5% on the second admission. Using similar criteria as Stiell et al. in our study, we obtained similar results for secondary ED visits and hospitalization.

OCRS was created via an analysis of factors affecting the poor prognosis in 945 ECOPD patients admitted to six academic EDs in Canada (22) and it was subsequently tested on 1415 patients multiculturally (7). OCRS consists of 10 criteria designed to identify patients in an ED with COPD who are at a high risk of severe consequences in the short term. The total score of the patients at the end of the test ranges from 0 to 10. In the study by Stiell et al., the sensitivity of the test was reported as 71.9% and the specificity as 54.6% in patients with a score of  $<2$ . The first study outside of Canada was done in Turkey. This study reported superior sensitivity and specificity than its validation study, and when the OCRS threshold value was more than 4, the sensitivity was 99.3% and the specificity 85.2% (20). In our study, OCRS sensitivity was 82.3% and specificity was 56.7% in patients with a score of  $<2$ . The results we obtained are similar, for sensitivity and specificity, to those obtained in the OCRS validation study for  $<2$  thresholds (7). However, when the score was 0, we found that there was greater sensitivity, but lower specificity compared to the validation study. Based on the results of our study, when the OCRS was used in making decisions on discharge, if the threshold value was taken as 0, the recommendation was for 46 patients to be discharged and 254 patients hospitalized. Here, we calculated that it would have erred with 4.3% wrong discharges and 76.3% unnecessary hospitalizations. If the threshold value was taken as  $<2$ , it recommended incorrect discharge at a rate of 7.5% and informed the unnecessary hospitalization of 66.9% of the patients for whom it recommended hospitalization. We found

that patients who were discharged and outcomes poor can be reduced using the OCRS, but unnecessary hospitalizations may increase simultaneously.

The DECAF score was established in 2012 via a study evaluating markers for mortality in AECOPD patients (5). A validation study reported that the DECAF score can be used for decisions on discharge and home follow-up (low-risk patients: DECAF 0–1) (23). Compared with various clinical decision rules, the DECAF score has been reported to be more successful than other scores in guiding clinical decision making on admissions (24). We found that when the threshold value was taken as 0, DECAF score was more sensitive and specific than the OCRS in determining short-term mortality. In contrast, the sensitivity of the DECAF score in predicting a poor outcome was lower than that of the OCRS. Based on the results of our study, if the DECAF score was used in the decision-making on discharge, with the threshold value taken as 0, there would be a rate of patients discharged with a poor outcome of 7.9% and unnecessary hospitalization of 73.9% of the hospitalized patients. If the threshold value was taken as  $<2$ , the rate of patients who are discharged and end with poor outcomes will be 9.6%, and unnecessary hospitalization for 58.3% of the hospitalized patients. We found that the DECAF score, like the OCRS, would provide information on excessive unnecessary hospitalization and discharged patients with poor outcomes. Consequently, we are convinced that both the OCRS and the DECAF score alone are insufficient for decisions on discharge. However, they can guide physicians on safe discharge based on the results of clinical evaluations.

## **Limitations**

Our study is a single-center study. There may be differences in the management of ECOPD between hospitals, regions, and countries. Therefore, our results are not generalizable, and results may differ across various centers and multicenter studies. Second, all physicians at the Dokuz Eylul University Hospital ED participated in our study. There may be inconsistencies in the discharge and hospitalization of the patients due to a lack of standard criteria for decisions on patient discharge specified in any guidelines and the fact that we did not intervene in physicians' decisions on discharge during the study. For some patients, physicians may have made their decisions based on the specific treatment requirements or social status of the patient, rather than the patient's clinical condition.

Furthermore, the limited bed capacity of the chest diseases outpatient clinic at the Dokuz Eylul University Hospital may have informed some patients being treated and discharged to the ED, only to revisit within a short time. This situation may have contributed to an increase in revisit rates and the number of poor outcomes.

The criteria of the Stiell et al. study was used as the poor outcome criteria in our study. Accordingly, a patient's readmission to the ED was not considered a poor prognosis criterion, and only hospitalization indication on the same admission was considered a bad prognosis.

## **Conclusion**

In this study, we found that OCRS is more sensitive than the DECAF score in predicting a poor outcome when all threshold values are evaluated. The DECAF score is more specific than the OCRS in predicting a poor outcome at all threshold values. However, we found that the use of both the OCRS and DECAF score alone may result in unnecessary hospitalizations and, albeit at a low rate, may result in discharging patients who have poor outcomes. We observed that our physicians had high specificity but low sensitivity in predicting a poor outcome. Consequently, we are convinced that the evaluation on the OCRS before discharge by the patient's physician in cases where hospitalization is not indicated will facilitate safe discharge by increasing both sensitivity and specificity.

## **Take Home Messages**

Among the two clinical scales compared in this study, the DECAF score was found to be more specific, despite the high sensitivity of OCRS in predicting short-term serious outcomes. However, we found that using clinical decision rules alone may lead to unnecessary hospitalizations. OCRS may be considered a helpful tool alongside Physician's gestalt for safe discharge of patients with AECOPD from the ED.

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