ORIGINAL ARTICLE

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Assessment of the Relationship of REMS and MEWS Scores with Prognosis in Patients Diagnosed with COVID-19 Admitted to the Emergency Department

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Abstract

Objective: The current study predicts their clinical termination and the mortality rate at the end of the first-month with rapid scoring systems such as rapid emergency medicine score (REMS) and modified early warning score (MEWS) of Coronavirus disease-2019 (COVID-19) patients admitted to the emergency department.

Methods: A total of 392 patients diagnosed with COVID-19 admitted to the emergency department in 1-month included in the study. REMS and MEWS were calculated for each case. Demographic data of patients, clinical outcomes [discharge, service or intensive care unit (ICU) hospitalization] and first-month mortality were analysed with receiver operating characteristic (ROC) curves to determine the cut-off value based on these scores.

Results: The 1-month mortality rate of our patients was 4.3% (n=17). REMS was higher in the mortality of patients who are (7.24±3.77) with COVID-19 than survival (2.87±3.09), and there was a statistically significant difference between them ($p<0.01$). Similarly, the average of the MEWS was higher in the mortality of patients (2.76±1.86) than in patients who are survival (1.65±1.35), and there was a statistically significant difference ($p<0.01$). The REMS of patients admitted to the service was higher than that of patients discharged ($p<0.01$). When the REMS score was determined as 3 cut-off value in ROC analysis, service hospitalization was 5 times higher in patients with a REMS score of 3 and above than in those who were discharged (odds ratio: 1: 5.022 95% confidence interval: 3.088-8.168). Also, REMS and MEWS were higher in ICU patients than in discharged patients ($p<0.01$).

Conclusion: In predicting the 1-month mortality of patients with ED diagnosed with COVID-19, REMS, and MEWS scoring systems can be useful and guiding in determining the patients who need hospitalization for emergency physicians. The use of these scoring systems in emergency departments can help predict the clinical outcomes of patients at the time of the initial evaluation and can also be a practical method for predicting the prognosis of the patients.

Keywords: COVID-19, infectious diseases, viral, triage, emergency department

INTRODUCTION

Coronaviruses are RNA viruses that may cause diseases by affecting multiple systems in humans and other living things (1). Until the last few years, six types of coronaviruses that have caused the disease in humans. A novel type of coronavirus was discovered in Wuhan, China, in the last months of 2019, after an increase in pneumonia cases with an unknown factor. This virus was named Coronavirus disease-2019 (COVID-19). Some patients infected with the virus were asymptomatic, and some were admitted to the hospital with symptoms, such as fever, cough, weakness, rhinorrhoea, chest pain, diarrhea and respiratory failure (2,3).

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The clinical course of patients being affected by COVID-19 infection was linked to several risk factors, such as age, gender, presence of comorbid disease and smoking history, in some studies (4-7). Many scoring systems have also been investigated in these patient groups to predict the clinical course and the course of patients after hospitalization. To date, the use of scores that predict early mortality in emergency departments has been a rational approach, as it ensures close follow-up and treatment of patients. Examples of these scorings are rapid emergency medicine score (REMS) and modified early warning score (MEWS) scoring (8). Research on early warning scores that can predict prognosis during emergency department admission in COVID-19 infection is limited. One of these studies has been conducted only to predict the mortality of patients in intensive care, and the other has been conducted to predict 48-hour and 7-day mortality with some scoring systems (9,10).

This study aims to evaluate the availability of REMS and MEWS scores to predict 1-month mortality and emergency department clinical outcomes of the patients with COVID-19 infection admitted to the emergency department.

METHODS

Study Design

This study was designed as a single-centered, prospective, and observational study. To conduct this study, ethical approval was obtained from the University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital, Local Ethical Committee (no: 48670771-514.10). Patients diagnosed with COVID-19 who were admitted to University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital Emergency Medicine Clinic were included in this study. Our hospital emergency department is a tertiary, multidisciplinary hospital where approximately 500,000-550,000 patients are cared for annually. Our study was completed within one month on patients diagnosed with COVID-19 out of patients admitted to the emergency department pandemic area of our hospital. Our hospital has about 400 patients applying daily with the suspicion of COVID-19 to the emergency department pandemic area, and about 40 patients have been diagnosed with COVID-19 as of daily. Written informed consent was obtained from the patients for their anonymized information to be published in this article.

Study Subjects and Settings

Patients diagnosed with COVID-19 and admitted to our hospital's emergency medicine clinic between 07/06/2020 and 07/07/2020 were included in this study. All patients over the age of 18 who were clinically, radiologically or laboratory diagnosed with COVID-19 and who gave consent to participate in this study were included. Pregnant patients, patients under 18, patients who did not give consent to participate in this study, patients who had suffered from trauma, and patients on drugs that were primarily effective on the central nervous system, such as antidepressants and antipsychotics, were excluded from this study. This study was also in line with the Declaration of Helsinki. University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital, Local Ethical Committee (no: 48670771-514.10).

Data Analysis and Measurement

Demographic data of the patients included in this study, their symptoms during admission, and information about their clinical outcome in the emergency department, such as hospitalization or discharge, were collected and analysed. The data contained all the information needed to calculate REMS and MEWS scores. REMS to calculate the score; the state of consciousness, Glasgow Coma scale (GCS), Average blood pressure (mmHg), heart rate (beats/minute), respiratory rate (breaths/minute), fever (°C), partial oxygen saturation (%) and patient age (years) information to calculate MEWS score; state of consciousness, systolic blood pressure (mmHg), heart rate (beats/min), body temperature (°C) and respiratory rate (breath/min) data were used. REMS and MEWS scores calculated based on these data were recorded. The 1-month mortality information of patients enrolled in this study was examined and analysed through hospital data.

Statistical Analysis

The NCSS (number Cruncher Statistical System) (Kaysville, Utah, USA) program was used for statistical analysis. Descriptive statistical methods (mean, standard deviation, median, frequency, ratio, minimum, maximum) were used while evaluating the study data. The suitability of quantitative data for normal distribution was tested with the Kolmogorov-Smirnov, Shapiro-Wilk test, and graphical evaluations. Student's t-test was used in two-group comparisons of quantitative data with a normal distribution, and the Mann-Whitney U test was used in two-group comparisons of data without normal distribution. Kruskal-Wallis test and Bonferroni Dunn test were used for binary comparisons of three and above groups that did not show normal distribution. Pearson chi-square test, Fisher-Freeman-Halton Exact test and Fisher's Exact test was used to compare qualitative data. Diagnostic screening tests (sensitivity, specificity, PKD, NKD) and receiver operating characteristic (ROC) curve analyses were used to determine cut-off for parameters. Significance was evaluated at a level of at least $p<0.05$.

RESULTS

Our study included 455 patients. A total of 63 patients whose data were recorded incomplete and who were using antidepressants were excluded from this study. Of the 392 patients included in our study, 43.4% (n=170) were female and 56.6% (n=222) were male. The average age of our patients was 48.98±19.49 years. The age of the cases with mortality at the end of the first-month was higher ($p<0.01$). However, no statistically significant differences were found between gender distributions and 1-month mortality ($p>0.05$). The most common additional disease of our patients was hypertension, followed by diabetes mellitus (DM) and ischemic heart disease (IHD). The most common symptoms were shortness of breath and cough. These symptoms were followed by fever, headache, and myalgia. Information about our patient's vital signs, average REMS and MEWS scores, states of consciousness, comorbid diseases, symptoms and mortality rates are indicated in Table 1.

The mortality rate of our patients at the end of the first-month was 4.3% (n=17). At the end of the first-month, the mortality of patients with a comorbid disease - was 20.8 times higher than those without a comorbid disease, and a statistically significant difference was found between them ($p<0.01$) [odds ratio (OR): 1:20.810 (95% confidence interval (CI): 2.731-158.539]. The average REMS score was higher in patients who died (non-survival) (7.24±3.77) than in patients who survived (2.87±3.09), and there was a statistically significant difference between them ($p<0.01$). The average MEWS score was also higher in non-survival patients (2.76±1.86) than in survivor patients (1.65±1.35), and there was a statistically significant difference between them ($p<0.01$). In other words, at the end of the first-month of the disease, REMS and MEWS scores were higher in cases with mortality (Table 2). Based on this significance, calculating the cut-off point for REMS and MEWS scores was considered.

The cut-off point of groups for REMS score was determined as 5 and above. When 1-month mortality for 5 cut-off values of REMS score was examined, sensitivity was 82.35%, specificity 71.47%, positive estimation 11.57%, negative estimation 98.89% and accuracy was 71.94%. In the ROC curve obtained (Figure 1), area under the curve (AUC) 81.8% standard error was determined as 5.3%. A statistically significant association was found between mortality at the end of the first-month and the 5 cut-off values of the REMS score ($p<0.01$), and the risk of mortality was 11.7 times higher in patients with REMS score 5 and above [OR: 11.688 (95% CI: 3.293-41.493)]. For the MEWS score, the cut-off point was 3 and higher, and for this estimated value, sensitivity was 52.94%, specificity was 82.40%, the positive estimate was 12.0%, the negative estimate

Table 1. The distribution of demographic characteristics

		N (%) or min-max (median) mean ± SD
Age (years)		18-101
		48.98±19.49
Sex	**Female**	170 (43.4%)
	Male	222 (56.6%)
Comorbid diseases	**No**	213 (54.3%)
	Yes	179 (45.7%)
Comorbidities (n=179)	**Hypertension**	95 (53.1%)
	Diabetes mellitus	61 (34.1%)
	Coronary arter disease	46 (25.7%)
	COPD	42 (23.5%)
	Congestive heart failure	18 (10.1%)
	Chronic kidney disease	14 (7.8%)
	Others	32 (23.4%)
Symptom	**Asymptomatic/contact**	16 (4.1%)
	Sympmtomatic	376 (95.9%)
Symptoms (n=376)	**Dyspnea**	164 (43.6%)
	Cough	143 (38%)
	Fever	112 (29.8%)
	Fatigue-myalgia	110 (29.3%)
	Diarrhea	30 (8%)
	Headache	30 (8%)
	Nausea-vomiting	27 (7.2%)
	Loss of taste or smell	22 (5.9%)
	Throat ache	15 (4%)
	Chest pain	10 (2.7%)
	Others	33 (8.7%)
Systolic heart pressure, mmHg	-	17-233 (130)
	-	131.78±24.87
Diastolic heart pressure, mmHg	-	34-124 (75)
	-	76.45±13.06
Beats/minute	-	47-192 (90)
	-	93.20±17.21
Respiratory rate/ minute	-	12-96 (18)
	-	18.80±5.75
Fever, °C	-	35.3-40 (36.7)
	-	36.79±0.65
SpO_2, %	-	18-980 (97)
	-	97.60±45.07
REMS score	-	0-15 (2)
	-	3.06±3.24
MEWS score	-	0-10 (1)
	-	1.69±1.40

Contunuet Table 1

Glasgow Coma score	-	3-15 (15)
	-	14.71±1.55
AVPU (n=390)	**A**	374 (95.9%)
	V	8 (2.1%)
	P	4 (1%)
	U	4 (1%)
Clinical outcome	**Admitted to ICU**	24 (6.1%)
	Admitted to service	108 (27.6%)
	Discharged	260 (66.3%)
Mortality status after 1-month	**Mortality (-)**	375 (95.7%)
	Mortality (+)	17 (4.3%)

SD: Standard deviation, COPD: Chronic obstructive pulmonary disease, REMS: Rapid emergency medicine score, MEWS: Modified early warning score, ICU: Intensive care unit, A: Awake, V: Verbal, P: Pain, U: Unresponsive, min: Minimum, max: Maximum

Table 2. The evaluation of mortality results after 1-month according to demographic characteristics and comorbid diseases

		Mortality status after 1-month		p
		No (n=375)	Yes (n=17)	
		n (%)	n (%)	
Age (years)	Min-max (median)	10-101 (48)	45-88 (80)	[a]**0.001****
	Mean ± SD	47.83±18.98	73.76±15.01	
Sex	**Female**	164 (43.7)	6 (35.3)	[b]**0.492**
	Male	211 (56.3)	11 (64.7)	
Comorbid disease	**No**	212 (56.5)	1 (5.9)	[b]**0.001****
	Yes	163 (43.5)	16 (94.1)	
REMS score	Min-max (median)	0-15 (2)	0-14 (7)	[d]**0.001****
	Mean ± SD	2.87±3.09	7.24±3.77	
MEWS score	Min - max (median)	0-10 (1)	0-7 (3)	[d]**0.007****
	Mean ± SD	1.65±1.35	2.76±1.86	

[a]Student t-test, [b]Pearson chi-square test, [d]Mann-Whitney U test, *p<0.05, **p<0.01. REMS: Rapid emergency medicine score, MEWS: Modified early warning score, SD: Standard deviation, min: Minimum, max: Maximum

was 97.48%, and accuracy was 81.12%. In the obtained ROC curve, AUC 68.1% standard error was determined as 7.5%. At the end of the first-month, a statistically significant relationship was found between the mortality rate and the 3 cut-off values of the MEWS score (p<0.01). In patients with a MEWS score of 3 and above, the risk of mortality at the end of the first-month was 5.3 times higher [OR: 1:5.267 (95% CI: 1.960-14.157)] (Table 3).

In the study of clinical outcome of the patients with ED, the incidence of comorbid disease was higher in intensive care unit (ICU) and hospitalized patients than in discharged patients (p=0.001; p=0.001 p<0.01, respectively). The most common comorbid disease in ICU patients was hypertension, which was followed by DM, IHD and chronic obstructive pulmonary disease. REMS scores of ICU and service hospitalization cases are higher than those of discharge cases (p<0.01). Similarly, MEWS scores in ICU and service hospitalization were higher than in discharged cases (p=0.001; p=0.031; p<0.05, respectively). Additionally, REMS and MEWS scores of patients admitted to ICU were also higher than patients admitted to the service (p<0.01).

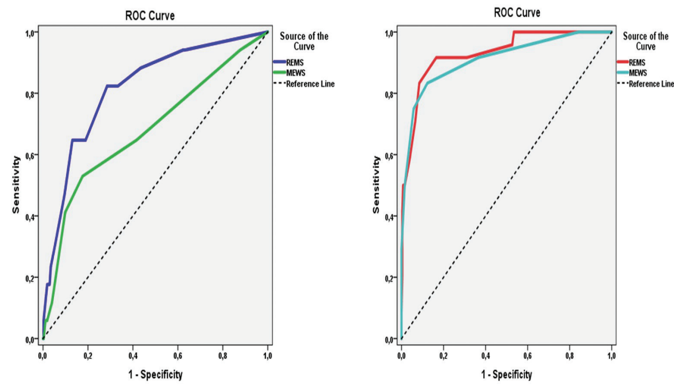

Figure 1. ROC curve for REMS and MEWS scores based on mortality (left) and ICU hospitalization and discharge (right) after 1-month

ROC: Receiver operating characteristic, REMS: Rapid emergency medicine score, MEWS: Modified early warning score, ICU: Intensive care unit

A statistically significant relationship was found between ICU admission and the discharge status and the 5 cut-off values of the REMS score (p<0.01). In patients with a REMS score of 5 and above, the risk of ICU hospitalization is 55.5 times higher than in those who were discharged [OR: 1:55.512 95% (CI: 12.586-244.847)] (Table 3).

According to ICU hospitalization and discharge groups, the cut-off point for MEWS score was determined as 3 and higher. For 3 cutting values of the MEWS score, sensitivity was 83.33%, specificity was 87.69%, positive estimation was 38.46%, negative estimation was 98.28%, and accuracy was 87.32%. In the obtained ROC curve, the underlying area was 91.1% standard error of 3.6% (Figure 1).

REMS and MEWS scores were higher in ICU hospitalization cases than in service hospitalization cases (p<0.01) (Table 4). Based on this significance, it was considered to calculate the cut-off point for REMS and MEWS scores. The cut-off point for REMS score was determined as 7 and above for ICU hospitalization and service hospitalization groups. For 7 cut-off values of REMS score, sensitivity was 70.83%, specificity was 75.93%, positive estimation was 39.53%, negative estimation was 92.13% and accuracy was 75.0%. In the obtained ROC curve, the underlying area was 81.5% standard error 5.1% (Figure 2). A statistically

Table 3. Diagnostic tests and ROC curve results for REMS and MEWS scores

		Patient's clinical outcome			p
		Admitted to ICU (n=24)	**Admitted to service (n=108)**	**Discharged (n=260)**	
		n (%)	**n (%)**	**n (%)**	
Comorbid diseases	**No**	3 (12.5)	34 (31.5)	176 (67.7)	[b]**0.001****
	Yes	21 (87.5)	74 (68.5)	84 (32.3)	
Comorbidities	**HT**	14 (58.3)	39 (36.1)	42 (16.2)	[b]**0.001****
	DM	7 (29.2)	28 (25.9)	26 (10.0)	[b]**0.001****
	COPD	5 (20.8)	15 (13.9)	22 (8.5)	[b]**0.079**
	CAD	8 (33.3)	22 (20.4)	16 (6.2)	[b]**0.001****
	CKD	3 (12.5)	6 (5.6)	5 (1.9)	[e]**0.015***
	CHF	4 (16.7)	10 (9.3)	4 (1.5)	[e]**0.001****
	Malignancy	2 (8.3)	5 (4.6)	7 (2.7)	[e]**0.203**
	CVD	5 (25.0)	5 (4.6)	0 (0)	[e]**0.001****
	Others	2 (8.3)	7 (6.5)	8 (3.1)	[e]**0.145**
REMS score	Min-max (median)	1-15 (9)	0-12 (5)	0-13 (2)	[f]**0.001****
	Mean ± SD	8.88±3.77	4.40±3.00	1.97±2.41	
MEWS score	Min-max (median)	1-10 (4.5)	0-6 (1)	0-5 (1)	[f]**0.001****
	Mean ± SD	4.63±2.12	1.74±1.13	1.40±1.06	

[b]Pearson chi-square test, [e]Fisher-Freeman-Halton Exact test, [f]Kruskal-Wallis test, *p<0.05, **p<0.01, HT: Hypertension, DM: Diabetes mellitus, COPD: Chronic obstructive pulmonary disease, CAD: Coronary arter disease, CKD: Chronic kidney disease, CHF: Congestive heart failure, ICU: Intensive care unit, REMS: Rapid emergency medicine score, MEWS: Modified early warning score, SD: Standard deviation, min: Minimum, max: Maximum, CVO: Cerebro vascular disease

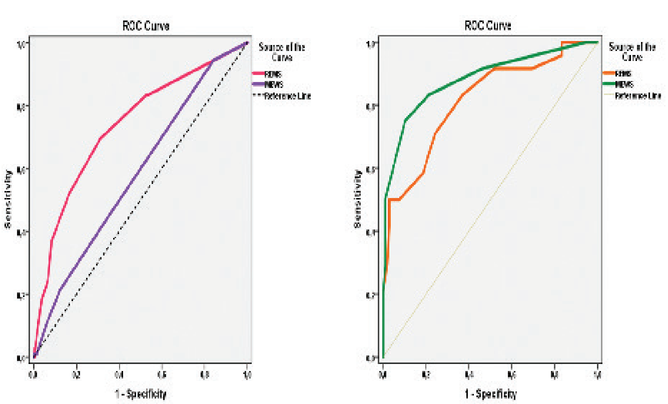

Figure 2. ROC curve for REMS and MEWS scores according to service admission or discharge (left) and ICU hospitalization or service hospitalization (right)

ROC: Receiver operating characteristic, REMS: Rapid emergency medicine score, MEWS: Modified early warning score, ICU: Intensive care unit

significant relationship was found between ICU hospitalization, service hospitalization and the 7 cut-off values of the REMS score (p<0.01). In patients with a REMS score of 7 and above, the risk of ICU hospitalization was 7.66 times higher than in those with a service hospitalization [OR: 1:7.659 (95% CI: 2.862-20.501)] (Table 5).

A statistically significant relationship was found between ICU admission/discharge status and the 3 cut-off values of the MEWS score (p=0.001; p<0.01). In patients with a MEWS score of 3 and above, the risk of ICU hospitalization was 35.63 times higher than in those who were discharged [OR: 1:35.625 (95% CI: 11ch445-110.890)] (Table 5).

REMS and MEWS scores were higher in patients with service hospitalization than in patients who were discharged (p<0.01, p<0.05). Based on this significance, the calculation of the cut-off point for REMS and MEWS scores was considered. The cut-off point for REMS score was determined as 3 and higher for groups who were hospitalized and discharged. For 3 cut-off values of REMS score, sensitivity was 69.44%, specificity was 68.85%, positive estimation was 48.08%, negative estimation was 84.43% and accuracy was 69.02%. In the obtained ROC curve, the underlying area was determined as 73.7% standard error 2.9% (Figure 2). In patients with a REMS score of 3 and above, service admission was 5.022 times higher than those discharged [OR 1:5.022 (95% CI: 3.088-8.168)]. The cut-off point for the MEWS score was determined as 1 and above in the same groups. For the 1 cut-off value of the MEWS score, sensitivity was 94.44%, specificity was 15.77%, positive estimation was 31.78%, negative estimation was 87.23% and accuracy was 38.86%. In the resulting ROC curve, the underlying area was 58.4% and standard error was 3.2% (Figure 2). A statistically significant relationship was found between service hospitalization and discharge status and the MEWS score cut-off value of 1 (p<0.01). In cases with a MEWS score of 1 and above, service hospitalization was 3.183 times higher than in those discharged [OR: 1: 3.183 (95% CI: 1.309-7.737)] (Table 5).

The cut-off point for MEWS score for ICU hospitalization and service hospitalization groups was determined as 4 and above. Sensitivity was 75.00%, specificity was 89.81%, positive estimation was 62.07%, negative estimation was 94.17% and accuracy was 87.12% for 4 cut-off values of the MEWS score. In the resulting ROC curve, the underlying area was 88.4% and the standard error to be 4.4% (Figure 2). A statistically significant relationship was found between ICU hospitalization, service hospitalization and the 4 cut-off values of the MEWS score (p=0.001; p<0.01). In patients with a MEWS score of 4 and above, the risk of ICU hospitalization was 26.46 times higher than in those with a service hospitalization [OR: 1:26.455 (95% CI: 8.678-80.648)] (Table 5).

DISCUSSION

Our study has shown that there is no special rapid scoring system used to predict the prognosis of COVID-19. In this study, we have tried determining the prognosis of these patients using REMS and MEWS scoring systems. We have found that COVID-19 patients with high REMS and MEWS scores had higher hospitalization, ICU admission and 1-month mortality rate. Additionally, both

Table 4. Evaluations according to the patient's clinical outcome

	Diagnostic scan					ROC curve		p
	Cut-off	Sensitivity	Specificity	Positive predictive value	Negative predictive value	Area	95% confidence interval	
Mortality at the end of 1-month								
REMS	**≥5**	82.35	71.47	11.57	98.89	**0.818**	0.714-0.921	**0.001****
MEWS	**≥3**	52.94	82.40	12.00	97.48	**0.681**	0.534-0.828	**0.012***
According to ICU admission and discharge status								
REMS	**≥5**	91.67	83.46	33.85	99.09	**0.930**	0.876-0.984	**0.001****
MEWS	**≥3**	83.33	87.69	38.46	98.28	**0.911**	0.840-0.982	**0.001****
According to service admission and discharge status								
REMS	**≥3**	69.44	68.85	48.08	84.43	**0.737**	0.680-0.795	**0.001****
MEWS	**≥1**	94.44	15.77	31.78	87.23	**0.584**	0.521-0.647	**0.012***
ICU hospitalization and service hospitalization status								
REMS	**≥7**	70.83	75.93	39.53	92.13	**0.815**	0.715-0.915	**0.001****
MEWS	**≥4**	75.00	89.81	62.07	94.17	**0.884**	0.798-0.970	**0.001****

*p<0.05, **p<0.01. ROC: Receiver operating characteristic, ICU: Intensive care unit, REMS: Rapid emergency medicine score, MEWS: Modified early warning score

Table 5. Relationship between REMS and MEWS scores (cut-off values)

	REMS <5	REMS ≥5	p	MEWS <3	MEWS ≥3	p
Mortality (-)	268 (71.5)	107 (28.5)	[b]**0.001****	309 (82.4)	66 (17.6)	[c]**0.001****
Mortality (+)	3 (17.6)	14 (82.4)		8 (47.1)	9 (52.9)	
	REMS <5	REMS ≥5		MEWS <3	MEWS ≥3	
Discharged	217 (83.5)	43 (16.5)	[b]**0.001****	228 (87.7)	32 (12.3)	[c]**0.0011****
Admitted to ICU	2 (8.3)	22 (91.7)		4 (16.7)	20 (83.3)	
	REMS <3	REMS ≥3		MEWS <1	MEWS ≥1	
Discharged	179 (68.8)	81 (31.2)	[b]**0.001****	41 (15.8)	219 (84.2)	[b]**0.008****
Admitted to service	33 (30.6)	75 (69.4)		6 (5.6)	102 (94.4)	
	REMS <7	REMS ≥7		MEWS <4	MEWS ≥4	
Admitted to service	82 (75.9)	26 (24.1)	[b]**0.001****	97 (89.8)	11 (10.2)	[b]**0.001****
Admitted to ICU	7 (29.2)	17 (70.8)		6 (25)	18 (75)	

[b]Pearson chi-square test, [c]Fisher's Exact test, **p<0.01, REMS: Rapid emergency medicine score, MEWS: Modified early warning score, ICU: Intensive care unit

mortality and hospitalization rates of patients with comorbidity were higher. In previous studies, it has been emphasized that comorbidity is important for hospitalization and admission to intensive care (4,11,12). Consistent with previous studies, patients with comorbidity had higher mortality at the end of the first-month in our study.

MEWS is a modified version (13) of the EWS developed by Subbe et al. (14) in 2000. As an easily computable per-patient tool in a busy clinical area, MEWS can help identify the need for early intervention while evaluating emergency patients. Moreover, MEWS is a scoring system that uses vital parameters calculated using systolic blood pressure, heart rate, respiratory rate, body temperature and AVPU scale (14). However, REMS is a scoring system developed by Olsson et al. (15), and which uses the GCS instead of AVPU, unlike MEWS; the age of the patient is also included in the scoring while using REMS. The main reason we have received high scores in these two scoring systems is that the score points increase as the vital signs deteriorate. The study of Hu et al. (10) supports the findings of our study. Hu et al. (10) used the REMS and MEWS rapid scoring systems, which are normally used in the emergency department, on patients with COVID-19 in critical condition. Their study included 105 patients and they noted that mortality would be high at certain cut-off values in the REMS score and MEWS score. Considering these data, they have argued that the REMS scoring system is better than MEWS in predicting mortality in critical patients (10,16,17). In our study, we tried to predict mortality and prognosis in all patients with COVID-19 admitted to the emergency department using these two scoring systems.

The advantage of our study compared to other studies is that this study has examined all applications and reviewed service hospitalization, intensive care hospitalization and mortality altogether. Hu et al. (10) evaluated only mortality for each cut-off value in critical patients in intensive care. In our study, it has been determined that the patient's prognosis can be defined based on the cut-off values obtained.

When we compared REMS and MEWS scores in our study, we found that REMS score of 5 points and above was superior to the MEWS score of 3 points and above. A positive value as AUC value 0.818 was determined for REMS score 5 points and above. Although the high REMS score was not compelling in determining mortality (PPV: 11.57), it was very successful in determining that there would be no mortality of patients below 5 points (NPV: 98.89). We can attribute this to the fact that the number of patients we lost was only 17. A MEWS score of 3 or higher is also a useful method for determining patient mortality, but it is not as strong as REMS (AUC: 0.681).

The finding obtained in our study suggest that REMS is again superior to the MEWS score to distinguish when the patients will be admitted to intensive care or when they will be discharged. Patients with a REMS score of 5 points and above are more likely to be admitted to intensive care (AUC: 0.930). This value was as strong as the REMS score for 3 points and above values for the MEWS score (AUC: 0.911). Therefore, note that patients above 5 and 3 points in REMS and MEWS scores, respectively, are more likely to be admitted to intensive care.

Also, another substantial discovery we made was that the MEWS score slightly exceeded the REMS score when patients admitted to the service and admitted to the ICU were compared. Patients with a MEWS score of 4 points and above and patients with a REMS score of 7 points and above were mostly admitted to intensive care. Therefore we believe that the MEWS score is a good scoring system that will be used in the emergency department to be admitted to the ICU.

Study Limitations

The most important limitation of our study is that our number of patients and mortality rate are low. However, to our knowledge, this study has the largest number of patients in the literature. Our second limitation is that in our study, we did not separate the age groups of our patients based on decades. If we grouped patients based on their ages, we would probably find different mortality scores depending on the age group, given that in the REMS scoring system, different scores are received from different age groups. Another limitation is that we have not determined the mortality based on the treatment administered to our patients. Keeping this factor in mind for other prospective studies on this subject will contribute to the literature.

CONCLUSION

To sum up, our study has shown that REMS and MEWS scoring systems can be useful and guiding for emergency physicians in determining the 1-month mortality of COVID-19 diagnosed patients and in determining which patients need to be hospitalized. The use of these scoring systems in emergency departments can help predict the clinical endings of patients in the initial evaluation and can also be a practical method for predicting the prognosis of patients.

Ethics

Ethics Committee Approval: University of Health Sciences Turkey, Prof. Dr. Cemil Tascioglu City Hospital, Local Ethical Committee (no: 48670771-514.10).

Informed Consent: Written informed consent was obtained from the patients for their anonymized information to be published in this article.

Peer-review: Externally peer-reviewed.

Authorship Contributions

Surgical and Medical Practices: B.B., M.Ş., T.N.B., K.T., A.K., Concept: T.N.B., M.Ş., A.K., Design: B.B., T.N.B., K.T., A.K., Data Collection or Processing: B.B., M.Ş., T.N.B., K.T., A.K., Analysis or Interpretation: B.B., M.Ş., A.K., Literature Search: B.B., M.Ş., A.K., Writing: B.B., M.Ş., T.N.B., K.T., A.K.

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