ORIGINAL ARTICLE

COMPARISON OF CLINICAL FRAILTY SCALE AND EDMONTON FRAIL SCALE IN OLDER ADULTS PRESENTING TO THE EMERGENCY DEPARTMENT

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Abstract

Introduction: This study aimed to compare the prognostic values of Edmonton Frail Scale and Clinical Frailty Scale in the emergency department and determine their suitability for patient management.

Materials and Method: This study was conducted as a single-center prospective observational study. Patients aged 65 and older who presented to the emergency department were included. Clinical Frailty Scale and Edmonton Frail Scale scores, the emergency department outcomes, length of stay in the emergency department, 30-day mortality, and 30-day readmission data of the patients were recorded. ROC analysis was performed to examine the predictive values on outcomes. DeLong Test was used to compare the predictive values.

Results: This study included 400 patients. Intensive care unit admission was significantly more frequent in the frail group according to both Edmonton Frail Scale and Clinical Frailty Scale. The length of stay in the emergency department was significantly longer in the frail group in both classifications. The mortality rate was significantly higher in the frail group in both classifications. The optimal cut off value for predicting mortality was found to be 9 for Edmonton Frail Scale and 7 for Clinical Frailty Scale. There was no significant difference between the predictive values of two scales.

Conclusion: We found that two frail scales have good predictive values for adverse outcomes, such as mortality and the need for Intensive care unit admission in the emergency department. We believe that both scores would be valuable in guiding decisions for the emergency department usage due to their similar predictive values.

Keywords: Geriatrics; Emergency Service; Hospital; Frailty; Frail Elderly; Mortality.

INTRODUCTION

Emergency departments (EDs) are medical units that typically serve as entry points to hospital systems or long-term care and provide vital services to older adults (1). Individuals ages 75 and older have the highest rates of ED visits, second only to infants (2). Furthermore, the global older adult population is increasing steadily, thereby necessitating EDs' growing importance in older-adult care. Frailty is a practical and unifying concept that directs attention toward a more holistic view of care for older adults, focusing on their overall condition, rather than organ-specific diagnoses. Frailty involves a state of vulnerability to stressors and is associated strongly with adverse outcomes. Therefore, differentiating frail older adults from non-frail ones, particularly in situations involving invasive procedures or potential exposure to harmful medications, constitutes a significant aspect of assessment.

Patients with frailty have longer hospital stays and experience higher rates of readmission and mortality (3). In EDs, the aim is to reduce adverse outcomes from treatment by assigning risk classifications to frail patients (4). However, comprehensive geriatric assessments are often not feasible in routine practice in EDs due to limited time available for each patient (5). Therefore, the use of shorter and validated scales has been recommended to identify these high-risk patients (6). However, a recent systematic review reported very low completion rates for frailty scales in critically ill patients presenting at EDs, and it was found that no studies covered over half (52%) of potentially eligible patients for screening (7). Among the reasons for this, factors such as dealing with more complex and challenging cases, as well as knowledge and training gaps, have been cited (8).

The Clinical Frailty Scale (CFS) and Edmonton Frail Scale (EFS) are practical scales suitable for assessing frailty in EDs. This study aims to compare CFS and EFS frailty scales' prognostic values for adverse outcomes, such as mortality and the need for intensive care unit (ICU) admission, contributing to the identification of scores suitable for use in EDs.

MATERIALS AND METHOD

The study was conducted as a prospective observational study in the ED of a university hospital between March 1, 2021, and October 1, 2021.

Study Population

Patients ages 65 and older who presented to the ED were included in the study (n = 429). Patients who were unable to communicate due to language barriers or sequelae (n=2); had cerebrovascular events (n=2), major trauma (n=17), or Alzheimer's disease (n=3); or were comatose or intubated (n=5) were excluded from the study.

In a review by Theuou et al., the prevalence of frailty among older adults presenting to the EDs ranged from 7% to 80% (9). The sample size was calculated using the confidence interval method for proportions. The largest sample size was taken as 0.50. It was found, through calculations, that a minimum of 371 volunteers would need to be included in the study to estimate the value of 0.50 in the population, with a 95% confidence interval of ± 0.05 (0.45; 0.55).

Outcomes and data analysis

After patients presented at the hospital, the study team physician evaluated them, and their data were recorded in the case report form. ED outcomes, follow-up duration, 30-day readmission, and 30-day mortality data were monitored. The national health system database and phone interviews with patients and their caregivers were used for patient follow-up. No interventions were made regarding routine diagnosis, treatment, and testing practices that the responsible ED physician determined throughout the study.

Demographic information, vital signs, comorbidities, polypharmacy, and CFS and EFS scores were recorded. The ED follow-up duration, hospital admission status (discharge/general

ward/ICU), 30-day readmission rates, number of readmissions, and 30-day mortality data were tracked and recorded.

CFS evaluates fitness, active diseases, activities of daily living, and cognition. Patients with CFS scores of 1–4 were classified as non-frail; 5–6, mild to moderately frail; and 7-9, severely frail. The data then were compared between two categories: non-frail (CFS 1–4) and frail (CFS > 4) (10). Ozsurekci et al. conducted the Turkish validity and reliability of the CDS (11).

The EFS is a multidimensional scale comprising 10 domains and 17 potential deficits covering cognition, overall health status, functional independence, social support, medication use, nutrition, mood, continence, and functional performance. Patients were grouped into categories based on EFS scores: 0–5, non-frail; 6–11, mild frailty; and 12–17, severe frailty. The data then were compared between two categories: non-frail (EFS 0–5) and frail (EFS 6–17) (12). Aygör et al. conducted a validity study in the Turkish population and showed that the ECS is appropriate and valid for use in the Turkish population (13).

The study's primary outcome was determined through a comparison of the predictive values of CFS and EFS for 30-day mortality. Secondary outcomes were defined as determining the predictive value of CFS and EFS for length of stay (LOS) in the ED, hospital admission, and readmission to the ED within 30 days. Mortality and/or ICU admission were viewed as a composite outcome and were analyzed among secondary outcomes.

Statistical Package for the Social Sciences (SPSS) software, Version 25, was used for analysis. The normal distribution was determined through the Kolmogorov-Smirnov test and an examination of histograms. Normally distributed data were presented as mean ± standard deviation, and non-normally distributed data were presented as median (interquartile range [IQR] 25–75). For a comparison of continuous numerical variables, Student's t-test was used for normally distributed data, while the Mann-Whitney U test was used for non-normally distributed data. Categorical variables were compared using the chi-square test or Fisher's exact test. A receiver operating characteristic (ROC) analysis was conducted to examine predictive values. Area under the curve (AUC) values were examined, and optimal cutoff values were determined using Youden's index. Differences between ROC curves were analyzed using the DeLong test. A p-value < 0.05 was viewed as statistically significant.

Ethical Considerations

Ethical approval was obtained from the Ege University Clinical Research Ethics Committee on February 19, 2021 (protocol number 21-2.1T/47). This study was conducted in accordance with Declaration of Helsinki principles. Informed consent was obtained from all patients or their legal guardians.

RESULTS

Out of the 400 patients included in the study, 52.3% were female. The median age for all patients was 77 years (65–100). Patients' demographic characteristics, vital signs, and comorbidities are summarized in Table 1.

The median CFS score for the patients was 6 (1–9), and the median EFS score was 8 (0–15). A comparison of clinical parameters in EFS and CFS frailty groups is presented in Table 1.

Significantly higher ages were observed in the frail group, according to the EFS ($p < 0.001$). Both systolic blood pressure (SBP) and diastolic blood pressure (DBP), as well as SpO_2 and Glasgow Coma Scale (GCS) values, were significantly lower in the frail group, according to both EFS and CFS. Respiratory rate was higher in the frail group, according to both EFS and CFS. Coronary artery disease (CAD), chronic kidney disease (CKD), and cerebrovascular disease

(CVD) were significantly more common in the frail group (p=0.003, p=0.002, p=0.024, respectively). Polypharmacy was significantly more frequent in the EFS frailty group (p < 0.001).

In the comparison between CFS groups, age was significantly higher in the frail group (p<0.001). Female gender was significantly more common in the frail group (p<0.001). CKD and CVD were significantly more prevalent in the frail group, according to CFS (p=0.004 and p=0.020, respectively). Polypharmacy was more common in the CFS frail group (p=0.001). The patients' demographic and clinical characteristics, according to CFS and EFS groups, were compared and presented in Table 2.

The hospitalization rate (ward or ICU) was significantly higher in the EFS frail group (p=0.014), while no significant difference was found between CFS groups (p=0.131). ICU admission was significantly more frequent in both the EFS and CFS frail groups (p<0.001 and p=0.027, respectively). The LOS in the ED was significantly longer in the frail group in both classifications (both p<0.001). Mortality was observed in 63 patients in the EFS frail group and 61 in the CFS frail group. The mortality rate was significantly higher in the frail group in both classifications (both p< 0.001) (Table 3).

In the ROC analysis for predicting mortality, the optimal cutoff value for EFS was found to be 9 (AUC: 0.810 [0.754–0.866], p<0.001). According to this cutoff, the negative predictive value (NPV) for mortality was determined to be 95.4%. For CFS, the optimal cutoff was found to be 7 (AUC: 0.783 [0.722–0.844], p<0.001). According to this cutoff, the NPV for mortality was determined to be 94.1%. No

Table 1. Demographic, clinical, and outcome characteristics of all patients

Demographic and Clinical Data		Outcome Data	
	n (%) Total n = 400		**n (%)**
		EFS, median (IQR25-75)	8 (0-15)
Age, year, median (IQR25-75)	77 (65-100)	Non-frail	131 (32.8)
Gender, Female, n(%)	209 (52.3)	Mildly-Moderate Frail	195 (48.8)
HT	257 (64.3)	Severe Frail	74 (18.5)
CAD	168 (42)	**CFS, median (IQR25-75)**	6 (1-9)
DM	151 (37.8)	Non-frail	108 (27)
Dementia	31 (7.8)	Mildly-Moderate Frail	148 (37)
CKD	39 (9.8)	Severe Frail	144 (36)
CVD	168 (42)	Hospital Admission	150 (37.5)
Malignancy	77 (19.3)	Service Admission	65 (16.3)
Hepatic Failure	15 (3.8)	ICU Admission	98 (24.5)a
Polypharmacy	210 (52.5)	ED Length of Stay (hours)	13 (7-26)
		30-day ED readmission	89 (22.3)
		30-day Mortality	66 (16.5)
		Composite Outcome	123 (30.8)

[a]Patients requiring transfer to the Intensive Care Unit (ICU) were also included during the service admission. IQR: Interquartile Range, HT: Hypertension, CAD: Coronasry Artery Disease, DM: Diabetes Mellitus, CKD: Chronic Kidney Disease, CVD: Cerebrovascular Disease, ICU: Intensive Care Unit, ED: Emergency Department, EFS: Edmonton Frailty Scale, CFS: Clinical Frailty Scale

Table 2. Comparison of clinical parameters in EFS and CFS frailty groups

		EFS Frail n = 269	EFS Non-Frail n = 131	P Value[a]
Age, year, median (IQR25-75)		78 (72-85)	73 (70-77)	**<0.001[b]**
Gender, Female, n (%)		149 (55.4)	60 (45.8)	0.072
Median (IQR 25-75)	SBP, mmHg	133 (111-150)	140 (124-163)	**0.003[b]**
	DBP, mmHg	74 (63-87)	77 (69-91)	**0.022[b]**
	Pulse rate, /min	86 (74-101)	89 (78-100)	0.449[b]
	Temperature, C°	36.5 (36.3-36.8)	36.5 (36.3-36.8)	0.874[b]
	SpO_2, %	96 (94-97)	96 (95-98)	**0.004[b]**
	GCS	15 (15-15)	15 (15-15)	**<0.001[b]**
	Respiratory Rate, /min	17 (15-19)	15 (15-17)	**<0.001[b]**
N (%)	HT	172 (63.9)	85 (64.9)	0.853
	CAD	127 (47.2)	41 (31.3)	**0.002**
	DM	106 (39.4)	45 (34.4)	0.328
	Dementia	25 (9.3)	6 (4.6)	0.098
	CKD	35 (13)	4 (3.1)	**0.002**
	CVD	31 (11.5)	6 (4.6)	**0.024**
	Malignancy	58 (21.6)	19 (14.5)	0.093
	Hepatic Failure	12 (4.5)	3 (2.3)	0.218[c]
	Polypharmacy	164 (61)	46 (35.4)	**<0.001**
		CFS Frail n = 292	**CFS Non-Frail n = 108**	**P Value[a]**
Age, year, median (IQR25-75)		77 (72-85)	72 (69-77)	**<0.001[b]**
Gender, Female, N (%)		172 (58.9)	37 (34.3)	**<0.001**
Median (IQR 25-75)	SBP, mmHg	135 (114-151)	137 (121-163)	**0.035[b]**
	DBP, mmHg	74 (64-87)	80 (67-92)	**0.041[b]**
	Pulse rate, /min	86 (74-101)	89 (78-100)	0.599[b]
	Temperature, °C	36.5 (36.3-36.8)	36.5 (36.3-36.8)	0.931[b]
	SpO_2, %	96 (94-97)	96 (95-98)	**0.039[b]**
	GCS	15 (15-15)	15 (15-15)	**0.001[b]**
	Respiratory rate, /min	17 (15-19)	16 (15-17)	**<0.001[b]**
N (%)	HT	187 (64)	70 (64.8)	0.886
	CAD	130 (44.5)	38 (35.2)	0.093
	DM	107 (36.6)	44 (40.7)	0.453
	Dementia	27 (9.2)	4 (3.7)	0.066
	CKD	36 (12.3)	3 (2.8)	**0.004**
	CVD	33 (11.3)	4 (3.7)	**0.020**
	Malignancy	58 (19.9)	19 (17.6)	0.609
	Hepatic Failure	9 (3.1)	6 (5.6)	0.248[c]
	Polypharmacy	168 (57.5)	42 (39.3)	**0.001**

[a]ChiSquareTest [b]Mann Whitney U test [c]Fisher Exact Test IQR: Interquartile Range, SBP: Systolic Blood Pressure, DBP: Diastolic Blood Pressure, GCS: Glasgow Coma Scale HT: Hypertension, CAD: Coronary Artery Disease, DM: Diabetes Mellitus, CKD: Chronic Kidney Disease, CVD: Cerebrovascular Disease, EFS: Edmonton Frailty Scale, CFS: Clinical Frailty Scale

Table 3. Comparison of outcome measures in EFS and CFS frailty groups

	EFS Frail n = 269	EFS Non-Frail n = 131	P Value*
Hospital Admission	112 (41.6)	38 (29)	**0.014**
Service Admission	41 (15.2)	24 (18.3)	0.433
ICU Admission[c]	80 (29.7)	18 (13.7)	**<0.001**
ED Length of Stay (h)[b]	15 (8-28)	9 (5-21)	**<0.001**
30-day ED Readmission	60 (22.3)	29 (22.1)	0.970
Number of Readmissions[a,b]	1 (1-1)	1 (1-2)	0.416
30-day Mortality	63 (23.4)	3 (2.3)	**<0.001**
	CFS Frail n = 292	**CFS Non-Frail n = 108**	**P Value***
Hospital Admission	116 (39.7)	34 (31.5)	0.131
Service Admission	44 (15.1)	21 (19.4)	0.292
ICU Admission[c]	80 (27.4)	18 (16.7)	**0.027**
ED Length of Stay (h)[b]	28 (16-57)	18 (9-36)	**<0.001**
30-day ED Readmission	65 (22.3)	24 (22.2)	0.994
Number of Readmissions[a,b]	1 (1-1)	1 (1-2)	0.540
30-day Mortality	61 (20.9)	5 (4.6)	**<0.001**

[a]Evaluated among patients with readmissions.[b]Presented as Median (IQR25-75). Mann Whitney U test was applied. [c]Included patients requiring transfer to the ICU during service admission. *Chi Square Test IQR: Interquartile Range, ICU: Intensive Care Unit, ED: Emergency Department, EFS: Edmonton Frailty Scale, CFS: Clinical Frailty Scale

Table 4. Predictive values of CFS and EFS for mortality and composite outcome

ROC analysis results for 30-day mortality							
	Cut-off	**Sensitivity**	**Specifity**	**PPV**	**NPV**	**AUC (%95CI)**	**P Value**
EFS Total	9	83.3	67.7	33.7	95.4	0.810 (0.754-0.866)	**<0.001**
CFS Total	7	77.3	72.2	35.4	94.1	0.783 (0.722-0.844)	**<0.001**
						De Long Test between CFS and EFS	0.159
ROC analysis results for composite outcome							
	Cut-off	**Sensitivity**	**Specifity**	**PPV**	**NPV**	**AUC (%95CI)**	**P Value**
EFS Total	9	64	70	49.1	82	0.702 (0.644-0.760)	**<0.001**
CFS Total	7	60.2	74.7	51.4	80.9	0.698 (0.638-0.758)	**<0.001**
						De Long Test between CFS and EFS	0.820

ROC: Receiver Operating Characteristic, PPV: Positive Predictive Value, NPV: Negative Predictive Value, AUC: Area Under the Curve, IQR: Interquartile Range, EFS: Edmonton Frailty Scale, CFS: Clinical Frailty Scale

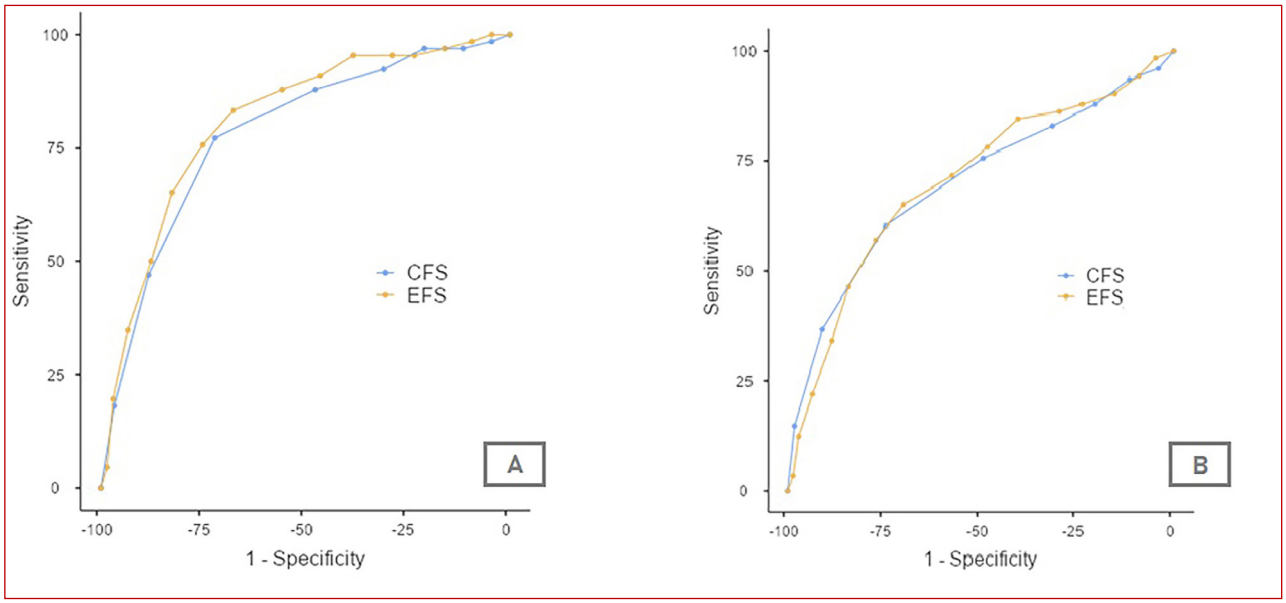

Figure 1. A. ROC analysis for 30-day mortality, **B.** ROC analysis for composite outcome.

significant difference in predictive values was found between EFS and CFS (p=0.159, DeLong Test) (Table 4, Figure 1).

In the ROC analysis for the composite outcome defined as mortality and/or ICU admission, the optimal cutoff for EFS again was found to be 9 (AUC: 0.702 [0.644–0.760], p<0.001). The optimal cutoff for CFS was 7 (AUC: 0.698 [0.638–0.758], p<0.001). No significant difference in predictive values was found between EFS and CFS for the composite outcome (p = 0.820, DeLong Test) (Table 4, Figure 1).

DISCUSSION

In this study, in which we compared the predictive values of EFS and CFS frailty scales for adverse outcomes, such as mortality and ICU admission in EDs, we found that both EFS and CFS had significant predictive value, but neither displayed superiority over the other. According to both scales, mortality, ICU admission, and LOS in the ED were significantly higher in the frail group.

Joseph et al. found a frailty prevalence of 44% based on a 50-item frailty scale assessment among 250 older adults admitted to a Level 1 trauma center (14). Battagia et al. reported a frailty prevalence of 58.5% among 200 older adults presenting to the ED (15). In this study, we believe that the higher frailty rates according to both scales can be attributed to this study being conducted in a tertiary ED serving as a reference hospital in the region catering to the increasing geriatric population.

In this study, CAD, CKD, and CVD rates were significantly higher in the EFS frailty group. In the CFS frailty group, CKD and CVD were significantly higher. The association of frailty with many comorbidities has been examined previously in the literature. Sinclair et al. found a statistically significant association between frailty and diabetes mellitus (DM), suggesting that diabetes may accelerate the aging process and provide an early pathophysiological environment for frailty (16). Castrejón-Pérez et al. (17) found a statistically significant association between frailty and HT. This

systematic review demonstrated that frailty is a strong predictor of mortality, hospitalization, and falls resulting in injuries in hypertensive patients. In this study, no significant difference in HT and DM was found between the EFS and CFS frailty groups. However, considering that CAD, CKD, and CVD are well-established comorbidities similar to DM and HT, their contribution to frailty should be considered (18). We believe that these comorbidities may lead to this result through their impact on cardiac functions and sarcopenia.

Pulok et al. (19) reported a 17% 30-day mortality rate in patients identified as frail, according to the CFS score in their study of 808 ED patients. Kaeppeli et al. (20) found a 12% mortality rate in patients with a CFS score of 5 or higher. Chong et al. (21) reported a mortality rate of 4.7% in the frail group in their study of 210 patients. In this study, the mortality rate was 4.6% in non-frail patients and 20.9% in frail patients, according to the CFS assessment. We believe that the higher mortality rates in the frail group in this study, compared with similar studies in the literature, may be because the hospital where the study was conducted serves as a reference tertiary care center in the region. Furthermore, Kaeppeli et al. (20) reported an ICU admission rate of 16% in the frail group, according to CFS. They stated that CFS is a good scale for predicting ICU admission. In this study, ICU admission rates were significantly higher in the CFS frail group (27.4%). Therefore, we believe that CFS can be a useful predictor for both mortality and ICU admission in EDs.

In a study by Rose et al. (22) using EFS, it was found that frailty was associated with longer hospital stays and mortality. In this study, LOS in the ED was significantly longer in both frailty groups (both $p<0.001$). The longer LOS in the frail group in line with the literature may be attributed to the need for comprehensive evaluation of this patient group, rather than disease-specific management, and, therefore, the need for a more comprehensive assessment before making a safe discharge decision or determining the appropriate unit for admission, as well as the difficulties in determining patient needs.

Serina et al. (23) examined the predictive value of CFS for hospitalization, readmission within nine days, and readmission within 30 days in the ED, and found that higher CFS values were associated with increased hospitalization, and readmission within 30 days. However, the CFS did not indicate a significant predictive value for return visits within nine days (23). In this study, no significant difference in readmission within 30 days was found between frail groups, according to both EFS and CFS. However, as for hospitalization need, no significant difference was found between CFS groups, while hospitalization need was significantly higher in the EFS frail group. The lack of significance in the number of readmissions between groups may be attributed to multifactorial reasons that increase readmissions in both groups, such as deficiencies in the effective use of EDs in the region and attempts to resolve problems in the healthcare system through EDs. In terms of predicting hospitalization need, we believe that EFS may be a better scale than CFS.

Malstrom et al. (24) compared the predictive power of FRAIL, the Study of Osteoporotic Fractures frailty scale, Frailty Index (FI), and Cardiovascular Health Study frailty scale for nine-year mortality in a study conducted with African Americans using in-home assessments and found that the FRAIL and FI scales were stronger predictors. However, comprehensive extant studies evaluating other scores for predicting mortality in EDs and 30-day mortality are limited.

Nowak et al. (25) evaluated EFS, CFS, FRAIL, and Fried scale data on older adults with acute coronary syndrome admitted to a coronary ICU and found high concordance among the scales, but the FRAIL scale had the highest hazard ratio for mortality. EFS was found to be more successful in predicting readmission (25). In this study, no significant

difference in readmission rates was found between CFS and EFS frailty groups. However, this study was conducted among all ED visits without grouping according to specific presenting complaints. The frailty scales' success may vary depending on specific presenting complaints and diagnoses. For 30-day mortality, we found that EFS had an NPV of 95.4%, and CFS had an NPV of 94.1%. We believe that these rates can guide discharge and follow-up decisions in EDs. When comparing the predictive values of CFS and EFS for mortality and composite adverse outcomes, we found no significant difference for both. Therefore, we believe that both scales can be applied easily in EDs. However, the inclusion of more subjective assessments in CFS may lead to variations between studies, while EFS provides more objective results. As more studies are conducted and these scales are used effectively, we anticipate decreases in mortality, reductions in hospital costs, and shorter hospital stays.

Limitations

This study used a single-center study approach, conducted at a tertiary referral hospital in the region; therefore, it may not fully reflect the general population. Due to the wide range of final diagnoses, subgroup analyses based on final diagnoses could not be conducted.

CONCLUSION

In this study, in which we compared predictive values of the EFS and CFS scales for 30-day mortality, ICU admission, readmission, and LOS in EDs, we found that both scales have good predictive value, and no significant difference was found between them. We believe that both scales can be used safely in predicting poor outcomes and identifying frailty in older adults in EDs.

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