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# Validation and Reliability of Edmonton Frail Scale In Community - Dwelling Older Adults in Türkiye

## Edmonton Kırılganlık Ölçeği'nin Türkiye'de Toplumda Yaşayan Yaşlı Yetişkinlerde Geçerlik ve Güvenirliği

**ABSTRACT**

**Objective:**
The purpose of study was to demonstrate the validity and reliability of the Edmonton Frail Scale (EFS) among community-dwelling older adults in Türkiye.

**Material and Methods:**
One hundred and three participants who applied to the geriatrics outpatient clinic of a university hospital were included. The validity of the EFS was tested by its concordance with the Clinical Frailty Scale (CFS).

**Results:**
The median EFS score was 4.0 (IQR: 2.0-7.0), and the median CFS score was 3.0 (IQR: 3.0-4.0). There was substantial concordance between EFS and CFS (Cohen's kappa: 0.715, p<0.001). Furthermore, the EFS inter-rater and retest reliability values were excellent (Cohen's kappa: 0.846, p<0.001; Cohen's kappa: 1.000, p<0.001, respectively). Calculated based on the reference scale, the EFS specificity was 100.0%, and the sensitivity was 62.96%.

**Conclusion:**
The EFS is a valid and reliable scale for assessing frailty in community-dwelling older adults. Its widespread clinical use can help predict adverse health outcomes and enable timely interventions.

**Key Words:**
Aged, Frailty, Geriatric assessment

## ÖZ

### Amaç:
Çalışmada, Edmonton Kırılganlık Ölçeği'nin (EKÖ) Türkiye'de toplumda yaşayan yaşlı yetişkinlerde geçerlik ve güvenirliğinin gösterilmesi amaçlandı.

### Gereç ve Yöntemler:
Bir üniversite hastanesi geriatri polikliniğine başvuran katılımcılar dahil edildi. Edmonton Kırılganlık Ölçeği'nin geçerliği Klinik Kırılganlık Skalası (KKS) ile uyumu ile test edildi.

### Bulgular:
Ortanca EKÖ skoru 4,0 (Çeyrekler arası aralık (ÇAA): 2,0-7,0) ve ortanca KKS skoru 3,0 (ÇAA: 3,0-4,0) idi. Edmonton Kırılganlık Ölçeği ile KKS arasında önemli derecede uyum vardı (Cohen's kappa: 0,715, p<0,001). Edmonton Kırılganlık Ölçeği'nin gözlemciler arası ve test-tekrar test güvenirlikleri mükemmeldi (Cohen's kappa: 0,846, p<0,001; Cohen's kappa: 1,0, p<0,001, sırasıyla). Referans ölçeğe göre hesaplanan değerlerde, EKÖ'nün seçiciliği %100,0, duyarlılığı %62,96 olarak saptandı.

### Sonuç:
Edmonton Kırılganlık Ölçeği, toplumda yaşayan yaşlı yetişkinlerde geçerli ve güvenilirdir. Klinikte yaygın olarak kullanımı olumsuz sağlık sonuçlarının öngörülmesine ve zamanında müdahelelerin yapılmasına yardımcı olabilir.

### Anahtar Kelimeler:
Yaşlı, Kırılganlık, Geriatrik değerlendirme

## INTRODUCTION

As life expectancy continues to increase, more people are experiencing chronic diseases, cognitive impairments, infections, falls, and other age-related issues (1). However, even among people of the same age, their functional status, risk of disability, and life expectancy can differ. The concept of frailty has therefore been developed to more accurately assess and treat patients (2). Frailty is defined as a loss of resources across various functional domains, leading to a decreased ability to store reserves for handling stressors (3). Frailty is related to several negative medical consequences, including hospitalization, longer hospital stays, higher healthcare costs, institutionalization, functional dependence, falls, and mortality (4, 5).

As the population of older people grows, the concept of frailty is becoming increasingly important. Its evaluation in various fields, from primary healthcare to tertiary hospitals, helps predict negative health outcomes (6). Consequently, numerous scales have been developed to assess frailty (7). These scales evaluate components of frailty, such as physical, cognitive, psychological, social, and disease burden, separately or together (8). The Edmonton Frail Scale (EFS) is one such scale that assesses the components of frailty together. The EFS is designed to identify frailty early in older adults and

has great promise in frailty evaluation. It is easy to administer and suitable for performance by all physicians. The EFS comprises nine elements, which query cognition, general health status, functional independence, social support, medication use, nutrition, mood, continuity, and functional performance (9). Validation and reliability studies of the EFS need to be performed cross-culturally (10). Validation studies have been conducted in various countries (11-13). The present study aims to demonstrate the validity and reliability of the EFS among community-dwelling older individuals in Türkiye.

## MATERIAL and METHODS

### Participants

The study included patients who presented to a geriatric medicine outpatient clinic at a university hospital between May 2, 2022, and June 30, 2022. The inclusion criteria were being ≥65 years old, not residing in a nursing home, being able to cooperate with the tests, and willing to participate in the study. Exclusion criteria were being younger than 65, living in a nursing home, not being able to cooperate with the tests, and not agreeing to participate in the study. One hundred and three patients' demographic properties, chronic diseases, comprehensive geriatric assessment (CGA) components, and frailty scale scores were recorded. The CGA included the Katz Index of Activities of Daily Living (ADL), Lawton-Brody Instrumental Activities of Daily Living (IADL), Mini Nutritional Assessment-Short Form (MNA-SF), Mini-Mental State Examination (MMSE), Yesavage Geriatric Depression Scale-15 (GDS), SARC-F, grip strength, gait speed, number of drugs, urinary incontinence, osteoporosis, and fall history. Multimorbidity was defined as the coexistence of two or more chronic diseases (14). Polypharmacy was defined as the regular use of five or more drugs, which is one of the common definitions (15). To perform the frailty screening scales, the necessary medical, social, psychological, and cognitive data were collected. The Non-interventional Clinical Researches Ethics board of Hacettepe University Faculty of Medicine approved the study protocol. The approval number was GO/22/457. The principles of the Declaration of Helsinki have been complied with. All participants supplied their informed consent.

### Study Tool

The EFS was developed by the University of Alberta in Edmonton, Canada, and its validity and reliability were demonstrated in 2006 (9). It is designed to identify frailty in older adults and is a potentially useful screening tool that can be used by non-geriatricians. There are nine domains in the EFS, and the score ranges from 0 to 17 points. Scores of 0-4 are considered not frail, 5-6 points indicate apparent vulnerability, 7-8 points suggest mild frailty, 9-10 points indicate moderate frailty, and 11 or more points indicate severe frailty. Two of the domains are scored based on performance: the clock drawing test for cognitive function assessment and the timed get up and go test for balance and mobility. Scoring for the clock drawing test is 0 for no errors, 1 for minor spacing errors, and 2 for other errors. Scoring for the timed up and go test is 0 for a 0-10 second interval, 1 for an 11-20 second interval, and 2 for more than 20 seconds. General health sta-

tus is evaluated based on the number of times the patient has been hospitalized in the last year and the patient's subjective opinion of their health. A minimum of 0 and a maximum of 2 points are awarded for both subdomains. Functional independence is scored according to the Lawton-Brody IADL. It is evaluated as 0 points if there is a loss of 0 or 1 function, 1 point if there is a loss of 2-4 functions, and 2 points if there is a loss of 5-8 functions. Social support is evaluated with the question "When you need help, can you count on someone who is willing and able to meet your needs?" Always gets 0 points, sometimes gets 1 point, and never gets 2 points.

Evaluation of drugs is made with two questions. The first question asks how many regular medications the patient uses, and if there are five or more, 1 point is taken. The second question is whether the patient forgets to take medication from time to time, and a yes answer is 1 point. Nutritional status is evaluated with the question "Have you recently lost weight such that your clothing has become looser?" A yes answer is 1 point. In the mood evaluation, the question "Do you often feel sad or depressed?" is used, and a yes answer is 1 point. Finally, the continence status is questioned, and the presence of urinary incontinence is 1 point. Eleven patients were retested two weeks later for retest reliability, and the EFS was repeated by the same physician (performed by Serdar Ceylan). Eleven patients, for inter-rater reliability, EFS was reapplied by a second physician in another room immediately after the first physician performed the EFS.

## Translation

The recommendations of the ISPOR Task Force were followed during the translation and cultural adaptation process (16). Native Turkish speakers who were experts in translation and could speak English fluently translated the EFS from English to Turkish to validate the language. The Turkish translation was accepted by all authors. After the translation check was completed, the Turkish version of the test was translated back into English by two academics who were native English speakers and who had no knowledge of the original version. The "forward-backward" translation technique was used to verify the language. Finally, physicians (Serdar Ceylan, Merve Guner, Arzu Okyar Bas) performed the test on community-dwelling older adults to assess cultural adaptation.

## Reference Tool

The Clinical Frailty Scale (CFS) was chosen as the reference tool. It was developed by Rockwood et al. with patients participating in the Canadian Study of Health and Aging (17). The CFS is based on clinical judgment by the physician and assigns a score between one and nine based on activity, function, and disability. It can be applied without the need for any tools or laboratory tests and can be used by all physicians and other health personnel due to its easy and fast-performing features. Scores between 1-4 are defined as 'robust/vulnerable,' while patients who score ≥5 are categorized as 'living with frailty' (17). Turkish validity and reliability of the CFS has been proven by Ozsurekci et al. (18).

## Statistical Analysis

Statistical Package for the Social Sciences 24.0 was used to conduct the statistical analysis. According to the normal distribution situation, numerical data were expressed as mean and standard deviation or median and interquartile range, while categorical variables were expressed as numbers and percentages. As the reference method for assessing the construct validity of the EFS, the CFS was adopted. Cohen's Kappa was operated to appraise the assessment agreement between categories. The CFS was classified as robust/vulnerable and frail. Cohen's kappa was also applied to explore inter-rater and retest reliabilities. Sensitivity, selectivity, positive and negative predictive values were counted up. P-value of <0.05 was considered as statistically significant.

The sample size was estimated using two rater kappa statistics (19) with 90% power to identify the right kappa when two categories according to the CFS robust/vulnerable and frail frequencies in Türkiye were 0.64 and 0.36 respectively (18). The significance value was accepted as 0.05.

## RESULTS

The median age of 103 participants was 72.0 (IQR: 67.3-77.8). Of the patients, 65 (63.1%) were female, and 23 (22.3%) were illiterate. Additionally, 38.9% (n=38) of the patients were not married, and 38 (36.9%) patients had a history of smoking (active or ex-smoker). Moreover, 72 (69.9%) patients had multimorbidity. Table I provides information on demographic characteristics and chronic diseases.

**Table I:** Demographic and Clinical Characteristics of Patients

| | N=103 (n,%) |
|---|---|
| Demographics | |
| Age (median, IQR) | 72.0 (67.3-77.8) |
| Sex (female) | 65 (63.1) |
| Illiterate | 23 (22.3) |
| Marital Status (not married) | 38 (36.9) |
| BMI (mean, SD) | 30.17 ± 5.69 |
| Smoking | 38 (36.9) |
| Chronic Diseases | |
| Diabetes Mellitus | 50 (48.5) |
| Hypertension | 73 (70.9) |
| Coronary Artery Disease | 19 (18.4) |
| Congestive Heart Failure | 7 (6.8) |
| Atrial Fibrillation | 12 (11.7) |
| Cerebrovascular Event | 10 (9.7) |
| Chronic Kidney Disease | 4 (3.9) |
| Chronic Obstructive Pulmonary Disease-Asthma | 10 (9.7) |
| Malignancy | 11 (10.7) |
| Hypothyroidism | 10 (9.7) |
| Multimorbidity ≥2 | 72 (69.9) |
| Comprehensive Geriatric Assessment- Geriatric Syndromes | |
| Dementia | 4 (3.9) |
| Depression | 32 (31.1) |
| Osteoporosis | 25 (24.3) |
| Falls | 23 (22.3) |
| Polypharmacy | 55 (53.4) |
| Urinary Incontinence | 42 (40.8) |
| Katz Index of Independence in Activities of Daily Living (median, IQR) | 6.0 (5.0-6.0) |
| Lawton-Brody Instrumental Activities of Daily Living Scale (median, IQR) | 8.0 (8.0-8.0) |
| Mini Nutritional Assessment-Short Form (median, IQR) | 13.5 (10.3-14.0) |
| Mini-mental State Exam (median, IQR) | 28.0 (25.0-29.0) |
| Yesavage Geriatric Depression Scale (median, IQR) | 2.0 (0.0-6.0) |
| SARC-F (median, IQR) | 1.0 (0.0-3.0) |
| Grip strength (kg) (mean, SD) | For females:17.97±5.02, for males:27.39±7.41 |
| Gait speed (m/sn) (mean, SD) | 0.94±0.35 |
| Edmonton Frail Scale (median, IQR) | 4.0 (2.0-7.0) |
| Clinical Frailty Scale (median, IQR) | 3.0 (3.0-4.0) |

N: Number, IQR: Interquartile Range, SD: Standart Deviation

Regarding the components of CGA, 4 (3.9%) patients had dementia, and 32 (31.1%) patients had depression. Additionally, 24.3% (n=25) of the patients had osteoporosis, 22.3% (n=23) had a history of falling, 53.4% (n=55) had polypharmacy, and 40.8% (n=42) had urinary incontinence. The Katz ADL median was 6.0 (IQR: 5.0-6.0), while the Lawton-Brody IADL median was 8.0 (IQR: 8.0-8.0). The MNA-SF median was 13.5 (IQR: 10.3-14.0), the MMSE median was 28.0 (IQR: 25.0-29.0), and the Yesavage GDS median was 2.0 (IQR: 2.0-6.0). The SARC-F median was 1.0 (IQR: 0.0-3.0). The mean grip strength was 17.97±5.02 kg for females and 27.39±7.41 kg for males. The mean gait speed was 0.94±0.35 m/sec. The median EFS score was 4.0 (IQR: 2.0-7.0), and the median CFS score was 3.0 (IQR: 3.0-4.0) (Table I), indicating frailty levels. There was substantial concordance between EFS and CFS (Cohen's kappa: 0.715, p<0.001). Furthermore, the EFS inter-rater and retest reliability values were excellent (Cohen's kappa: 0.846, p<0.001; Cohen's kappa: 1.000, p<0.001, respectively) (Table II). Calculated based on the reference scale, the EFS specificity was 100.0%, and the sensitivity was 62.96%. The negative likelihood ratio was 0.37, the positive predictive value was 100.0%, and the negative predictive value was 88.37% (Table III). The CGA components were statistically significantly correlated with the total EFS score. The correlations between the total EFS score, EFS domains and the components of CGA were indicated in Table IV.

**Table II.** Edmonton Frail Scale and Reference Test Concordance Results

|  |  | Edmonton Frail Scale | | Kappa | Approximate Significance |
|---|---|---|---|---|---|
|  |  | No Frail/ Apparently Vulnerable | Frail |  |  |
|  |  |  |  | 0.715 | <0.001 |
| Clinical Frailty Scale | Robust/Vulnerable | 76 (88.4) | 0 (0.0) |  |  |
|  | Frail | 10 (11.6) | 17 (100.0) |  |  |
| Inter-rater reliability | | - | - | 0.846 | <0.001 |
| Retest reliability | | - | - | 1.000 | <0.001 |

**Table III.** Diagnostic Test Evaluation of Edmonton Frail Scale

|  | Edmonton Frail Scale |
|---|---|
| Specificity (%) | 100.0 |
| Sensitivity (%) | 62.96 |
| Positive Predictive Value (%) | 100.0 |
| Negative Predictive Value (%) | 88.37 |
| Positive Likelihood Ratio | - |
| Negative Likelihood Ratio | 0.37 |

**Table IV.** Correlation of Edmonton Frail Scale with Components of Comprehensive Geriatric Assessment

|  | Cognition | General Health Status-1 | General Health Status-2 | Functional Independence | Social Support | Medication Use-1 | Medicatioon Use-2 | Nutrition | Mood | Continence | Funcitonal Performance | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Katz Index of Independence in Activities of Daily Living | -0.22* | -0.17 | -0.26** | -0.42** | -0.06 | -0.23* | 0.02 | -0.11 | -0.08 | -0.46** | -0.46** | -0.47** |
| Lawton-Brody Instrumental Activities of Daily Living Scale | -0.21* | -0.15 | -0.39** | -0.68** | -0.02 | -0.25* | -0.32** | -0.17 | -0.22* | -0.06 | -0.39** | -0.50** |
| Mini Nutritional Assessment-Short Form | -0.22* | -0.25* | -0.45** | -0.39** | 0.02 | -0.13 | -0.14 | -0.59** | 0.32** | -0.10 | -0.35** | -0.55** |
| Mini-mental State Exam | -0.61** | -0.05 | -0.30** | -0.34** | -0.26** | -0.15 | -0.17 | -0.07 | -0.12 | -0.26 | -0.35** | -0.55** |
| Yesavage Geriatric Depression Scale | 0.31** | 0.07 | 0.52** | 0.21* | -0.20 | 0.02 | 0.14 | 0.30** | 0.68** | 0.37** | -0.26** | 0.57** |
| SARC-F | 0.20* | 0.42** | 0.40** | 0.52** | 0.05 | 0.16 | 0.26 | 0.27** | 0.24* | 0.12 | 0.47** | 0.56** |
| Grip strength | -0.23* | -0.15 | -0.41** | -0.42** | 0.04 | -0.20* | -0.21* | -0.18 | -0.23* | -0.10 | -0.40** | -0.48** |
| Gait speed | 0.25* | 0.27** | 0.38** | 0.48** | -0.002 | 0.33** | 0.08 | 0.21* | 0.15 | 0.18 | 0.75** | 0.58** |

## DISCUSSION

The present study aimed to assess the validity and reliability of the EFS in community-dwelling older adults in Türkiye. The study found substantial agreement between the EFS and the CFS, which was used as a reference scale, indicating that the EFS is a valid and reliable tool in this population. Excellence in inter-rater and retest reliability also supports the use of EFS in the geriatric Turkish population.

Frailty is a common condition in older adults, and its prevalence varies depending on the frailty model and scale used. A review study published in 2012 reported a global frailty prevalence of 10.7% (20). The prevalence of frailty also varies depending on the model and scale used. In a review study that examined data from 62 countries, the prevalence of frailty was 12% according to the physical frailty model and 24% according to the deficit accumulation model (21). The frailty ratio also varies depending on the frailty scale used. Previous studies using different physical frailty scales have reported frailty ratios ranging from 1.0% to 7.0% (22). Frailty ratios in prior studies with EFS ranged from 11.8 to 36.2% (23-25). In the present study, the frailty ratio with the EFS was 25.2%. These varying proportions can be attributed to the characteristics of the study population and the setting in which the study was conducted (inpatient ward, outpatient clinic, acute care ward, nursing home, etc.).

Frailty is a critical concept that should be assessed at every stage of healthcare. Treatment should be tailored to the patient's frailty, and treatment goals should evolve accordingly (26). The CGA is the gold standard for evaluating frailty, but it is time-consuming and not feasible for healthcare providers other than geriatricians to implement (27). Therefore, there is a need for practical, short, and easy-to-use screening scales that can be used by all physicians to evaluate frailty. Many frailty screening scales have been developed for this purpose, including the EFS (28).

The EFS was developed by Rolfson et al. in 2006 and includes patients from acute care wards, rehabilitation units, day hospitals, and outpatient clinics (9). It takes less than five minutes to complete and does not require special equipment. The clock drawing test and timed up and go test are used to evaluate specific domains, while the healthcare personnel ask questions to the patient to evaluate other domains. The scoring is based on the presence or absence of the situation described in the questions, and the timed up and go test is scored based on the test completion time (9, 28). The multi-dimensional evaluation of EFS allows for the identification of frailty at an earlier stage and the implementation of preventive measures. Frailty detected by EFS is associated with adverse health outcomes such as morbidity, mortality, longer length of hospital stay, and unfavorable postoperative outcomes (29-31).

It is crucial to validate EFS in various populations and languages since it is easy to apply by all physicians and competent in predicting adverse health outcomes. While its Turkish validity and reliability was performed with geriatric patients living in nursing homes, its Turkish validity and reliability has not yet been demonstrated in older adults living in the community (23). The present study has found that EFS is a valid

and reliable tool in the community-dwelling Turkish older adult population. Frailty is a complex, dynamic process that encompasses physical, cognitive, social, and psychological components (32, 33). However, most frailty assessment tools do not comprehensively evaluate all of these aspects. The EFS is a multidimensional scale that assesses frailty in various domains, including physical, cognitive, social, psychological, general health status, nutrition, and polypharmacy (9). Similarly, the reference scale CFS evaluates frailty across different dimensions, such as disease symptoms, function, and cognition (17). In this study, it is important to consider these comprehensive scales as references for evaluating the validity and reliability of the EFS.

As the population of older adults in Türkiye continues to grow, the prevalence of frailty is also increasing. According to the FrailTURK project, which used the FRIED frailty index and included 1126 patients, 39.2% of older adults were living with frailty (34). Other studies in Türkiye have reported frailty rates ranging from 6.5% to 41.2% (35-38). Given the longer life expectancy, high illiteracy rate, poor socioeconomic level, and rise in multimorbidities in Türkiye, the number of older adults living with frailty is likely to increase. Therefore, it is crucial to validate frailty assessment tools in the Turkish population to identify frailty and take early action. The validation of the EFS in community-dwelling older adults, which can be easily applied by all physicians, is particularly important.

## CONCLUSION

The EFS is a valid and reliable scale for assessing frailty in Turkish community-dwelling older adults. Its widespread clinical use can help predict adverse health outcomes and enable timely interventions.

### Ethical Approval

### Author Contributions

Concept: S.C., C.B.; Design: S.C., C.B.; Supervision: B.B.D., M.G.H., M.C.; Data Collection and/or Processing: S.C., M.G., A.O.B.; Analysis and/or Interpretation: S.C., M.G., A.O.B.; Literature Research: S.C., M.G., A.O.B., C.B.; Writing Manuscript: S.C., C.B.; Critical Review: B.B.D., M.G.H, M.C., C.B.

### Conflict of Interest

### Financial Disclosure

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