



RESEARCH

THE ROLE OF FRAILTY IN PHYSICIANS' DECISIONS FOR SEVERE DISABILITY

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ABSTRACT

Introduction: We aimed to evaluate the correlation between disability approved by the medical board and frailty determined by the Edmonton Frail Scale, which is a tool used to assess frailty.

Materials and Method: We enrolled patients admitted to the neurology outpatient clinic of the Bursa Yuksek Ihtisas Training and Research Hospital between 1st-31st March 2019 for examination in order to obtain a disability report from the medical board.

Results: Cerebrovascular disease and dementia were more prevalent in older age, while epilepsy, cerebral palsy sequela and other neurological diseases were observed at a younger age. A strong correlation was observed between frailty analysis score and Balthazard disability percentage ($p < 0,001$, $r = 0,57$). Similarly, there was a correlation between the physicians' severe disability opinion and the Edmonton Frail index score. Scores for cognition, general health status, functional independence, frequency of forgetting to take prescription drugs, or indications of recent weight loss were higher for patients in the severe disability group who also had higher EFS scores. We found that EFS scores >8 correlate significantly with an increased risk of severe disability.

Conclusion: We conclude that use of the frailty analysis score in combination with Balthazard disability percentage for patients applying to the medical board could be practical and rational in evaluating the degree of disability and predicting severe disability. Since only patients who applied for medical board evaluation to the neurology clinic were included in our study, our results are relevant for neurology cases and cannot be generalized for all patients who applied for evaluation.

Keywords: Frailty; Social Support; Disability Evaluation; Frail Elderly; Cerebrovascular Disorders



INTRODUCTION

A disabled person is defined as an "individual affected by environmental aspects and attitudes restricting his/her total and effective integration in society in equal conditions with other individuals due to various levels of loss in his/her physical, mental, spiritual and sensorial abilities" (1).

The "World Report on Disability," published in 2011, stated that 15.6% of the world's adult population (aged 18 and over) suffer from a disability. According to the "Turkey Disabled Research 2002" report, conducted by the Prime Ministry's State Institute of Statistics and the Prime Ministry Department for the Administration of the Disable, found that 12.29% of the Turkish population had some form of disability (2,3).

Living standards for disabled citizens and the quality of service provided to these individuals are two important indicators of a country's level of development. In Turkey, disabled persons can be admitted to a health care provider who is authorized

to certify an annual disability report, which allows that individual to request a medical board report that is needed for claiming social benefits such as financial support, disability allowance, employment, education, disability retirement, and tax reductions. Those who receive medical board approval are evaluated by specialists in physical medicine and rehabilitation, internal medicine, ophthalmology, otorhinolaryngology, general surgery, neurology, and mental health, and their disability status is graded using the percentage scale (from zero to 100), according to disability rates tables. These regulations categorize individuals who are unable to fulfil their daily needs even if they receive help as severely disabled (or "fully dependent disabled") (1). Patients who are considered severely disabled ("fully dependent disability") are presented to the physicians on the committee.

Frailty is defined as a state of increased vulnerability to stress factors as a result of age-related decreases in physiological abilities (4). As frailty levels

Table 1. Distribution of chronic diseases by gender

Chronic Disease	Female (n=44)	Male (n=46)	p-value
Cerebrovascular Disease	18(40.90%)	15(32.60%)	0.414 ^a
Epilepsy	5(11.40%)	9(19.60%)	0.283 ^a
Dementia	12(27.30%)	6(13%)	0.092 ^a
Parkinson Disease	1(2.30%)	1(2.20%)	1.00 ^b
Cerebral Palsy Sequel	2(4.50%)	2(4.30%)	1.00 ^b
Other Neurologic Disease	11(25%)	14(30.40%)	0.565 ^a
Neuropathic Pain	5(11.40%)	7(15.20%)	0.591 ^a
Hypertension	10(22.70%)	14(30.40%)	0.408 ^a
Diabetes Mellitus	8(18.20%)	9(19.60%)	0.867 ^a
Cardiac Disease	8(18.20%)	11(23.90%)	0.505 ^a
Orthopedic Diseases	2(4.50%)	1(2.20%)	0.612 ^b
Eye Diseases	3(6.80%)	1(2.20%)	0.355 ^b
Psychiatric Diseases	5(11.40%)	4(8.70%)	0.737 ^b
Other Diseases	18(40.90%)	15(32.60%)	0.414 ^a

Data expressed as n (%), ^a: Pearson chi-square test, ^b: Fisher's exact chi-square test

Note: More than one disease may occur in the same patient.

Table 2. Chronic disease and age correlation

Chronic Disease	n with the disease/ free from the disease	Positive	Negative	p-value ^c
CVD	33/57	68(44-89)	58(22-90)	0.003
Epilepsy	14/76	40(22-78)	65(24-90)	<0.001
Dementia	18/72	83(37-90)	58.50(22-89)	<0.001
Parkinson Disease	2*/88	60.50(37-84)	63(22-90)	NA
Cerebral Palsy Sequel	4/86	31.50(22-37)	63.50(24-90)	<0.001
Other Neurologic Diseases	25/65	52(24-84)	66(22-90)	0.002
Neuropathic Pain	12/78	59(31-70)	64(22-90)	0.288
Hypertension	24/66	65(42-88)	62(22-90)	0.273
Diabetes Mellitus	17/73	63(48-84)	63(22-90)	0.351
Cardiac Disease	19/71	66(58-89)	59(22-90)	0.011
Orthopedic Diseases	3*/87	65(58-81)	63(22-90)	NA
Eye Diseases	4/86	73(36-84)	62.50(22-90)	0.478
Psychiatric Diseases	9/81	46(37-83)	63(22-90)	0.208
Other Diseases	33/57	62(24-90)	63(22-89)	0.947

For each chronic disease the data in the upper row is median age (minimum -maximum), n is the number of subjects having the disease /free from the disease.

*: Unit number in the group not enough for statistical analysis. ^c: Mann Whitney U test

Note: More than one disease may occur in the same patient.

increase with more exposure to stress factors, so too does the risk of hospitalization, falls, delirium, mortality, and morbidity (5,6). Frailty has become a more pressing issue as the world population continues to age, with levels of frailty between 4 and 59.1% having been reported (7). The prevalence of frailty among patients admitted to outpatient clinics in developing countries is particularly high, at 55 to 71% in Brazil and 28% in Peru (8). In Turkey, this rate is 39.2% (9).

There is no existing literature that applies the Edmonton Frail Scale (EFS)—which is used to assess frailty—to patients who are admitted to a medical board for disability evaluation in order to determine whether frailty levels can be used to predict approved disability status. The aim of this study is to evaluate the correlation between disability approval by a medical board in Turkey and frailty as detected by the EFS.

METHODS

Patients with a neurological disability who applied to the institutional health board of Bursa Yuksek Ihtisas Training and Research Hospital for the purpose of obtaining a disability report between the 1st and 31st March 2019, and had been admitted to the neurology outpatient clinic for examination, were included in the study. Patients under the age of 18, those who applied to obtain a medical committee report for job application, driver's license, gun license, rest report and status reports were excluded from the study.

For each patient, we recorded age, gender, diagnosis, comorbidity, disability rates, and severe disability status. Patients were also evaluated using the EFS. The patients' disability statuses, which were being presented to the medical board for evaluation, were calculated using the Balthazard formula, after they had been assessed by specialists from each of the divisions listed above. The Baltha-

**Table 3.** Relationship between Balthazard Disability Percentage and Edmonton Frail score

Edmonton Frail Scale		Disability Percentage (%)	
		Median (min: max)	p-value
Medication use 1	Yes(n=38)	67(36-89)	0.034 ^c
	No(n=52)	57.50(22-90)	
Medication use 2	Yes(n=48)	72.50(22-90)	0.010 ^c
	No(n=42)	53.50(24-78)	
Nutrition	Yes(n=22)	73.50(30-90)	0.003 ^c
	No(n=68)	59.50(22-89)	
Mood	Yes(n=69)	64(24-90)	0.017 ^c
	No(n=21)	52(22-89)	
Continence	Yes(n=46)	71(30-90)	<0.001 ^c
	No(n=44)	56(22-83)	
Edmonton Frail Scale		Disability Percentage(%)	
		r _s	p-value
Cognition		0.49	<0.001
General health status 1		0.20	0.056
General health status 2		0.47	<0.001
Functional independence		0.53	<0.001
Social support		0.05	0.661
Functional performance		0.55	<0.001
Frailty analysis score		0.57	<0.001

Data is given as median(minimum: maximum). ^c: Mann Whitney U test

r_s: Spearman correlation coefficient

Medication use 1: Do you regularly use 5 or more different drugs?

Medication use 2: Do you forget to take your prescription medicines from time to time?

General Health 1: How many times were you hospitalized last year?

General Health 2: How would you describe your health in general?

zard formula is used to calculate degree of impairment for individuals with more than one disability (1). The EFS is a simple test that was developed by Rolfson et al. at the University of Alberta in Canada, consisting of 11 questions and a physical assessment (10). Turkish validity and reliability studies for the EFS were conducted by Aygor et al. (11). Our scale for this study consisted of 11 questions covering nine items: cognitive status, general health status, functional independency, social support, med-

ication usage, nutrition, mood, continence, and functional performance. All items were assessed with one question, except general health status and medication usage, which used two questions. Cognitive status and functional performance were tested using the EFS; the timed-up-and-go test (TUGT) was used to assess functional performance; and the clock-drawing test was used to assess cognitive status (10). The EFS test is scored between 0-17, with the following categories: 0-4 – not frail; 5-8 – vulner-

Table 4. Relationship between frailty total and sub-group scores and severe disability status

Edmonton Frail Scale	Severe Disability		p-value
	Yes (n=33)	No (n=57)	
Cognition	2(0-2)	1(0-2)	<0.001 ^c
General Health 1	0(0-1)	0(0-2)	0.088 ^c
General Health 2	2(1-2)	1(1-2)	<0.001 ^c
Functional independence	2(1-2)	1(0-2)	<0.001 ^c
Social support	0(0-2)	0(0-2)	0.314 ^c
Medication use 1	15(45.50%)	23(40.40%)	0.637 ^a
Medication use 2	25(75.80%)	23(40.40%)	0.001 ^a
Nutrition	14(42.40%)	8(14%)	0.003 ^a
Mood	27(81.80%)	42(73.70%)	0.379 ^a
Continence	28(84.80%)	18(31.60%)	<0.001 ^a
Functional performance	2(0-2)	0(0-2)	<0.001 ^c
Frailty Score	11(5-14)	6(1-13)	<0.001 ^c

Data given as median (minimum: maximum) and n(%).

^a: Pearson chi-square test, ^c: Mann Whitney U test

able; 7-8 – mild frailty; 9-10 – moderate frailty; and 11 and above – severe Frailty.

Assessment of disability rates for all patients were conducted as per the guidelines in the “Regulation on Disability Assessment for Adults,” published in Official Gazette No.30692 on February 20, 2019. Approval for the study was received from the Bursa Yuksek Ihtisas Training and Research Hospital Ethics Committee (2011-KAEK-25 2019/02-21).

Statistical analysis

Based on the findings of this study, we conducted a post hoc power analysis using a large effect size, which was calculated by comparing the average EFS scores between severe disability status groups. Using an effect size of ($d=1.56$) with a sample size of 90 ($n_1=57$, $n_2=33$), we achieved an estimated power of 95% with a significance level of $\alpha=0.05$. A Kolmogorov-Smirnov test was used to assess whether the variables followed a normal distribution. Variables were reported as median (minimum: maximum) values. Based on the normality test results, a Mann Whitney U test was used to perform between-group

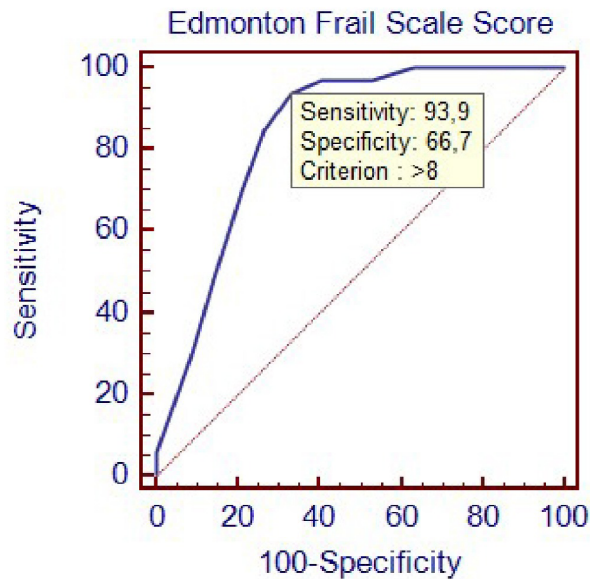
comparisons. Categorical variables were compared using a Chi-square test or a Fisher’s exact test. In order to estimate the sensitivity and specificity of EFS score values in predicting severe disability status, a receiver operator characteristic (ROC) curve analysis was performed. The reliability of the EFS was assessed using Cronbach’s alpha (α) coefficient; the reliability of the EFS was determined as $\alpha=0.83$. We used SPSS (IBM Corp., released 2015. IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY) and MedCalc Statistical Software, trial version 16.4.3 (MedCalc Software bvba, Ostend, Belgium; <https://www.medcalc.org>; 2016) were used. A p-value of <0.05 was considered statistically significant.

RESULTS

Ninety people participated in the study. A total of 44 (48.8%) participants were female and 46 (51.1%) were male. The mean age of the participants was 60.5 ± 18.3 (min-max: 22-90) years. The median Edmonton Frail Scale (EFS) score was 9 (1-14). The median disability rate of the whole group was 87.5%



Figure 1. Receiver-operator characteristic (ROC) curves for determining the presence of severe disability. The area under the curve (AUC) for Edmonton Frail Scale Score is 0.84 with $p < 0.001$.



(26–100%). In our study, cerebrovascular diseases (36.6%), dementia (20%), and epilepsy (15.5%) were among the most frequent causes of neurological disability. No statistical difference was observed between genders for cerebrovascular disease, epilepsy, or Parkinson's disease patients. Although dementia was more common among women, no statistically significant difference was observed ($p > 0.05$). Distribution of chronic diseases by gender is shown in Table 1.

Table 2 shows that the median age for those with cerebrovascular disease or dementia was higher. Epilepsy was more common in younger participants, but cerebral palsy patients were on average the youngest. Correlation between chronic diseases and age are shown in Table 2.

Disability percentages were higher for patients who regularly used five or more different medications, as well as for those who forgot to take their prescription drugs, those who indicated that they had lost weight recently, those who frequently felt

upset or depressed, and those who suffered from involuntary urination. An increase in disability percentages was detected in patients who had higher scores for cognition, general health status (based on the question, "In general, how would you describe your health?"), and functional independence. A significant parallel correlation was found between disability percentages and EFS score. The relationship between the Balthazard disability percentages and EFS scores is shown in Table 3.

Scores for cognition, general health status, functional independence, rates of forgetting to take prescription drugs, or indications of recent weight loss were higher for patients in the severe disability group; EFS scores were also higher for this group. The correlations between EFS scores and committee-certified disability status certified are included in Table 4.

A ROC curve analysis was performed to estimate the sensitivity and specificity of EFS scores in predicting the presence of severe disability, with a

cut-off point for EFS scores being set at >8 (see Figure 1). The area under the curve for the EFS score was 0.84 (sensitivity: 93.90%; specificity: 66.70%; $p < 0.001$), indicating that EFS scores >8 correlate significantly with an increased risk of severe disability.

DISCUSSION

The power of the research was calculated as 95%. While cerebrovascular disease and dementia were more common in older participants, epilepsy, cerebral palsy, and other neurological diseases were observed in younger patients. A strong correlation was observed between EFS score and Balthazard disability percentage; there was also a correlation between physicians rating a patient as severely disabled and EFS index score.

There are not many studies on neurological disability in our country. One of the few, conducted by Çabalar et al. (12), reported that 10.87% of patients admitted to a medical board for evaluation were judged to be disabled because of their suffering from a neurological disease. Another study by Benli Ar et al. (13) reported a figure of 22.3% for the same class of patients.

According to this research by Çabalar et al. (12), the highest mean age of any group admitted to the medical board with neurological disorders was for the group of dementia and Parkinson's disease patients. In our study, the highest mean age was for dementia patients, while the second highest was for cerebrovascular disease. Epilepsy was more common for younger patients, while the youngest admitted patients were those with cerebral palsy. The diseases that most often caused neurological disability were cerebrovascular diseases, dementia, and epilepsy, according to the studies by Çabalar et al. (12) and Evlice et al. (14). Similarly, we observed that the most common neurological diseases among patients admitted to the medical evaluation board were cerebrovascular diseases, dementia, and epilepsy.

Çabalar et al. (12) found that 56.2% of the neurologically disabled patients admitted to the medical board were male and 43.8% were female; Evlice et al. (14) found that 66% of neurological patients were men and 34% were women. In our study, however, 46 (51.1%) of the participants were male and 44 (48.85%) were female. We observed no statistical difference between genders for cerebrovascular disease, epilepsy, and Parkinson's disease patients. Although dementia was more prevalent among women, no statistically significant difference was detected.

There are several studies in existing literature that analyze the correlation between frailty and disability, with one study demonstrating a notable correlation between frailty and disability in farmers over 65 years of age who live in rural areas (15). It has also been observed that frailty and disability rates are higher in older adults with anorexia of aging than in those without anorexia of aging (16).

Studies have also shown that frailty is an independent risk factor for injury, complications, and mortality among surgical patients: Pre-operational frailty assessments have predicted complications and mortality following cardiac and abdominal operation (17-19), while frailty has also been associated with higher mortality in lung and kidney transplant candidates and during the liver transplant waiting period (20-22). In addition, frailty has been shown to be a strong prognostic factor for mortality in elderly patients admitted for acute coronary syndrome and is associated with lower survival rates in colorectal carcinoma patients (23,24).

In Turkey, documented severe disability is one criterion for receiving social support. Severe disability in patients ("fully dependent disabled" persons) is presented to a committee of physicians, who provide an opinion on disability status, with the possibility of different physicians having diverging opinions. We observed that patients with a frailty scale score >8 were more frequently certified as severely disabled, in line with Balthazard disability percentage assessments. This study also found



strong correlation between EFS scores and Balthazard disability percentages and a correlation between physicians' opinion of severe disability status and EFS index scores. Since the EFS is an easy and fast scale that can be applied by the nurse working with the physician in outpatient clinics, it may ease physicians' decision making process for severe disability.

To date, no studies have used the EFS to predict how a patient admitted to a medical board for disability status approval will be assessed. As the first study in the field to do so, this research study is valuable. A limitation of this study was that only one month of medical board data was analyzed. More valuable results could be obtained from long-term

data analysis. We consider the strength of our research to be evident in its power analysis. Another important issue is that we conducted our study on patients who applied to the neurology outpatient clinic for evaluation by the health board. Therefore, our results are acceptable for neurology cases and cannot be generalized for all patients applying for health board evaluation.

In conclusion, we believe that the EFS, in combination with the Balthazard disability percentage assessment, could be a practical and rational method of assessing degree of disability and predicting severe disability status for patients whose disability status is being evaluated by a medical board.

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