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Which Frailty Scale Predicts 4-Year Mortality in Community-Dwelling Turkish Elderly Better: The FRAIL Scale or the Fried Frailty Index?

ORIGINAL ARTICLE

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ABSTRACT

Objective: Frailty is a prevalent geriatric syndrome that can indicate mortality in the elderly. The aim of this study was to determine if there was an association between frailty and 4-year mortality in the community-dwelling Turkish older people.

Materials and Methods: The Fried Frailty Index (FFI) and FRAIL scale data from the Kayseri Elderly Health Study were used. Univariate and multivariate analyses were conducted to determine the association between frailty and mortality, as assessed by the FFI and FRAIL scales.

Results: The 4-year mortality frequency was found at 7.2% (n=65/905).The gender-specific mortality was 2.4% (n=22) in females and 4.8% (n=43) in males. The frequency of mortality in the elderly aged ≥75 years was 12.8% (n=34/265), and in those aged 60–74 years, it was 4.8% (n=31/640). The frequency of mortality in the frail, pre-frail, and non-frail older people was 57.4%, 25.9%, and 16.7%, respectively, for the FFI. The corresponding frequency of mortality for the FRAIL scale was 20.6%, 54.0%, and 25.4%, respectively. In a multivariate analysis, male gender (OR 2.67, 95% confidence interval [CI] 1.43–4.96) and being frail (OR 5.34, 95%CI 2.45–11.67) were significantly associated with 4-year mortality according to the FFI.

Conclusion: Both the FFI and FRAIL scales may be significant predictors of 4-year mortality in the sample. However, the FFI may be considered as the strongest predictor for 4-year mortality, primarily in male gender.

Keywords: Frailty, mortality, older people, community-dwelling

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INTRODUCTION

Turkey's population, like that of most developing countries, is aging. The elderly population in Turkey was greater than 6.9 million in 2017, and it constitutes approximately 8.3% of the general Turkish population. In 2013, the elderly made up 7.3% of the population in Kayseri/Turkey (which was the year of our sampling). According to population projections, the proportion of the elderly in 2023 is expected to be 10.2% of the general population (1).

Frailty is a common clinical syndrome in which vulnerability to poor health outcomes such as disability, falls, institutionalization, and mortality is increased (2, 3). Frailty prevalence in the community-dwelling elderly is reported to be 4.0%–59.1% in Europe, 21%–44% in Russia, 5%–31% in China, 15% in Mexico, and 17%–31% in Brazil (4, 5). In our study published in 2014, the frailty prevalence in Kayseri/Turkey was determined as 27.1% and 10.0%, respectively (6). In this study, the FFI and FRAIL scales were used to assess frailty. The FFI determines frailty in five sub-domains: weight loss, exhaustion, low energy expenditure, slowness, and weakness (7). The FRAIL scale was initially developed in 2008 by the Geriatric Advisory Panel of the International Academy of Nutrition and Aging (FRAIL: Fatigue, Resistance, Ambulation, Illness, Low Weight) (8).

Frailty is a significant determinant of mortality in the elderly. To the best of our knowledge, there are no data showing the relationship between frailty and mortality in the community-dwelling Turkish older people. Numerous valid and reliable scales are available to assess frailty in the elderly, independently from the causative effects. We designed this study to determine the discriminative power of two frequently used scales, namely the FFI and FRAIL scale, to assess their effectiveness in predicting mortality in the Turkish community-dwelling older people.

MATERIALS and METHODS

The data of the community-dwelling older people (n=905) who were included in this study were drawn from the Kayseri Elderly Health Study (KEHES). The study group from 2013 was assessed again in 2017 for mortality. The KEHES was a cross-sectional study in which 1% of the community-dwelling older people (89,303) living in a city with a population of 1,200,000 were included. The recruitment of community-dwelling older people took place

between August and December 2013 from 21 Family Health Centers. Data were collected from the 21 Family Health Centers. The distribution of health centers included in the study was stratified according to the socioeconomic level, i.e., low, moderate, and good with respect to the socioeconomic status of the general population. In our initial design for the age grouping, we considered that the grouping as 65–74, 75–84, and ≥85 years was reliable. However, in our analysis, we changed this grouping to 60–74 and ≥75years. The rationale for this new grouping was a relatively low number of elderly in some groups (primarily elderly over 80 years and detecting a significant decline after 75 years). In addition, the rationale of including elderly aged 60–64 was their insistent request to be included in the study.

The exclusion criteria were the following: patients who had a prior history of any other cancer, patients who were bedridden, and patients unwilling to participate in the study. The older people were invited to health centers, and physical examinations were performed. A list of deaths from the last 4 years—from August 2013 to January 2017—was obtained from the local health authority (Türk Halk Sağlığı Kurumu/Kayseri). Using this list, a cross match was done with individuals included in the current study to determine the number of deaths in the study group. The Medical Ethics Committee of Erciyes University Medical Faculty approved the study (2013/441; 02.07.2013).

We used the modified version of the FFI in which the physical activity was not included (9, 10). These criteria included four components:

1. Unintentional weight loss >4.5 kg (10 lbs) was categorized as positive.
2. Weakness was assessed as the grip strength: ≤25.6 kg for females and ≤14.7 kg for males (≤25th percentile) were categorized as positive for the grip strength criterion (≤25th percentile=1, ≥25th percentile=0).
3. Exhaustion was assessed by the Geriatric Depression Scale: "Do you feel full of energy?" (Yes=0, No=1) (9–12).
4. Slowness was assessed by the 4-m walking speed: ≥5.67 sec/m for females and ≥4.67 sec/m for males (≥75th percentile=1, ≤75th percentile=0) were considered as positive indicators for slowness. The elderly were categorized as non-frail (0 points), pre-frail (1 points), and frail (≥2 points).

The FRAIL scale consists of five self-reported components: fatigue, resistance, ambulation, illnesses, and loss of weight. The scale score ranges from 0 to 5 points, with 1 point given to each positive answer. Fatigue was evaluated by asking participants if they felt tired most of the time. Resistance was measured by the participants' self-report on their capacity to climb a flight of stairs. Ambulation was assessed by self-reporting that they had difficulty in walking several hundred yards alone and without aid. Disease burden was measured by the presence of five or more of a total of 11 diseases such as diabetes, heart disease, hypertension, stroke, low iron level (iron deficiency anemia), osteoporosis, asthma, chronic obstructive pulmonary disease (i.e., bronchitis/emphysema), anxiety, arthritis/rheumatism, breast cancer, cervical cancer, or chronic fatigue syndrome. The weight loss was assessed as 5% or greater weight loss within the previous 12 months (13). The elderly were categorized as non-frail (0 points), pre-frail, (1 to 2 points), and frail (≥3 points).

The chi-squared test was used to compare categorical variables. The binary logistic regression was done for demographic information, the socioeconomic and smoking status, fear of falling, and having experienced falls. Additionally, both frailty scales were analyzed in a logistic regression analysis to determine their sole or combined effect on mortality. Significant variables at $p<0.25$ on the univariate analysis were included into a multiple model, and a forward stepwise selection was performed using the likelihood ratio statistic at the $p<0.10$ stringency level. The odds ratios (OR) were also given with 95% confidence intervals (CI). To discriminate the power of the two scales (FFI and FRAIL scale), a chi-square test was performed separately for the gender and age groups. The R 3.2.0 (www.r-project.org) software was used for statistical analysis. Moreover, receiver operating characteristic (ROC) curves were generated to identify the predictive effect of the FRAIL and FFI scores on mortality. The area under the ROC curves was calculated with 95% CI and compared between each other. The R 3.2.0 (www.r-project.org) software and easyROC (14) were used for the statistical analysis. A p-value <0.05 was considered to be statistically significant.

RESULTS

We included 905 community-dwelling elderly. However, we failed to calculate frailty in 1.0% (n=8) and 6.0% (n=57) of the elderly for FRAIL and FFI, respectively, because of missing data. The actual numbers of community-dwelling elderly for the FFI and FRAIL reduced accordingly, and a new sample size that was used to calculate frailty is shown in Tables 1–3. In this study, the 4-year unadjusted mortality was 7.2% (65/905 older people). The gender-specific mortality in males was double the one in females (4.8% [n=43] and 2.4% [n=22] in males and females, respectively). The 4-year mortality frequency in the elderly aged ≥75 years was 12.8% (n=34/265), and in the group aged 60–74 years, it was 4.8% (n=31/640).

The frequency rates of the short period (4 years) mortality in the elderly for frail, pre-frail, and non-frail conditions were 57.4%, 25.9%, and 16.7%, respectively, according to the FFI (Table 1). According to the FRAIL scale, the frequency rates of mortality in the frail, pre-frail, and non-frail elderly were 20.6%, 54.0%, and 25.4%, respectively (Table 1). The ratio of non-frail to frail/pre-frail mortality for FFI was 1/16 and 8/29 in females and males, respectively. In addition, the ratio of non-frail to frail/pre-frail mortality for FRAIL was 1/21 and 15/26 in females and males, respectively (Table 2). In case of determining frailty with the FRAIL scale, the ratio of mortality in the frail/pre-frail compared with the non-frail was more than 21 times and more than 1.5 times higher in females and in males, respectively (Table 2).

A comparison of mortality in the elderly aged 60–74 years and ≥75 years yielded significant differences between frailty and mortality as determined by the FFI and FRAIL scale. According to both frailty scales, mortality was higher in the pre-frail group compared with the frail and non-frail group in those aged 60–74 years. In individuals aged ≥75 years, mortality was significantly higher in the frail older people according to the FFI, but the high-

Table 1. Age interval, gender, income, living alone, smoking status, fear of falling, falls, and the FFI and FRAIL Scales to assess mortality status

Variable	All (n=905)		Survived (n=840)		Died (n=65)		p
	n	%	n	%	n	%	
Age							
60–74	640	70.7	609	72.5	31	47.7	<0.001
75≥	265	29.3	231	27.5	34	52.3	
Gender							
Female	458	50.6	436	51.9	22	33.8	0.004
Male	447	49.4	404	48.1	43	66.2	
Income							
Low	192	21.5	183	22.1	9	13.8	0.211
Moderate	447	50	414	49.9	33	50.8	
Good	255	28.5	232	28	23	35.4	
Living alone							
Married	616	68.1	571	68	45	69.2	
None	289	31.9	269	32	20	30.8	
Smoking status							
Never smoking	594	65.6	559	66.5	35	53.8	0.078
Former smoker	80	8.8	74	8.8	6	9.2	
Current smoking	231	25.5	207	24.6	24	36.9	
Fear of falling							
Yes	358	40	325	39.2	33	50.8	0.045
No	537	60	505	49.2	32	60.8	
Falls							
Yes	216	24.1	199	24	17	26.2	0.365
No	679	75.9	631	76	48	73.8	
FFI	**All (n=848)**		**Survived (n=794)**		**Died (n=54)**		
Frail	236	27.8	205	25.8	31	57.4	<0.001
Pre-frail	295	34.8	281	35.4	14	25.9	
Non-frail	317	37.4	308	38.8	9	16.7	
FRAIL	**All (n=897)**		**Survived (n=834)**		**Died (n=63)**		
Frail	90	10	77	9.2	13	20.6	0.001
Pre-frail	409	46.6	375	45	34	54	
Non-frail	398	44.4	382	45.8	16	25.4	

FFI: Fried Frailty Index; FRAIL: Fatigue, Resistance, Ambulation, Illness, Low Weight. P-value for comparison between the groups in which the subjects survived or died. Chi-squared test for categorical variables

est mortality frequency was in the pre-frail group according to the FRAIL scale (Table 3).

In addition to determining the effect of frailty on mortality for gender and age, we made a further logistic regression analysis. In the univariate logistic regression analysis, the age, gender, sociodemographic characteristics, falls, fear of falling, and the two frailty scales were analyzed (FFI and FRAIL scale) as independent variables for mortality (Table 4). The age ≥75 years and male gender, being a smoker, being frail according to the FFI, and being frail or pre-frail according to the FRAIL were determined as significant independent variables for mortality. However, in a multivariate analysis, the male gender (OR 2.67, 95%CI 1.43–4.96) and being frail (OR 5.34, 95%CI 2.45–11.67) were significantly associated with mortality according to the FFI (Table 4). We made a further analysis to reveal if any of these measures are superior to each other, as well as predicting mortality. The area under the curve in the ROC analysis was 0.672 (0.596–0.747) and 0.588 (0.508–0.667) for the FFI and FRAIL, respectively (Figure 1).

DISCUSSION

The primary aim of this study was to determine the 4-year mortality frequency according to two different frailty assessment scales

Table 2. Frequency of mortality in females and males according to both the FFI and FRAIL Scales

Variable	Female							Male						
	All (n=427)		Survived (n=410)		Died (n=17)		p	All (n=421)		Survived (n=384)		Died (n=37)		p
	n	%	n	%	n	%		n	%	n	%	n	%	
FFI														
Frail	130	30.4	117	28.5	13	76.5	<0.001	106	25.2	88	22.9	18	48.6	0.001
Pre-frail	154	36.1	151	36.8	3	17.6		141	33.5	130	33.9	11	29.7	
Non-frail	143	33.5	142	34.6	1	5.9		174	41.3	166	43.2	8	21.6	
FRAIL														
Frail	66	14.5	59	13.6	7	31.8	0.005	24	5.4	18	4.5	6	14.6	0.003
Pre-frail	247	54.3	233	53.8	14	63.6		162	36.7	142	35.4	20	48.8	
Non-frail	142	31.2	141	32.6	1	4.5		256	57.9	241	60.1	15	36.6	

FFI: Fried Frailty Index; FRAIL: Fatigue, Resistance, Ambulation, Illness, Low Weight. P-value for comparison between the groups in which the subjects survived or died. Chi-squared test for categorical variables

Table 3. Frequency of mortality in the elderly aged 60–74 years and ≥75 years according to the FFI and FRAIL Scales

Variable	60–74 years							75≥ years						
	All (n=609)		Survived (n=581)		Died (n=28)		p	All (n=239)		Survived (n=213)		Died (n=26)		p
	n	%	n	%	n	%		n	%	n	%	n	%	
FFI														
Frail	128	21	117	20.1	11	29.3	0.038	108	45.2	88	41.3	20	76.9	0.002
Pre-frail	230	37.8	220	37.9	10	35.7		65	27.2	61	28.6	4	15.4	
Non-frail	251	41.2	244	42	7	25		66	27.6	64	30	2	7.7	
	All (n=634)		Survived (n=604)		Died (n=30)		p	All (n=263)		Survived (n=230)		Died (n=33)		p
FRAIL														
Frail	51	8	46	7.6	5	16.7	0.123	39	14.8	31	13.5	8	24.2	0.010
Pre-frail	295	46.5	280	46.4	15	50		114	43.3	95	41.3	19	57.6	
Non-frail	288	45.4	278	46	10	33.3		110	41.8	104	45.2	6	18.2	

FFI: Fried Frailty Index; FRAIL: Fatigue, Resistance, Ambulation, Illness, Low Weight. P-value for comparison between the groups in which the subjects survived or died. Chi-squared test for categorical variables

in the community-dwelling Turkish older people. To the best of our knowledge, this is the first study to have found the association between frailty and mortality in the community-dwelling Turkish older people. The criteria to assess the frailty status were the FFI and FRAIL scale. Both of these frailty scales make an assessment about frailty with relatively different measures. The FFI can be considered to be an objective scale, since it has sub-domains reflecting the muscle function, such as the handgrip and 4-m walking speed. Unlike the FFI, the FRAIL scale can be considered as a subjective measure since its assessment depends on the older people self-reporting. The use of two different scales in the assessment of frailty reinforces our conclusion. On the other hand, deriving our data from an epidemiologic study whose primary aim is not predicting mortality and calculating mortality frequency in a relatively short period may be a weakness of our study.

Studies that compared the relationship between frailty and mortality for both genders produced different results (increased or decreased) (15–18). We found that frailty is associated with higher mortality that is prominent in male gender (Table 4). Additionally, the FFI showed that the frail/pre-frail and non-frail ratio is a good indicator of mortality in both genders (Table 2). On the other hand, in the case of the FRAIL scale, the highest mortality frequency was prominent in the pre-frail elderly. The relatively objective character of the FFI may be the cause of this difference since the subjective character of the FRAIL scale may lead to frailty being underestimated. In general, Turkish people overexpress their well-being, so the elderly in our study that could have been grouped in the frail group may have presented themselves as pre-frail (19).

The European Male Aging Study (EMAS) was conducted in relatively young male elderly subjects. Two different frailty scales (FFI

Table 4. Univariate and multivariate analysis to assess mortality with age, gender, income, living alone, smoking status, fear of falling, falls, and the FFI and FRAIL Scales

Variable	Univariate		Multivariate	
	Odds (95%CI)	p*	Odds (95%CI)	p**
Number (%)				
Age				
60–74	1.00	–	–	–
75>	2.89 (1.74–4.82)	<0.001	–	–
Gender				
Female	1.00	–	1.00	–
Male	2.11 (1.24–3.59)	0.006	2.67 (1.43–4.96)	0.002
Income				
Good	1.00	–	–	–
Moderate	1.62 (0.76–3.46)	0.211	–	–
Low	2.02 (0.91–4.46)	0.084	–	–
Living alone				
None	1.00	–	–	–
Married	0.94 (0.55–1.63)	0.834	–	–
Smoking status				
Never smoking	1.00	–	–	–
Former smoker	1.30 (0.53–3.18)	0.573	–	–
Current smoking	1.85 (1.08–3.19)	0.026	–	–
Fear of falling				
No	1.00	–	–	–
Yes	1.60 (0.97–2.65)	0.068	–	–
Falls				
No	1.00	–	–	–
Yes	1.13 (0.63–2.00)	0.680	–	–
FFI				
Non-Frail	1.00	–	1.00	–
Pre-Frail	1.71 (0.73–4.40)	0.220	1.82 (0.77–4.29)	0.172
Frail	5.18 (2.41–11.09)	<0.001	5.34 (2.45–11.67)	<0.001
FRAIL				
Non-Frail	1.00	–	–	–
Pre-Frail	2.17 (1.18–3.99)	0.013	–	–
Frail	4.03 (1.86–8.72)	<0.001	–	–

FFI: Fried Frailty Index; FRAIL: Fatigue, Resistance, Ambulation, Illness, Low Weight. *P-value for comparison between the groups in which the subjects survived or died. Univariate logistic regression test variable. **P-value for comparison between the groups in which the subjects survived or died. Multivariate logistic regression test variable

and FRAIL) were used, as in our study, and a positive relationship was observed between frailty and mortality. In EMAS, the hazard ratios for mortality were 3.84 and 3.87, respectively, for the FFI and FRAIL scales (20). Comparing our study with EMAS, we found that there is a positive relationship between frailty and mortality in the male gender with the FFI. However, when using the FRAIL scale to assess the relationship between frailty and mortality, our data showed that the frequency of mortality was higher in the pre-frail older people when compared with the frail older people. The reason for the difference between our and the EMAS study may be a relatively low mean age in the EMAS study. Although in the EMAS study both scales showed similar results for the frequency of mortality, in our study, the FRAIL scale failed to show a similar result. Our explanation for this situation is underestimating of frailty with a relatively subjective measure (FRAIL scale). Therefore, we may conclude that the FRAIL scale may have a variable power as an indicator of frailty in different populations. Comparing the FFI and FRAIL for mortality, we found that the FFI is superior to FRAIL according to the ROC analysis.

Indeed, we detected several factors related with mortality in a univariate analysis. In a further analysis, we detected two significant factors that were significantly related with an increased mortality

frequency. These factors were the male gender and being classified as frail according to the FFI scale. Frailty is associated with higher mortality, and the effect of frailty on mortality was the strongest in the frail male group. In addition, total mortality was higher in males in our study population. The explanation for a higher mortality in males could be a higher prevalence of medical comorbidities, such as cardiovascular disease and diabetes mellitus, in addition to a high smoking frequency in males.

An increased frequency of mortality in individuals older than 80 years is well known, and the additional positive contribution of frailty during this age has been shown in several studies (21–23). Although in the univariate analysis increased age was a significant factor for increased mortality, this relationship was not found in the multivariate analysis. Additionally, the positive relationship between frailty and mortality in the advanced age was not confirmed by the multivariate analysis.

CONCLUSION

Frailty is a prevalent and substantial geriatric syndrome associated with increased mortality. There are several measures to assess frailty in elderly. Among these, the FFI is the most frequently used, and the FRAIL is an easy-to-use scale to assess frailty. In this cross-sectional study, we checked the association between frailty and 4-year mortality. The FRAIL scale can be used to assess mortality, but our results showed that the FFI is a stronger predictor for mortality than the FRAIL scale..

Ethics Committee Approval: The Medical Ethics Committee of Erciyes University Medical Faculty approved the study (2013/441; 02.07.2013).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Conceived and designed the experiments or case: SA, MM. Performed the experiments or case: EDŞ, SG and SM. Analyzed the data: SA, FFO and GE. Wrote the paper: SA. All authors have read and approved the final manuscrip.

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REFERENCES

1. İstatistiklerle Yaşlılar, 2017. Available at: http://www.tuik.gov.tr/PreHaberBultenleri.do?id=27595. Accessed February 7, 2019.
2. Rochat S, Cumming RG, Blyth F, Creasey H, Handelsman D, Le Couteur DG, et al. Frailty and use of health and community services by community-dwelling older men: the Concord Health and Ageing in Men Project. Age Ageing 2010; 39(2): 228–33. [CrossRef]
3. Fried LP, Tangen C, Walston J, Newman AB, Hirsch C, Gottdiener J, et al; Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001; 56(3): 146–56. [CrossRef]
4. Collard RM, Boter H, Schoevers RA, Oude Voshaar RC. Prevalence of frailty in community-dwelling older persons: a systematic review. J Am Geriatr Soc 2012; 60(8): 1487–92. [CrossRef]
5. Nguyen TN, Cumming RG, Hilmer SN. A Review of Frailty in Developing Countries. J Nutr Health Aging 2015; 19(9): 941–6. [CrossRef]
6. Akın S, Mazıcıoglu MM, Mucuk S, Gocer S, Deniz Şafak E, Arguvanlı S, et al. The prevalence of frailty and related factors in community-dwelling Turkish elderly according to modified Fried Frailty Index and FRAIL scales. Aging Clin Exp Res 2015; 27(5): 703–9. [CrossRef]
7. Fried LP, Tangen CM, Walston J, Newman AB, Hirsch C, Gottdiener J, et al; Cardiovascular Health Study Collaborative Research Group. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001; 56(3): M146–56. [CrossRef]
8. Malmstrom TK, Miller DK, Morley JE. A comparison of four frailty models. J Am Geriatr Soc 2014; 62(4): 721–6. [CrossRef]
9. Ottenbacher KJ, Ostir GV, Peek MK, Snih SA, Raji MA, Markides KS. Frailty in older Mexican Americans. J Am Geriatr Soc 2005; 53(9): 1524–31. [CrossRef]
10. Runzer-Colmenares FM, Samper-Ternent R, Al Snih S, Ottenbacher KJ, Parodi JF, Wong R. Prevalence and factors associated with frailty among Peruvian older adults. Arch Gerontol Geriatr 2014; 58(1): 69–73.
11. Yesavage JA, Brink TL, Rose TL, Lum O, Huang V, Adey M, et al. Development and validation of a geriatric depression screening scale: a preliminary report. J Psychiatr Res 1982–1983; 17(1): 37–49.
12. Ensrud KE, Blackwell TL, Redline S, Ancoli-Israel S, Paudel ML, Cawthon PM, et al; Osteoporotic Fractures in Men Study Group. Sleep disturbances and frailty status in older community-dwelling men. J Am Geriatr Soc 2009;5 7(11): 2085–93.
13. Morley JE, Malmstrom TK, Miller DK. A simple frailty questionnaire (FRAIL) predicts outcomes in middle aged African Americans. J Nutr Health Aging 2012; 16(7): 601–8. [CrossRef]
14. Goksuluk D, Korkmaz S, Zararsiz G, Karaagaoglu E. easyROC: An Interactive Web-tool for ROC Curve Analysis Using R Language Environment. The R Journal 2016; 8(2): 213–30. [CrossRef]
15. Kulmala J, Nykanen I, Hartikainen S. Frailty as a predictor of all-cause mortality in older men and women. Geriatr Gerontol Int 2014; 14(4): 899–905. [CrossRef]
16. Bartley MM, Geda YE, Christianson TJ, Pankratz VS, Roberts RO, Peterson RC. Frailty and Mortality Outcomes in Cognitively Normal Older People: Sex Differences in a Population-Based Study. J Am Geriatr Soc 2016; 64(1): 132–7. [CrossRef]
17. Berges IM, Graham JE, Ostir GV, Markides KS, Ottenbacher KJ. Sex differences in mortality among older frail Mexican Americans. J Females Health (Larchmt) 2009; 18(10): 1647–51. [CrossRef]
18. Zhang Q, Guo H, Gu H, Zhao X. Gender-associated factors for frailty and their impact on hospitalization and mortality among community-dwelling older adults: a cross-sectional population-based study. PeerJ 2018; 6: e4326. [CrossRef]
19. C Gulec. A Transcultural Perspective to the Disease and HealthConcepts in the Anatolian Culture. J Clin Psy 2000; 3(1): 34–9.
20. Ravindrarajah R, Lee DM, Pye SR, Gielen E, Boonen S, Vanderschueren D ,et al; European Male Aging Study Group. The ability of three different models of frailty to predict all-cause mortality: results from the European Male Aging Study (EMAS). Arch Gerontol Geriatr 2013; 57(3): 360–8. [CrossRef]
21. Cawthon PM, Marshall LM, Michael Y, Dam TT, Ensrud KE, Barrett-Connor E, et al; Osteoporotic Fractures in Men Research Group. Osteoporotic Fractures in Men Research Group. Frailty in older men: prevalence, progression, and relationship with mortality. J Am Geriatr Soc 2007; 55(8): 1216–23. [CrossRef]
22. Ensrud KE, Ewing SK, Taylor BC, Fink HA, Stone KL, Cauley JA, et al; Study of Osteoporotic Fractures Research Group. Frailty and risk of falls, fracture, and mortality in older women: the study of osteoporotic fractures. J Gerontol A Biol Sci Med Sci 2007; 62(7): 744–51.
23. Bartosch, McGuigan FE, Akesson KE. Progression of frailty and prevalence of osteoporosis in a community cohort of older women-a 10-year longitudinal study. Osteoporos Int 2018; 29(10): 2191–9. [CrossRef]