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Original Article

Multidimensional Approach to Frailty among Rural Older People: Applying the Tilburg Frailty Indicator

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Introduction: Frailty is a common geriatric syndrome. Studies of frailty and old age have been able to help reduce its underlying causes and complication. Understanding the frailty and its associated factors in developing countries such as Iran, can help gather information on conditions of the elderly and better plan for this age population. Therefore, the present study was implemented to investigate the prevalence and determinants of frailty in the rural elderly population of Shabestar, East Azarbayjan, Iran.

Methods: This cross-sectional study was conducted among 565 rural older people in Shabestar, Iran during 2018-2019. The data collection tool was the Tilburg Frailty Indicator. The participants were selected by using stratified and simple random approach. Descriptive statistics, t-test, one-way ANOVA and logistic regression were used to perform data analysis.

Results: Of the participants, 46.7% were detected as being frail. The associations between the prevalence of frailty and sociodemographic characteristics such as age, gender, marital status, types of lifestyle, educational level, and income status were statistically significant ($p < 0.05$). Regression analysis showed that age ($\beta = -0.84$, $p < 0.05$), the number of medications used ($\beta = -2.72$, $p < 0.001$), hypertension ($\beta = -0.633$, $p < 0.006$), diabetes ($\beta = -535$, $p < 0.045$) and the history of fall during the last year ($\beta = -4.21$, $p < 0.001$) were the most important predictors of frailty among non-institutionalized rural older people.

Conclusion: The study confirms the importance of common chronic medical conditions and sociodemographic characteristics in the development of frailty syndrome among older adults. The descriptive nature of the study implies observational trials to clarify more deeply relationship between frailty and the determinants found.

Keywords: Frailty, Older Adults, Prevalence, Determinants

Introduction

According to the United Nations, the world's older population will increase from 10.5% in 2007 to 21.8% in 2050 (1). According to the Iranian Population and Housing Census, the older population will increase from 9.2% in 2019 to around 12% in 2025 (2). Population ageing will lead to substantial implications for the planning and delivery of health and social care (3), including increased number of frail older people (4). As the age increases, inevitable declining physiological changes occur in various systems of the body (5), leading to debilitating diseases. These changes result from a combination of genetic, environmental and lifestyle factors (6). Therefore, some people remain healthy, and some others become increasingly frail because of internal and

external risk factors of old age (7, 8). Frailty increases the risk of aging outcomes (including disability, comorbidities, admission to the nursing home, falls, fractures, hospital admission, reduced independence, over medications use, and mortality) (6, 7, 9, 10).

It is important to identify frail people and perform primary interventions with the aim of preventing the development of frailty and the resulting adverse outcomes in the older adults (4). Many studies have reported with increasing age, the prevalence of frailty in various communities ranges from 4% to 59.1% (11-17). The prevalence of frailty has been reported 17-31% in Brazil, 15% in Mexico, 5-31% in China, 21-44% in Russia, 49% in hospitalized patients in Brazilian institutes, 32% in hospitalized patients in India, 51-71% in outpatient clinics in Brazil, and 28% in Peru (18).

The prevalence of frailty in older adults admitted to general hospitals affiliated to Tehran University of Medical Sciences was 39% (19). The prevalence of frailty is associated with demographic characteristics such as gender, marital status, ethnicity, and race (20-23).

A systematic review of 11 studies carried out in 2012 showed the prevalence of frailty in women was 9.6%, which was higher than that in men (2.5%) (24).The frailty is lower in married people than in widows/widowers and single people (13-15). The prevalence of frailty in older adults is also associated with their education level and socioeconomic status, so that with increasing education level and income, the prevalence of frailty decreases (11, 15, 25-28).

Varied prevalence of frailty between older people in urban and rural regions has been reported from developed countries [29]. For example, in one study in older people aged over 80 in Canada, rural residents were reported to be frailer than urban ones (23). A study in China also showed that urban elderly had lower frailty than rural elderly (29).

Studies on the old-age frailty have been done mainly in western countries, helping reduce the old-age frailty by understanding its causes. However, such studies have been rarely done in developing countries such as Iran, and therefore, elderly health has been somewhat neglected especially with respect to the provision of various health services for the elderly in developed countries compared to Iran where most older adults are illiterate and lowly educated and lack adequate facilities and income.

Therefore, considering the importance of the older adults and the growing increase of this age population in Iran, understanding frailty and its associated factors can help clarify their conditions and better planning for them. Considering the large population of older adults (14%) and the high prevalence of chronic diseases such as diabetes, hypertension and cardiovascular diseases in the Shabestar region (30, 31), the present study was conducted to investigate the prevalence and determinants of frailty in rural older adults in Shabestar, Iran.

Methods

Study design

The cross-sectional study was conducted with the aim of investigating the prevalence and determinants of frailty in the rural older adults of Shabestar, East Azarbaijan in 2018-2019.

Sample size and procedure

The statistical population of the study included older adults living in Shabestar rural areas. Considering $Z_{1-\alpha/2} = 1.96$, $d = 0.05$, and $p = 0.5$, the sample size was calculated to be approximately 400 individuals. In order to the enrollment of an adequate number of samples, an additional 20% was added to the calculated sample size so that the final sample size was decided to be 560 individuals. Shabestar has three districts: Sufian, Central, and Tasouj. The participants were selected from 56 (out of the 58) health houses across the county by stratified, simple random sampling. To this end, a sampling protocol was designed in accordance with the various classes of stratification and the distribution table of older adults' population in each class. Then, the percentage and ratio of each class in older adults' population were calculated, and according to the ratio of each class in the community, the percentage and ratio of that class in the samples were determined.

After calculation of the population ratio, a numbered list of older people filed in health houses was prepared, from which the participants were selected by simple random sampling given a 50% proportion for each gender.

An interview with potential participants was conducted at the health center. If a potential participant had motor difficulties, a questionnaire was completed for him/her at his/her own home.

The inclusion criteria were aged 60 and over and living in rural areas of the county under purpose, and the exclusion criteria were suffering from severe cognitive impairment (attaining a score of 9 and lower on the Persian duplicate of Mini-mental State Examination) (32), and injury-related and congenital disabilities.

Instruments

The data collection instrument was the Tilburg Frailty Indicator (TFI), developed by Gobbens et al. at Tilburg University, the Netherlands in 2010 (33). This instrument consisting of two parts A and B as follows:

Part A consists of 10 items about frailty determinants such as age, gender, education level, income, marital status, unpleasant life events in the last year, comorbidities, and satisfaction with the environment and lifestyle; and Part B addresses the main components of the frailty and consists of 15 items divided into three domains consisting of physical, psychological and social.

Eleven items are answered by two (Yes or No) choices and four items are answered by three (Yes, No, and Sometimes) choices. All items are scored as zero or one (No = 0 and Yes and Sometimes = 1). The

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psychometric properties of this instrument was conducted in Iran (33).

The physical domain consists of eight items about physical health (physical functioning), unwanted weight loss, difficulty walking, difficulty maintaining balance, hearing impairment, low vision, reduced (lack of) strength in the hands and bodily (physical) fatigue.

The mental domain consists of four items regarding cognition, depression, neurological symptoms, and coping with problems.

The social domain consists of three items related to living alone, social communication and social support.

The minimum and maximum attainable scores on the TFI are 0 to 15, respectively, with the cut-point of five. The respondents attaining the scores five and above are considered frail.

Ethical considerations

The protocol of the study was approved by the Ethics Committee of Tabriz University of Medical Sciences (code: IR.TBZMED.REC.1396.1151).

The ethical considerations observed in this study included providing a letter of introduction and explanations about the research objectives and procedure for the participants, obtaining consent to participate in the study from them, observing trustworthiness and making any efforts to avoid various biases during the whole research procedure, and keeping the participants' personal information confidential.

Data analysis

The SPSS version 21 (IBM SPSS.INE, IL, Chicago, USA) was used to perform data analysis. Descriptive statistics were used to report frequency, percentage, and mean (standard deviation). Because the data was normally distributed, Chi-squared test and one-way ANOVA were used to investigate the relationship between the main constructs of the questionnaire and demographic variables. Logistic regression models were also used to determine the determinants of frailty.

Results

The mean age of the participants was 71.53±7.41 years, and most them were married (75.4%). Most of participants were illiterate, and over 42% of them had an income of 6000000 to 15000000 Rials (Table 1).

Hypertension (66.7%) was the most frequent disease in our participants and 46% of them consumed one to three medications.

Regarding the frequency of frailty components, missing relatives over the past month (89.4%), feeling neurotic or anxious over the past month (50.7%) and memory problems (50.5%) were reported as being the most frequent components (Table 2).

The results of the study showed that 46.7% (n = 259) of the participants were frail.

The associations between the prevalence of frailty and sociodemographic characteristics such as age, gender, marital status, types of lifestyle, educational level, and income status were statistically significant (Table 3).

The most common chronic medical conditions such as hypertension, diabetes, cardiovascular disease, stroke and cancer was higher among frail older people. (Table 4).

The associations between the prevalence of frailty and use of medications was statistically significant, so that the elderly who were frail took more medications ($p < 0.001$).

The most important predictors of frailty in the participants, based on the regression analysis results, were age, hypertension, diabetes, and history of falls over the past year (Table 5).

Table 1. Sociodemographic characteristics of the participants (n=555)

Variables	Items	N (%)
Age	60-74	362 (65.1)
	75-84	143 (25.7)
	85 and above	51 (9.2)
Gender	Male	290 (52.2)
	Female	266 (47.8)
Marrital status	Married	419 (75.4)
	Not married	9 (1.8)
	Widow	128 (23)
Living status	Single	87 (15.6)
	With spouse	294 (52.9)
	With spouse and children	124 (22.3)
	With children	51 (9.2)
Educational level	Irritate	317 (57)
	Primary school	203 (36.5)
	Secondary school	24 (4.3)
	Diploma and above	12 (2.2)
Income level	< 6,000,000	202 (36.3)
	6,000,000-15,000,000	238 (42.8)
	15,000,000-25,000,000	70 (12.6)
	25,000,000-35,000,000	30 (5.4)
	35,000,000 >	16 (2.9)
Types of job	Housewife	263 (47.3)
	Farmer	177 (3.8)
	Manual worker	40 (7.2)
	Employee	27 (4.9)
	Self-employment	49 (8.8)

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Table 2. Frequency distribution of responses to frailty items (components) in participants

Components	Items	Yes N (%)	No N (%)
Physical	Do you feel physically healthy?	360 (64.7)	196 (35.3)
	Have you lost a lot of weight recently without wishing to do so?	26 (4.7)	530 (95.3)
	Do you experience problems in your daily life due to difficulty in walking?	155 (27.9)	401 (72.1)
	Do you experience problems in your daily life due to difficulty maintaining your balance?	92 (16.5)	464 (83.5)
	Do you experience problems in your daily life due to poor hearing?	102 (18.3)	454 (81.7)
	Do you experience problems in your daily life due to poor vision?	120 (21.6)	436 (78.4)
	Do you experience problems in your daily life due to lack of strength in your hands??	117 (21)	439 (79)
	Do you experience problems in your daily life due to physical tiredness?	183 (32.9)	373 (67.1)
Psychological	Do you have problems with your memory?	280 (50.5)	275 (49.5)
	Have you felt down during the last month?	67 (12.1)	489 (87.9)
	Have you felt nervous or anxious during the last month?	282 (50.7)	274 (49.3)
	Are you able to cope with problems well?	398 (71.6)	158 (28.4)
Social	Do you live alone?	81 (14.6)	475 (85.4)
	Do you sometimes miss having people around you?	497 (89.4)	59 (10.6)
	Do you receive enough support from other people?	399 (71.8)	157 (28.2)

Table 3. Frequency distribution of frailty according to sociodemographic characteristics among older people (n = 555)

Variables	Items	Frail N (%)	Not-frail N (%)	p-value
Age	60-74	122 (47.1)	239 (80.7)	
	75-84	97 (37.5)	46 (15.5)	< 0.001
	85 and above	40 (15.4)	11 (3.7)	
Gender	Male	122 (47.1)	168 (56.8)	0.023
	Female	137 (52.9)	128 (43.2)	
Married status	Married	166 (64.1)	252 (85.1)	
	Not married	6 (2.4)	3 (1)	< 0.001
	Widow	87 (33.6)	41 (13.9)	
Living status	Single	65 (25.1)	22 (7.4)	
	With spouse	119 (45.9)	174 (58.8)	< 0.001
	With spouse and children	45 (17.4)	79 (26.7)	
	With children	29 (11.2)	21 (7.1)	
Educational level	Irritate	176 (68)	141 (47.6)	
	Primary school	77 (29.7)	125 (42.2)	< 0.001
	Secondary school	5 (1.9)	19 (6.4)	
	Diploma and above	1 (0.4)	11 (3.7)	
Income level	<6,000,000	119 (45.9)	82 (27.7)	
	6,000,000-15,000,000	98 (37.8)	140 (47.3)	
	15,000,000-2,500,0000	28 (10.8)	42 (14.2)	< 0.001
	25,000,000-35,000,000	7 (2.7)	23 (7.8)	
	35,000,000 >	7 (2.7)	9 (3)	
Types of job	Housewife	135 (52.1)	127 (42.9)	
	Farmer	86 (33.2)	91 (30.7)	
	Manual worker	15 (5.8)	25 (8.4)	0.009
	Employee	6 (2.3)	21 (7.1)	
	Self-employment	17 (6.6)	32 (10.8)	

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Table 4. Distribution of frailty according to common diseases problems and number of medication used among the participants (n = 555)

Variable		Frail N (%)	Not-frail N (%)	p-value
Hypertension	Yes	197 (23.9)	173 (58.4)	< 0.001
	No	62 (76.1)	123 (41.6)	
Diabetes	Yes	70 (27)	46 (15.5)	0.001
	No	189 (73)	250 (84.5)	
Cardiovascular	Yes	33 (12.7)	19 (6.4)	0.011
	No	226 (87.3)	277 (93.6)	
Lipid disorder	Yes	70 (27)	72 (24.3)	0.467
	No	189 (73)	224 (75.7)	
Mental disorder	Yes	16 (6.2)	8 (2.7)	0.045
	No	243 (93.8)	288 (97.3)	
Heart attack	Yes	4 (1.5)	1 (0.3)	0.133
	No	255 (98.5)	295 (99.7)	
Stroke	Yes	4 (1.5)	0 (0)	0.047
	No	255 (98.5)	296 (100)	
Asthma	Yes	14 (5.4)	7 (2.4)	0.061
	No	245 (94.6)	289 (97.6)	
Cancer	Yes	9 (3.5)	2 (0.7)	0.018
	No	250 (96.5)	294 (99.3)	
Thyroiditis	Yes	3 (1.2)	4 (1.4)	0.573
	No	256 (98.8)	292 (98.6)	
Osteoporosis	Yes	1 (0.4)	1 (0.3)	0.716
	No	258 (99.6)	295 (99.7)	
Arthritis	Yes	4 (1.5)	2 (0.7)	0.282
	No	255 (98.5)	294 (99.3)	
Injury history	Yes	97 (37.5)	71 (24)	0.001
	No	162 (62.5)	225 (76)	
Fracture history	Yes	39 (15.1)	13 (4.4)	< 0.001
	No	220 (84.9)	283 (95.6)	
History of falls in the past year	Yes	59 (22.8)	10 (3.4)	< 0.001
	No	200 (77.2)	286 (96.6)	
Number of medications used	0	0 (0)	1 (0.3)	< 0.001
	1-3	84 (32.4)	174 (58.8)	
	4-6	129 (49.8)	110 (37.2)	
	7 ≤	46 (17.8)	11 (3.7)	

Table 5. Logistic regression analysis of frailty in participant by demographic characteristics and diseases

Variables	β	df	p	Exp(β)	CI
Age	-1.84	1	0.001	0.15	0.680-0.463
Gender	-0.494	1	0.566	0.610	0.113-3.299
Educational level	2.38	1	0.170	10.84	0.359-327.31
lncome level	0.397	1	0.586	1.48	0.356-6.209
Medication use	-2.72	1	0.001	0.065	0.028-0.151
Married status	1.21	1	0.387	3.38	0.213-53.74
Hypertension	-0.633	1	0.006	.531	0.339-0.831
Diabetes	-0.535	1	0.045	0.585	0.347-0.989
Fall history	-1.42	1	0.001	0.240	0.104-0.553
BMI	-1.44	1	0.234	0.237	0.022-2.53

Discussion

Considering the importance of the older adults and the growing increase of this age population in Iran, understanding the frailty and its associated factors can help gain more information about the conditions of the older adults and better planning for them. Therefore, the present study aimed to investigate the prevalence and determinants of frailty in rural older adults in Shabestar, East Azarbaijan, northwest of Iran.

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The main finding of our study was that the prevalence of frailty was 46.7%. The prevalence of frailty was significant with respect to most demographic variables (age, sex, marital status, living with spouse, illiteracy, and low income) and chronic diseases such as hypertension, diabetes, cardiovascular disease, stroke and cancer, history of fracture, history of fall and the number of medications used. The regression analysis results showed that age, medication, hypertension and diabetes, as well as a history of fall over the past year were among the most important predictors of frailty in our participants.

Results revealed that about half of the participants are frail. The prevalence of frailty has been reported to range from 4% to 59.1% , increasing with aging (11-17). In one study in China, the prevalence of frailty in the hospitalized elderly was obtained 18% (34). In the study of Sousa et al. in Brazil, the prevalence of frailty was 17.1% (35). In the studies of Abizanda et al. (36) and Bandeen-Roche et al. (37) the prevalence of frailty was 16.9% and 15%, respectively. The study of Evenhuis et al. showed that the prevalence of frailty was 11% in people aged 50-64 and 18% in those aged over 65 years (38). In the study of Çakmur et al. in 168 elderly people aged 65-96 years from 12 rural areas in Turkey using the Phenotype Frailty Indicator, the overall prevalence of frailty was obtained 7.1% (39). In Iran, few studies have been conducted on frailty so that, to the best of our knowledge, one studies have so far investigated this subject. The prevalence of frailty in this study were obtained 39% (19). There is no worldwide consensus on the prevalence of frailty (24), which is due to the availability and use of various instruments to assess frailty and demographic and otherwise differences among participants. However, the prevalence of frailty has been reported to range between 9.9% and 32% in studies (40-42). It should be noted that the prevalence of frailty in the elderly is higher in developing countries such as Iran than in developed countries (43). The reasons for the varied prevalence of frailty include different methodologies, e.g., methods of assessment and evaluation of frailty, and various instruments used to assess frailty in different studies. Besides that, the elderly have been exposed to various stressors during their lifetime.

Risk factors, tough social conditions, poverty, as well as adverse occupational conditions in adulthood, risky and harmful conditions to health and violence can contribute indirectly to the development of stress and disrupt anti-inflammatory processes and immunity response to stress in the elderly. Because these processes are associated with sarcopenia and worsened adaptation of homeostasis-related organism, they are partly associated with the development of frailty as well (44).

The results of our study showed that the associations between the prevalence of frailty and socio-demographic characteristics such as age, gender, marital status, types of lifestyle, educational level, and income status were statistically significant. A systematic review in 2012 showed that the prevalence of frailty increases with aging [65-69 years (4%), 70-74 (7%), 75-79 (9%), 80-84 (16%) and above 85 years (26%)] (24). As the age increases, declining physiological changes inevitably occur in various systems of the body (5), leading to debilitating diseases. These changes result from a combination of genetic, environmental and lifestyle factors (6). Therefore, some people remain healthy and some others become increasingly frail because of internal and external risk factors during old age (7, 8). Frailty increases the risk of aging outcomes (including disability, comorbidities, admission to the nursing home, falls, fractures, hospital admission, reduced independence, over-consumption of drugs, and mortality) (6, 7, 9, 10).

A systematic review of 11 studies carried out in 2012 showed the prevalence of frailty in women was 9.6%, which was higher than that in men (2.5%) (25). Also, this rate is lower in married people than in widows/widowers and single people (13-15). The prevalence of frailty is also associated with education level and socioeconomic status of the elderly, so that the prevalence of frailty is lower in people with comparatively higher education level and income (11, 15, 25-28). The study of Moreira et al. showed that frail individuals were comparatively older and had lower education levels, and that older people living alone or widows, as well as those with low income were more frail (15). In the study of Pin Ng et al. old age and illiteracy were drawn as frailty components (45). Because most women have lower weight and muscle strength than men, they are more likely to develop overweight as they get older. Women may also be more frail due to external changes. For example, older women are more likely to have a less satisfactory diet than older men because they are more likely to live alone. The reasons for the association between education level and frailty include social structure, lifestyle, access to information, and that educated people are more likely to live a healthier lifestyle, are more aware of the benefits of physical activity and have a better diet, and therefore the prevalence of frailty will be lower in them.

The prevalence of frailty was significantly related to hypertension, diabetes, cardiovascular disease, stroke and cancer, history of fracture, history of falls and number of medications used. In the study of Yang et al. cognitive problems, poor health status, depression, consumption of multiple drugs, disability and a history of fall in the last year were significantly associated with frailty (34). One of the causes is polypharmacy (46). In the study of Sousa et al. the results showed comorbidities, being dependent to do daily living activities, osteoporosis, stroke, depression, at least one fall during the last year, as well as negative perception of health status were significantly associated with the prevalence of frailty (35). In the study of Fried et al. high rates of comorbidities (cardiovascular disease, pulmonary disease, and diabetes) were found to be associated with frailty (11). The study of Moreira et al. showed that chronic diseases were associated with frailty. The elderly who had history of falls over the past year were also more frail (15). In the Cardiovascular Health Study, comorbidity and frailty were observed in 46.2% of the elderly, frailty and

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disability were observed in 5.7% of them, and frailty, comorbidities, and disability were observed in 21.5% of them (47). In the study of Abizanda et al. people with comorbidities and cognitive problems were more frail (36). The study of Bandeen-Roche et al. showed that the prevalence of frailty was comparably higher in people with a history of hip, waist, and heart surgery, as well as history of fall over the past year (37). The study of Garcia et al. showed that the prevalence of frailty syndrome increased with depression, history of hip fracture and co-morbidity with several diseases, such as cardiovascular disease and central nervous system disorders (Parkinson's disease and dementia) (48). History of stroke, osteoarthritis, and hospitalization lead to the development of frailty (49). In the study of Fried et al. high rates of comorbidities (cardiovascular disease, pulmonary disease, and diabetes) were found to be associated with frailty (11). The study of Moreira et al. showed that chronic diseases were associated with frailty. The elderly who had a history of fall over the past year were also more frail (15). In the Cardiovascular Health Study, comorbidity and frailty were observed in 46.2% of the elderly, frailty and disability were observed in 5.7% of them, and frailty, comorbidities, and disability were observed in 21.5% of them (47).

The regression analysis results showed that age, medication, hypertension and diabetes, as well as a history of falls in the past year were among the most important predictors of frailty in the elderly. Several studies have shown that the prevalence of frailty increases with aging (24, 50) because old age increases the risk of hospitalization, falls and disability (51-53). In the study of Sousa et al. the results showed that aging, comorbidities, and at least one history of fall in the past year had a significant relationship with frailty (35). The study of Garcia et al. showed that the frailty syndrome increased with aging and comorbidities, such as cardiovascular disease and central nervous system disorders (Parkinson's disease and dementia) (48). Regression analysis results in the study of Jurschik et al. showed that age, depressive symptoms, comorbidities, cognitive problems, and poor health status were statistically associated with frailty (54). In the study of Runzer-Colmenares et al. the regression analysis results showed that old age and history of falls over the past year were among significantly associated factors with frailty (13). A review article showed that frailty had a significant relationship with age (55). The study of Biritwum et al. showed that frailty and disability were significantly associated with age (56). The risk of death also increases with aging. However, all people of the same age are not at an equal risk of death. People who are at high risk of death compared to their peers are likely to be more frail. Therefore, the number of frailties may differ among people of the same age so that those with more frailties are more likely to die (57). Physiological reserve gradually decreases with aging, but this decline is accelerated in case of frailty development and cannot be counteracted by compensatory and hemostatic mechanisms (58, 59).

Therefore, an important question regarding frailty is that how the complex mechanisms of aging, cumulative degradation of multiple physiological systems, homeostatic reserve erosion and predisposition to adverse changes in health status due to stressful events should be studied. Old age is considered complex due to the accumulation of life-long molecular and cellular damage caused by multiple mechanisms regulated by a maintenance network (60).

Frailty is a practical and integrated concept for elderly care according to which patients and their conditions are addressed from a more general perspective (61) irrespective of the diagnosis of a specific disease or disorder. Therefore, the differentiation of frail older people from non frail ones should be considered as an essential constituent of assessments in any health care program, because lack of such differentiation may lead to unnecessary invasive procedures or the prescription of harmful drugs.

Conclusions

According to our findings, the prevalence of frailty in the elderly was approximately 50%, which is a warning rate. This could also be considered as an important risk factor for death. Since the prevalence of frailty is higher in older women than older men, as demonstrated in numerous studies, special attention should be directed to elderly women from both physiological and psychosocial perspectives. Low income was found to be another factor with a significant relationship with frailty in older people, necessitating that specific measures be taken to improve the financial conditions of the elderly and to draw the attention of legislators and policy makers to this issue.

The most important determinants of old-age frailty were comorbidities, the number of medications consumed and history of falls over the past year. It is therefore essential to design specific interventions to prevent the adverse outcomes of frailty.

Study limitations

Although our study is one of the first studies to investigate old-age frailty, it suffers from certain limitations, including the data collection instrument that was a self-report tool and that diagnosis of the diseases was not made by a physician. This research is not naturally able to clarify cause-and-effect phenomena.

Conflict of interest

The authors declare no potential conflicts of interests.

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Authors' contribution

Designing the study: HM, MMS, SMSh
Acquisition of data: MMS
Analysis and interpretation of data: HR, SMSh, HM
Drafting the manuscript: HM, HR, MMS, SMSh
All authors have read, critically reviewed and approved the final manuscript.

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