TWO-YEAR MORTALITY PROFILE IN ELDERLY WITH FRAILTY. AN OBSERVATIONAL DESCRIPTIVE STUDY IN ELDERLY HEALTH COMMUNITY IN SURABAYA, INDONESIA

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ABSTRACT

Indonesia in the next few years will face problems related to the increasing population of the elderly. Frailty becomes one of the most common health problems in the elderly. The prevalence of frailty in the Indonesian elderly range from 17% to 36.5%. Frailty raises the risk of death and health care costs, as well as functional disability, hospitalization, and fall risk. This was an observational descriptive study conducted in the elderly health community in Surabaya. This study aimed to determine the proportion and describe the associated factors of 2-year mortality in the elderly with frailty, so it can help determine appropriate preventive and intervention ways to prevent mortality and increase the quality of life in the elderly. There were 113 subjects. Most of the subjects had elementary school grade, married, had an income of less than 1.5 million rupiah/month, financially dependent, regularly exercised, did not use walking aids, and had no history of falls in the last year. The mortality rate within 2 years was 8.8% with the characteristics of older than 70 years old, had sarcopenia, decreased functional status, were at risk of malnutrition, CIRS score $\geq$ 5, moderate cognitive impairment, probably depression, and had components of exhaustion, slowness, and low physical activity based on the CHS Frailty.

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INTRODUCTION

Indonesia in the next few years will face challenges related to the increasing population of the elderly. This will have a major impact on health problems. One of the most common causes of health problems and death in the elderly is frailty syndrome. Frailty is a strong predictor of poor health outcomes in the elderly. Frailty increases the risk of death, functional disability, hospitalization, increased health costs, risk of falls, and decreased quality of life (Kojima, 2016). The prevalence of frailty in Indonesia is quite large. In a research in the Surabaya community in 2018, the prevalence of frailty was 36.5%, while in the community in Malang it was 35.4% (Sunarti et al., 2018; Widajanti et al., 2020).

Frailty is decreased physiological reserves of various body systems and the ability to maintain homeostasis, thereby increasing susceptibility to stressors (Fried et al., 2001; Kojima, 2016). Frailty is a dynamic condition in which a transition to improvement occurs if a stressor is overcome or intervention is given (Kojima, 2016). From various studies, frailty is one of the factors that increase the risk of mortality in the elderly, both in the short and long term (Kojima et al., 2015; Wang et al., 2019). Research on mortality profiles in the frailty group is very important to identify populations with possible high mortality risk in the community and determine the time and appropriate prevention.

Mortality in the elderly is influenced by internal and external factors, one of which is frailty. Physical frailty is associated with 1.5-2.6 times increased risk of mortality in the observation range of 1-9 years (Ekram et al., 2020). In the current state of the Covid-19 pandemic, frailty is also an aggravating factor and a predictor of mortality in the elderly. The components of Sarcopenia and the Comprehensive Geriatric Assessment (CGA) that include psychological, functional, and sociodemographic factors are also the factors that increase mortality in the elderly. Those sociodemographic factors include older age, male gender, malnutrition, functional disability, depression, dementia, and multiple comorbid conditions (Brandao et al., 2015; Naseer et al., 2015; Shakersain et al., 2015; Huang et al., 2016; Nunes et al., 2016).

Several studies in Indonesia on frailty and mortality in the elderly have been carried out in hospitalized patients, but there have been no studies in the community. This study was a follow-up study to determine the 2-year mortality profile in elderly frailty based on previous research data. By undertaking the research at the elderly health community, it was expected that real data on frailty in the elderly community can be obtained so that it can be the basis for determining appropriate preventive measures and interventions to prevent an increase in elderly mortality, and can be applied in the elderly health community.

MATERIALS AND METHODS

This was an observational descriptive study. The primary data were obtained using phone interviews with clinical officers in the elderly health community while the secondary data were obtained from previous research (Widajanti et al., 2020).

Study Setting

The primary data were collected in May 2021 from the elderly health community in Community Health Care Tambak Rejo, Sememi, Menur, Perak Timur, and Putat Jaya in Surabaya.

Study Population and Sampling Method

Subjects in this study were the elderly registered in 5 elderly health communities in Surabaya who participated in the previous research “Profile of sarcopenia and frailty in the elderly community in Surabaya” in 2018. The elderly included in this study were at least 60 years old in 2018 and had frailty based on CHS criteria from a previous study. As many as 113 subjects from the previous study had complete data and were included in this study. The study was conducted under ethical clearance No.89/EC/KEPK/FKUA/ 2021.

Study Instruments

This study used primary and secondary data. The primary data were mortality data taken by interviewing elderly health community clinical officers where the subjects were registered. Subsequently, the data were cross-checked with the list of elderly health community members in that year. The secondary data were taken from the previous research (Widajanti et al., 2020), including identity and sociodemographic data, frailty status, the severity of sarcopenia, nutritional status, functional status, depression status, cognitive status, and comorbidities. Frailty status was measured using the Cardiovascular Health Study (CHS) criteria, the severity of sarcopenia using the Asian Working Group for Sarcopenia (AWGS) parameters, nutritional status using the Mini Nutritional Assessment (MNA), functional status using the Barthel Activity of Daily Living (ADL) scale, depression status using the Geriatric Depression Scale (GDS), cognitive status using the Mini-Mental State Examination (MMSE) and comorbidity index using the Cumulative Illness Rating Scale (CIRS).

Based on the CHS scale, the measurement of frailty included unintentional weight loss, handgrip weakness, exhaustion, slowness of gait speed, and low physical activity. Furthermore, the subjects were classified as frailty if a minimum of three criteria were met, prefrailty if one or two criteria, and fit if none was met.

Statistical Analysis

The data were descriptively analyzed in the form of narration, tables, and figures.

RESULTS

In May 2021, a total of 113 subjects who met the criteria were screened for this study. Then, mortality data from the subjects was taken in 2020 to determine the 2-year mortality rate (starting from 2018 to 2020). Research subjects had an age range of 60-88 years (age recorded in 2018), a mean age of 66.62 years, and 70.7% of them aged less than 70 years. Most of the research subjects (85.8%) were women, married (52.2%), in elementary school grade (44.3%), and had an income of less than 1.5 million per month (83.2%). Most of the research subjects' were not self-financed (62.8%), while 14.2% of the subjects were still self-employed. More than half of the subjects (56.6%) did regular exercise and were still in active motion without using a walker aid. Subjects who had a history of falling in the last 1 year were 19.5%.

Table 1. General characteristics of the subjects in this study.

General Characteristics		Total n (%)
Age	Mean of 66.62 (60-88 years)	
	≥70 years old	33 (29.2)
	<70 years old	80 (70.8)
Sex	Male	16 (14.2)
	Female	97 (85.8)
Marital status	Married	59 (52.2)
	Divorced	53 (46.9)
	Not married	1 (0.9)
Educational level	No formal schooling	30 (26.5)
	Elementary school	50 (44.3)
	Junior high school	17 (15)
	Senior high school	12 (10.6)
	Diploma	2 (1.8)
	Bachelor	2 (1.8)
Monthly income	<1.5 million rupiah	94 (83.2)
	1.5-3 million rupiah	14 (12.4)
	>3 million rupiah	5 (4.4)
Finance	Not self-financed	71 (62.8)
	Partially self-financed	15 (13.1)
	Self-financed	16 (14.2)
	Pension	11 (9.7)
Use of walker	With walker	8 (7.1)
	Without walker	105(92.9)
Exercise	Not routinely	49 (43.4)
	Routinely	64 (56.6)
History of fall in the last year	Yes	22 (19.5)
	No	91 (80.5)

Based on the geriatric profile, most (57.6%) had sarcopenia, normal nutritional status (64.6%), independent functional status (55.2%), normal cognitive (66.5%) and not depressed (88.5%). Most of them still had a CIRS score ≤5 (69.9%).

Table 2 Geriatric Profile of the Subjects

Geriatric Profile		Total n (%)
Severity of sarcopenia	Severe sarcopenia	40 (35.4)
	Sarcopenia	23 (20.4)
	Presarcopenia	2 (1.8)
Nutritional status	Normal	48 (42.5)
	Malnutrition	3 (2.7)
	Probable malnutrition	37 (32.7)
	Normal	73 (64.6)
Functional status	Moderately dependent	4 (3.5)
	Mildly dependent	50 (44.2)
	Independent	59 (52.2)
Cognitive status	Moderate cognitive impairment	9 (8)
	Mild cognitive impairment	29 (25.7)
Depression status	Normal	75 (66.4)
	Depressed	3 (2.7)
	Probably depressed	10 (8.8)
	Normal	100 (88.5)
Comorbidity	CIRS >5	34 (30.1)
	CIRS ≤5	79 (69.9)

Frailty, functional disability, and comorbidity are closely related. There were 28 frail subjects (24.77%) who also had functional limitations as well as comorbidities, 26 frail subjects (23%) had functional disabilities, 6 frail subjects (5%) had comorbidities with a CIRS score >5, and 53 subjects (46.9%) who only experienced frailty.

Based on the components of the frailty according to the CHS, slowness contributed 28.8%, low physical activity 25.7%, exhaustion 19.48%, handgrip weakness 18.7%, and weight loss 7.2%.

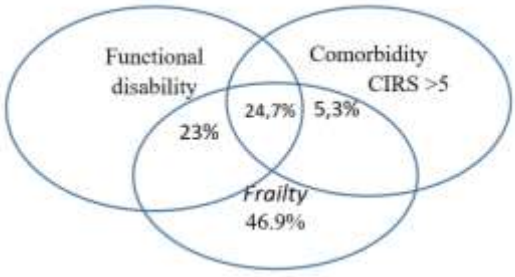

Figure 1 Overlap of frailty with functional disability, and comorbidity. 24.7% of subjects with frailty also had functional disability and comorbidity.

Frailty is considered to be a high-risk state predictive of a range of adverse health outcomes. There were 10 (8.8%) subjects who experienced mortality within 2 years. Based on the time of mortality, 10% experienced mortality in 6 months, 40% experienced mortality between 6 months and 1 year and 50% experienced mortality between 1 and 2 years. The cause of mortality for those 10 subjects was due to illness, none of them experienced mortality due to accidents. Most of those frailty subjects who were deceased had comorbidity with a CIRS score of more than five and also had a functional disability.

The age range of frailty subjects who experienced mortality was 60-84 years with a mean age of 69 years. The characteristic of frailty subjects who deceased was ≥ 70 years old (16.21%), male (31.25%), sarcopenia (17.85%), malnutrition risk status (21.62%), dependence in carrying out their activities (39%), CIRS score greater than 5 (17.64%), and probably depression (10%)

Table 3. Factors related to frailty

Factors related to frailty	Deceased n (%)	Alive n(%)	Total n (%)
Frailty subject			
Frailty only	2 (20)	51 (49.5)	53 (46.9)
Functional disability	2 (20)	24 (23.3)	26 (23)
CIRS score>5	0 (0)	6 (5.82)	6 (5.3)
Functional disability and CIRS score>5	6 (60)	22 (21.3)	28 (24.7)
Component CHS Frailty			
Slowness	10 (25)	101 (29.3)	111 (28.8)
Low physical activity	9 (22.5)	90 (26.1)	99 (25.7)
Exhaustion	10 (25)	65 (18.9)	75 (19.5)
Weakness	4 (10)	68 (19.7)	72 (18.7)
Weight loss	7 (17.5)	21 (6)	28 (7.2)

Based on the CHS frailty component, from 10 subjects who experienced mortality, all had exhaustion and slowness, 9 subjects had low physical activity, 7 subjects had weight loss and 3 subjects had a weakness (see table 3).

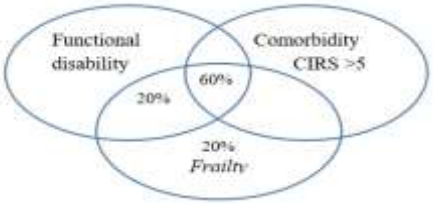

Figure 2. Comparison of overlapping of frailty, functional disability, and comorbidity in deceased and alive subjects

Table 4 Factors affecting the 2-year mortality of elderly with frailty.

	Mortality Factors	Deceased n (%)	Alive (n/%)
Age	Mean 69 (60-84 years old)		
	≥70 years old	6 (16.21)	31 (83.78)
	<70 years old	4 (5.26)	72 (94.73)
Sex	Male	5 (31.25)	11 (68.75)
	Female	5 (5.15)	92 (94.84)
Severity of sarcopenia	Severe sarcopenia	2 (5)	38 (95)
	Sarcopenia	5 (17.85)	23 (82.14)
	Presarcopenia	0 (0)	2 (100)
	Normal	3 (5.88)	48 (94.11)
Nutritional status	Malnutrition	0 (0)	3 (100)
	Probable malnutrition	8 (21.62)	29 (78.37)
	Normal	2 (2.73)	71 (97.26)
Functional status	Moderately dependent	1 (25)	3 (75)
	Mildly dependent	7 (14)	43 (86)
	Independent	2 (3.38)	57 (96.61)
Cognitive status	Moderate cognitive impairment	1 (11,11)	8 (88.88)
	Mild cognitive impairment	2 (6.45)	29 (93.54)
	Normal	7 (8.53)	75 (91.46)
Mental status	Depression	0 (0)	3 (100)
	Probably depression	1 (10)	9 (90)
	Normal	9 (9)	91 (91)
Comorbidity	CIRS>5	6 (17.64)	28 (82.35)
	CIRS≤5	4 (5.06)	75 (94.93)

Of the 28 frailty subjects who also had a functional disability and comorbid CIRS>5 based on Table 3, there were 6 subjects decreased (60%) and 22 subjects alive (21.3%). The 6 deceased subjects had a comorbidity score of more than 5, with the organ system attached including endocrine metabolic system (diabetes mellitus), hypertension, heart, and nervous system disease. All of the deceased subjects had slowness and exhaustion components of frailty based on CHS.

Table 5. Comorbidity based on CIRS score in the deceased subject

Organ system on CIRS score	Number n (%)
Cardiac	2 (20)
Hypertension	5 (50)
Vascular	2 (20)
Respiratory	4 (40)
Eye, ear, nose, throat	7 (70)
Upper gastrointestinal	6 (60)
Gastrointestinal	0 (0)
Hepatic	1 (10)
Renal	0 (0)
Other genitourinary	1 (10)
Musculoskeletal	6 (60)
Neurological	3 (30)
Endocrine/metabolic	5 (50)
Psychiatry	1 (10)

Most of the frailty subjects who experienced mortality had a CIRS score of more than 5. Seven subjects had problems in the eye, ear, nose, throat, and larynx. Six subjects had problems in the upper gastrointestinal and musculoskeletal tracts. Five subjects had problems with the endocrine system and hypertension, 4 subjects had breathing problems, 3 subjects had nervous system problems, 2 subjects had heart and vascular problems, and 1 subject had liver, genitourinary and psychiatric problems. There were no subjects who had problems with their lower gastrointestinal system and liver.

DISCUSSION

Frailty syndrome is affected by various factors. Along with age, the physiological reserves decrease, so the body's ability to deal with stressors will decrease. Women have less muscle mass and strength than men, and as they age, they lose more muscle mass (Fried et al., 2001). Physical, social, and environmental factors play a role. There are some risk factors for frailty, including low physical activity, low education level, loneliness, depression, disability, the severity of comorbid chronic disease, depressive symptoms, and lack of support and social contact. Poverty is also a risk factor for frailty in the elderly (Dent et al., 2016). Most subjects with frailty had sarcopenia because the sarcopenia assessment component is also a component of the CHS-based frailty assessment. The nutritional status was similar to the research by Perez-Ros et al., (2020) that most of the frailty subjects had normal nutritional status. Nutritional status is strongly related to the incidence of frailty, but poor nutritional status showed the acute condition of disease and the number of comorbidities (Wang et al., 2019). Based on the functional status from Barthel's ADL questionnaire, more than half of the frailty subjects had independent status. In contrast to Fried et al., (2001), only 27.4% of frailty subjects had limitations in ADL, but more had limitations in IADL, 59.7% and 71.7% with limited mobility. Langholz et al., (2018) also mentioned that subjects with frailty had a prevalence of disability of 91.7%. Most of

these frailty subjects had normal nutritional status and functional status, most likely because the subjects joined the elderly health community that had various programs for the health of their members.

The cognitive status assessment results of subjects in this research were similar to research by Langholz et al., (2018) where frailty subjects had a cognitive impairment of 35.3%. Depression only occurred in 2.7% of subjects and 8.8% probably had depression. On the other hand, the result in this study was different from the research conducted by Herr et al., (2018) showing a fairly high depression rate of 26.1%. This might be caused by the older average age of the subjects (86.3%) with higher comorbidities and low social support. Intellectual stimulation, adequate physical activity, and social involvement can reduce the occurrence of dementia and depression. In this study, the subjects were members of the elderly health community with the majority of CIRS comorbidities less than 5. Although the level of education of the subjects was mostly low, elderly health community activities, social support, and social involvement were higher and the level of physical activity was sufficient, so most still had normal cognitive and mental status

Research by Fried, et al., (2001) and Langholz et al., (2018) stated that 61.9% and 68% of frailty subjects had more than 2 comorbidities. Those differences because the comorbidity assessment of those studies was based on disease count and Charlson Comorbidity Index (CCI). CCI is reported to be reliable to show the correlation of morbidity with mortality and survival rate, but it does not show multiple comorbidities in the elderly. CIRS is superior in this regard (Fortin, 2005).

The functional disability conditions and comorbidities in this research were similar to the research by Fried et al., (2001) and Langholz et al., (2017) that there was a 21.5% and 22.4% overlap between frailty, functional disability, and comorbidity. Based on these studies, there were 21,5% of the subjects experienced frailty as well as functional disability and comorbidities. The overlap between frailty and functional disability indicates that this frailty phenotype can identify subjects at high risk for disability (Fried et al., 2001).

The CHS frailty assessment component in this study showed similar results as the frailty profile in Fried et al., (2001) that low physical activity was 22%, slowness was 20%, handgrip weakness was 20%, exhaustion was 17% and weight loss was 6%. In this study, slowness, low physical activity, and handgrip weakness accounted for the majority of the components of frailty being the prevalence of sarcopenia in the subjects.

The results of 2-year mortality in this research were similar to the study of Lee et al., (2014) that 8.84% of subjects with frailty experienced mortality. Greater results were found in the study of Ye, et al., (2020), which was 20.85% in 2 years but with a frailty index measurement scale. The research of Wang, et al., (2019) also found a high incidence of mortality, namely 8.46% in 1 year of observation, but with an older average age of the subjects (78.1 years). Fried et al., (2001) with a 3-year observation period showed mortality rates for frailty subjects of 18%.

The low mortality rate in this study indicated that the survival rate of frailty subjects is still quite high. The subjects of this study were members of the elderly health community who was still active, with a variety of activities that were routinely carried out to support the health of its members, such as elderly gymnastics, periodic health checks, distribution of additional food, social gathering, and other social activities. Most of the subjects lived with their families and in a friendly community environment. These various factors may be the reason for the high survival rate of frailty subjects in the elderly community.

Most of the frailty subjects who experienced mortality were male and over 70 years old. Men and older people have an increased risk of mortality in old age (Naseer et al., 2015; Huang et al., 2016). Research by Wang et al., (2019) in China regarding mortality in frailty obtained data showed that the average age of death was 78.11 years, with more mortality in males by 64.38%. Age reflects an accumulation of damage and decline in the ability of cells, tissues, organs, and organisms that eventually leads to death. It is this process that underlies the exponential relationship between age and mortality. Males have a lower survival rate than females. However, females have a higher prevalence of frailty and ADL disorders than males. This is called the 'male-female health survival paradox'. Better physiological capacity in females, hormonal factors, immune response, the ability to maintain homeostasis, and reduce oxidative stress become some protective factors in females than males (Crimmins et al., 2019).

Most of the frailty subjects who experienced mortality had sarcopenia. Sarcopenia in the elderly increases the risk of mortality (Liu et al., 2017). The combination of frailty and sarcopenia increases the risk of mortality compared to frailty only (Peterman-Rocha et al., 2020). The relationship between sarcopenia and the increased risk of mortality remains unclear. However, sarcopenia is known to be associated with the aging process, chronic disease, impaired mobility, and an unhealthy lifestyle. Mortality is also associated with these factors. The incidence of falls is more closely related to an increased risk of mortality in the elderly compared to other risk factors of sarcopenia, such as older age, muscle weakness, malnutrition, falls, low physical activity, and comorbidities (Liu et al., 2017).

The majority of frail subjects who experience mortality also had malnutrition risk status and dependence in carrying out their activities. Research from Shakersain et al., (2015) and Naseer et al., (2015) showed that malnutrition status and risk of malnutrition increased the risk of mortality. Wei et al., (2018) stated that the combination of frailty and the risk of malnutrition or malnutrition itself had a higher mortality risk than the frailty condition alone. Frailty status is known to be an important determinant of malnutrition in the elderly. Cognitive impairment and dementia are also important factors in the occurrence of malnutrition in the elderly. The presence of disease can reduce functional status, and lead to polypharmacy which can directly or indirectly cause malnutrition. Naseer et al., (2015) and Huang et al., (2016) in their research showed that functional disability increased the risk of mortality in the elderly. Functional disabilities in men accompanied

by nutritional disorders have a higher risk of possible mortality in the elderly. Functional status is an indicator of the quality of life. The presence of disturbances in this function is associated with various negative health outcomes, such as hospitalization, increased health costs, and mortality.

The frailty subjects who experienced mortality have moderate cognitive impairment. The findings in the study were similar to those of Naseer et al., (2015) and Huang et al., (2016), who found that cognitive impairment increased the risk of death. The combination of frailty and cognitive decline has a cumulative effect and increases the risk of mortality (Naseer et al., 2015). The mental status of the frailty subject who experienced mortality was probably depression (10%). This was in line with the study of Brandao et al., (2015), which showed that the co-incidence of frailty with depression and decreased functional status increased the risk of mortality compared to frailty alone.

Comorbidity increases the risk of mortality in the elderly. The presence of more than 2 comorbidities will increase the risk of mortality more than without comorbidities. Comorbidity is also one of the causes of disability, frailty, and a decrease in the quality of life of the elderly (Nunes et al., 2016).

Frail subjects who experienced mortality mostly had slowness, exhaustion, and low physical activity based on the CHS frailty component. This result was slightly different from the research by Wang et al., (2019) in which slowness, weakness of grip strength, and low physical activity predominated with percentages of 38%, 29%, and 15% of mortality, respectively. This may be because the study subjects were older (mean 73 years) compared to the current study (mean 66.62 years), and the measurement included both prefrailty and fit subjects who experienced mortality. Slow walking speed is a factor that increases the risk of mortality with increasing age. Step speed requires muscle strength, joint movement, proprioceptive coordination, balance, adequate cardiorespiratory function, and good mental concentration, all of which decline with age (Wang et al., 2019; Espinoza et al., (2012) mentioned that subjects who had slowness were at risk of mortality in a 6.4-year observation. Exhaustion was also experienced by all frail subjects who experienced mortality. Exhaustion reflects reduced physical and mental energy, thereby limiting physical activity and leading to sedentary behavior, which could decrease physical abilities and increase the risk of functional limitations and mortality. Along with frailty, fatigue occurs last (Stenholm et al., 2018). Physical ability can be a marker of disease and reflects general health status. Low physical activity is associated with mortality. Of the elderly who had low physical activity, 41.7% experienced mortality in 6.4 years (Espinoza et al., 2012)

Weight loss is the last component because this indicates an acute condition of disease (Wang et al., 2019). However, this weight loss also increased the risk of mortality. Espinoza et al., (2012) also showed that among the elderly who experienced weight loss, 30.8% experienced mortality in 6.4 years. Decreased handgrip strength in the elderly also reflects decreased muscle function and has been recognized to increase the risk of mortality and is not affected by

comorbid diseases. As humans get older, muscle mass tends to decrease as well, which will cause a decrease in strength and musculoskeletal function and cause various difficulties in maintaining ADL (Wang et al., 2020). Espinoza et al., (2012) stated that 40.5% of the elderly who had handgrip weakness experienced mortality in 6.4 years. Overall, this study's results were by research from Aarts et al., (2015), which stated that frailty conditions, functional disability, and comorbidities increased the risk of mortality. Most of the subjects who experienced the three conditions simultaneously had CHS frailty components of exhaustion and slowness (Aarts et al., 2015). The overlap between frailty, functional disability, and comorbidity begins with a disease process that causes impairment and eventually leads to functional limitations and disability. All of these stages of the process have the potential to increase the risk of frailty occurring and worsening the frailty. The increased risk of mortality in frailty, which is also accompanied by functional disability and comorbidities, is primarily due to an increase in disability and the severity of the disease (Espinoza et al., 2012).

CONCLUSION

Mortality in the elderly frailty was 8.8% within 2 years and was related to an age $\geq$ 70 years, sarcopenia, decreased functional status, risk of malnutrition, comorbidities based on a CIRS score greater than 5, moderate cognitive impairment, and probably depression. Based on the CHS frailty component, subjects who experienced mortality had slowness, exhaustion, and low physical activity. Further research is needed with a prospective cohort design with larger sample size and longer observations to see better frailty survival, as well as including objective variables such as laboratory data and statistical analysis.

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