
ORIGINAL ARTICLE**Prevalence and determinants of frailty among rural elderly in Trivandrum, South Kerala: A community-based cross-sectional study with geriatric depression screening***Alan J Kizhakkel¹, Mia George Kallumkal^{1*}, Y Suba Joice¹**¹Department of Community Medicine, Dr. Somervell Memorial CSI Medical College Karakonam, Trivandrum- 695504 (Kerala) India*

Abstract

Background: Frailty is characterized by progressive loss of reserve and adaptive capacity with a general decline in health that can lead to hospitalization, significant use of healthcare resources, impairment, loss of independence and death. Depression is a mental disorder that is characterized by loss of enjoyment, interest, lack of self-worth, disrupted routine activities and impaired concentration. **Aim and Objectives:** This study aimed to estimate prevalence of frailty and the factors associated with it among geriatric population in a rural part of Trivandrum district, South Kerala, India. The study also aimed to screen for geriatric depression among the participants. **Material and Methods:** A community based cross-sectional study was carried out among elderly (> 60 years) from two wards of Kunnathukal Panchayat, using systematic random sampling to select 300 participants. Epicollect5 was used to collect the data with a pre-designed semi-structured questionnaire administered to the participants by principal investigator and entered using Microsoft Excel 2021. Statistical Package for the Social Sciences software was utilized for the analyses. **Results:** Among the 300 study participants, 13.6% (41 participants) of the elder individuals had frailty. The prevalence of frailty was associated with marital status ($p = 0.001$), spouse ($p = 0.000001$), living arrangement ($p = 0.039$) and pension ($p = 0.003$). Frailty was linked to lifestyle characteristics such as sleep ($p < 0.001$), regular exercise ($p < 0.001$), and pack-years for smokers ($p = 0.050$). Furthermore, hypertension ($p = 0.000351$), diabetes ($p < 0.001$), chronic kidney diseases ($p = 0.000257$), cardiovascular diseases ($p = 0.006$) and dyslipidemia ($p = 0.010$) were associated lifestyle diseases. Nearly, 12% (36 participants) were screened positive for geriatric depression. Statistically frailty and depression were associated ($p = 0.000003$). **Conclusion:** This study highlights a notable prevalence of frailty among elderly. Screening for geriatric depression also identified a substantial proportion of participants at risk of depressive symptoms. Taken together, the findings of our study, frailty and geriatric depression are multifactorial conditions, underlining the urgent need for integrated interventions to improve the health standards of the elderly.

Keywords: Community Study, Depression, Frailty, Geriatric

Introduction

Frailty is defined as progressive loss of reserve and adaptive capacity associated with an overall deterioration in health that can result in disability, loss of independence, hospitalization, extensive use of healthcare resources, admission to long-term care and death [1]. The frailty phenotype includes five characteristics weakness, fatigue, weight loss,

physical illness and poor endurance [2]. Depression is a mental health disorder characterized by a gloomy feeling, a loss of enjoyment and interest, lower energy, guilt or a lack of self-worth, disrupted sleep or meals, and impaired concentration [3]. A steady rise in the elderly population with a higher growth than in previous decades is observed by the

2011 Indian National Census. For day-to-day maintenance, 65 % of our older population is economically dependent on others. This is contrary in rural areas, where the elderly still continue as daily wage workers even with their deteriorating health. Pension schemes offered by government may not be distributed regularly, which is the only source of day-to-day maintenance for many aged who are unable to go for work. Geriatric population is more susceptible to various lifestyle diseases as they are not routinely screened for these diseases [4]. Moreover, they face difficulty of depression due to loneliness and burden of comorbid diseases [5]. Diseased elderly often become a burden to the family. In the Indian scenario most of the population cannot afford the cost of treatment and often refuse hospitalization and medical treatment for various diseases. Thus, they present to the hospital critically ill. Many elderlies who have had a fall experience a fear of falling again leading to decreased activity, depression and increased susceptibility of falling again [6]. We aimed to conduct a community based cross sectional study to screen elderly to identify those at risk of potential falls and verge of disturbed mental health. The correlation between frailty and various unfavorable health consequences is well-established. However, the contribution of the social and economic context to the emergence of frailty is not as well-defined. There has been a remarkable advancement in technologies and better health care facilities. This offers elderly a better life expectancy [7]. The rural population still have access to bare minimum advancements [8]. Understanding the prevalence of frailty helps physicians to raise awareness among the caretakers of the elderly, educate the care-givers regarding risk of falls and motivate to adopt various preventive practices and methods to prevent falls. Thus, ensuring elderly a better

quality of life. Providing them proper physical and mental rehabilitation will help to improve their health standards. This study aimed to determine the prevalence of frailty and to screen for geriatric depression.

Material and Methods

Study design and setting: This community based cross-sectional study was conducted for 3 months (November 2024 – January 2025), among the geriatric population residing in two wards under Kunnathukal Panchayat of Trivandrum district in South of Kerala, after getting the Institutional Ethics Committee (IEC) approval on November 2024 (IEC No. SMCSIMCH/EC(PHARM)07/18/20).

Study population and sample size: Elderly individuals (≥ 60 years) residing at Karakonam and Nilamammoodu wards of Kunnathukal Panchayat were recruited. Elderly with senile dementia, diagnosed psychiatric illnesses and non-ambulatory individuals were excluded. A sample size of 285 ~300 participants was calculated considering relative deviate at 95% confidence level (1.96) and prevalence of 24.7 % as estimated in the cross-sectional study conducted in rural Bengaluru among elderly by K Shilpa *et al.* [8].

Sampling technique: Systematic random sampling was employed. We selected two wards namely, Karakonam (Ward 12) and Nilamammoodu (Ward 10) where 673 elderly reside according to the information maintained by the Family Health Centre (FHC) Kunnathukal. The aforementioned list of elderly was obtained. There were 314 and 359 elderly residents in Karakonam and Nilamammoodu respectively. Numbers were assigned to each of the elderly. From each ward, 150 elderly participants were selected for the study. A random number between 1 and 150 was generated using 'Random Number

Generator'. Every second individual from the list was selected thereafter until we had the required sample size.

Study Tools: A predesigned pretested semi-structured questionnaire was used to gather data.

SECTION A: Sociodemographic details.

SECTION B: The Edmonton Frail Scale [9] and Geriatric Depression Scale-15 (Short Version) [10-11]. The Edmonton Frail Scale assesses 9 frailty domains and give appropriate scores. If the score ≤ 5 , the participant is not frail. Scores between 6-7 is labelled as vulnerable. A score ≥ 8 is considered frailty and is stratified into mild, moderate and severe frailty.

Geriatric Depression Scale-15 (Short Version) is a screening tool and not diagnostic of depression. A score of ≥ 5 need clinical investigation.

Ethical consideration: After obtaining approval of IEC, the research was conducted. Written informed consent was acquired. Confidentiality of the obtained information from the participants were maintained by not revealing personal identification details. The principal investigator and guide have access to the password-protected system where the data is entered and stored. Adequate permissions were taken before the data was collected. The participants identified as frail were advised to consult department of physical medicine and rehabilitation and those having depressive symptoms to psychiatry department of the base hospital.

Statistical analysis

Data were collected via Epicollect5 using a predesigned semi-structured questionnaire administered to the study subject by the principal investigator. Data was collated in an Excel sheet and coded. Statistical Package for the Social Sciences (version 27) was utilized for the analyses. Quantitative data was expressed using mean and standard

deviation, while qualitative data was described using frequencies and percentages. Frailty was scored into mild, moderate and severe. Association between sociodemographic factors and frailty were tested using the Pearson Chi-Square and Fisher's Exact Test.

Results

The study population's mean age was found to be 70.67 ± 9.1 years. More than half of the participants in our study were elderly women, making up to 159 (53%) participants (N = 300). The mean height of the population was 159.93 ± 10.47 centimeters. The mean weight was around 61.53 ± 10.83 kg. The mean Body Mass Index (BMI) of the study participants was 27.67 ± 3.45 kg/m². According to Modified BG Prasad scale, 112 (37%) participants belonged to the middle class family. Among the 300 study participants, 293 (98%) were married, 285 (95%) lived with their families and 218 (73%) participants had their spouse alive. Nearly 73 (23%) individuals had high school education.

Table 1 shows different social security schemes and various lifestyle factors of the study population. More than half the population accounting to 168 (56%) individuals were predominantly dependent on various pension schemes. Among the 168 participants responded as receiving various pensions schemes, 112 (67%) participants were receiving old age pension. Majority of the study population belonged to Below Poverty Line (BPL) ration card forming 205 (68%) participants. Almost 275 (92%) participants followed mixed diet and 47 (16%) participants consumed alcohol. Among the study participants 72 (24%) participants were smokers and they were classified into light (46%), moderate (37.5%) and heavy (16.5%) smokers. Nearly 154 (51%) participants had regular exercise (brisk walking for 30 minutes) and 212 (71%) slept for ≥ 6 hours.

Figure 1 implies that among the 300 study participants, 164 (55%) individuals had hypertension, followed by 116 (39%) participants with diabetes mellitus, 64 (21%) participants with dyslipidemia, 40 (13%) participants with cardiovascular diseases, 20 (7%) participants with rheumatoid arthritis, 19 (6%) participants with chronic obstructive pulmonary disease, 12 (4%) participants with chronic kidney disease and 4 (1%) participants with osteoarthritis. Our study found that 41 participants had frailty as assessed by The Edmonton Frail Scale accounting to a prevalence of 13.6%. Nearly, 36 participants (12%) were screened positive for geriatric depression according to the Geriatric Depression Scale-15 (Short Version).

Figure 2 implies among the 300 study participants, 41 (13.6%) had frailty. Nearly 7 (2.4%) participants were at risk of developing frailty. Among the 41 participants, 38 (12.7%), 2 (0.6%), 1 (0.3%) participant had mild, moderate and severe frailty, respectively.

Table 2 implies that a statistically significant association ($p=0.001$) was obtained between status of marriage and frailty. Frailty was lower for married participants with 36 (12.3%) identified as frail, while 257 (87.7%) showed no frailty. In contrast, the unmarried group had a smaller count but a higher frailty proportion with 5 (71.4%) frail and 2 (28.6%) individuals with no frailty. This difference was found to be statistically significant ($p < 0.001$). Living arrangement of the participant was identified as an associated factor for frailty ($p = 0.039$). Our study identified a higher proportion of frailty among individual's dependent on pension and it was statistically significant ($p=0.003$).

Table 3 shows that lifestyle factors such as smoking ($p=0.050$), sleep ($p < 0.001$) and regular exercise ($p < 0.001$) were other associated factors identified among the study population for the prevalence of frailty. Heavy smokers (41.7%), participants with no regular exercise (24.0%) and sleep < 6 hours (43.9%) were increasingly affected as compared to the rest. Various lifestyle diseases were found to be statistically associated with frailty, like hypertension ($p = 0.000351$) diabetes ($p = 0.000119$), chronic kidney disease ($p = 0.000257$), cardiovascular diseases ($p = 0.006$) and dyslipidemia ($p = 0.010$). Diet ($p = 0.065$) of the participants and ration card ($p=0.072$) were factors which were nearing statistical significance.

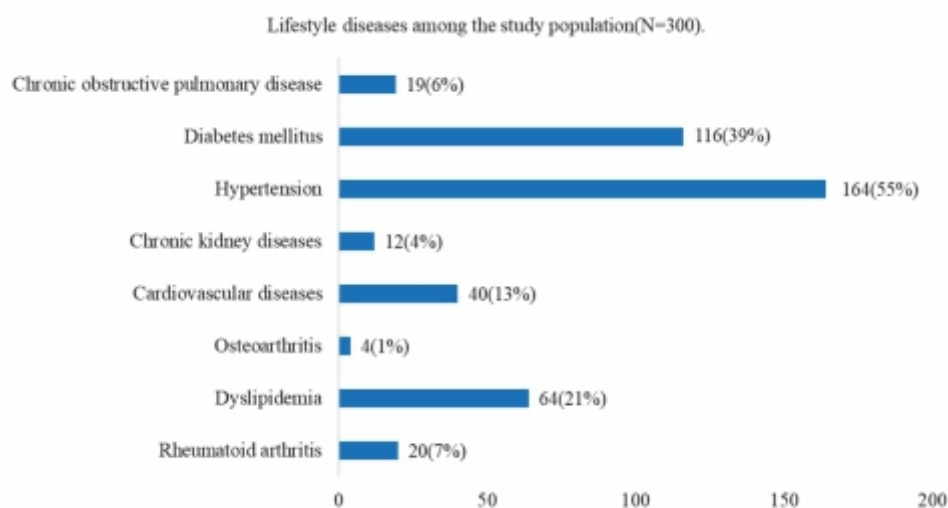
Table 4 implies that among elderly with symptoms of depression, 38.9% of participants had frailty, 8.3% of participants were at risk of frailty and 52.8% of participants had no frailty. However, among elderly who did not have symptoms of depression 10.2%, 1.5%, 88.3% of participants had frailty, at risk of frailty and no frailty respectively. This difference was found to be statistically significant ($p=0.000003$).

The participants identified to have frailty were advised to consult the department of Physical Medicine and Rehabilitation (PMR). Participants scoring more than five on the Geriatric Depression Scale-15 (Short Version) were advised to consult the Psychiatry department of the base hospital. Following the evaluation by PMR, participants were advised to procure any assisted devices as suggested by PMR.

Table 1: Income, social security schemes and lifestyle factors of the study population (N = 300)

Variable	Categories	N (%)
Financial dependence	Self	57 (19%)
	Family	75 (25%)
	Any old age pension schemes	168 (56%)
Pension schemes(n=168)	Old age pension	112 (67%)
	Farmers pension	20 (12%)
	Widow pension	36 (21%)
Ration Card Holder	APL	95 (32%)
	BPL	205 (68%)
Diet	Mixed diet	275 (92%)
Consumption of Alcohol	Yes	47 (16%)
Smoking status	Yes	72 (24%)
Smoker classification based on pack years (n = 72)	Light-smoker (< 10 years)	33 (46%)
	Moderate-smoker (10-20 years)	27 (37.5%)
	Heavy-smoker (> 20 years)	12 (16.5%)
Regular exercise	Yes	154 (51%)
Sleep	≥ 6 hours	259 (86%)

APL – Above poverty line; BPL – below poverty line

**Figure 1: Lifestyle diseases among the study population (N = 300)**

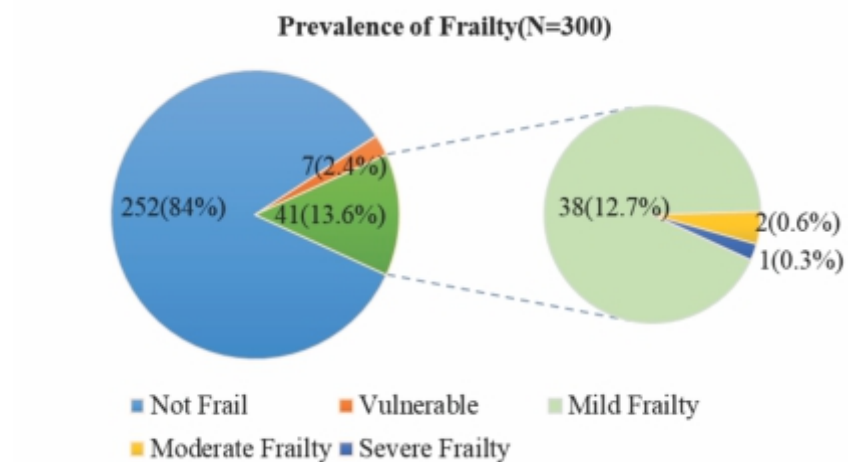


Figure 2: Prevalence of frailty and its categorization among the study population (N = 300)

Table 2: Association between sociodemographic variables and frailty (N = 300)

Variable	Categories	Frailty		<i>p</i>
		Present	Absent	
Gender	Male	19 (13.5%)	122 (86.5%)	0.928*
	Female	22 (13.8%)	137 (86.2%)	
Socioeconomic class (Modified BG Prasad Scale)	Upper	2 (14.3%)	12 (85.7%)	0.690**
	Upper-Middle	10 (10.1%)	89 (89.9%)	
	Middle	18 (16.1%)	94 (83.9%)	
	Lower-Middle	10 (14.5%)	59 (85.5%)	
	Lower	1 (16.7%)	5 (83.3%)	
Marital status	Married	36 (12.3%)	257 (87.7%)	0.00001**
	Unmarried	5 (71.4%)	2 (28.6%)	
Spouse	Alive	17 (7.8%)	201 (92.2%)	
	Dead spouse	19 (25.3%)	56 (74.7%)	0.039**
	Unmarried	5 (71.4%)	2 (28.6%)	
Living arrangement	Alone	5 (33.3%)	10 (66.7%)	0.628*
	With family	36 (12.6%)	249 (87.4%)	
Financial dependence	Self and pension schemes	32 (14.2%)	193 (85.8%)	0.628*
	Family	9 (12.0%)	66 (88.0%)	

Continued...

Pension schemes	Old age pension	17 (14.7%)	98 (85.3%)	0.003*
	Farmers pension	6 (30.0%)	14 (70.0%)	
	Widow pension	9 (25.0%)	27 (75.0%)	
	No pension schemes available	9 (7.0%)	120 (93.0%)	
Ration card	APL	8 (8.4%)	87 (91.6%)	0.072*
	BPL	33 (16.1%)	172 (83.9%)	

*=Pearson Chi-Square. **=Fisher's Exact Test

Table 3: Association of lifestyle factors and diseases with frailty (N=300).

Diet	Vegetarian	0 (0.0%)	18 (100.0%)	0.065**
	Mixed	41 (14.5%)	241 (85.5%)	
Consumption of alcohol	Never	37 (14.6%)	216 (85.4%)	0.402**
	Monthly	2 (6.1%)	31 (93.9%)	
	Weekly	1 (10.0%)	9 (90.0%)	
	Daily	1 (25.0%)	3 (75.0%)	
Smoking status	Never	31 (13.6%)	197 (86.4%)	0.122**
	Former	9 (20.5%)	35 (79.5%)	
	Current	1 (3.6%)	27 (96.4%)	
Pack year classification for smokers	Non-smoker (0 years)	31 (13.6%)	197 (86.4%)	0.050**
	Light-smoker (<10 years)	3 (9.1%)	30 (90.9%)	
	Moderate-smoker (10-20 years)	2 (7.4%)	25 (92.6%)	
	Heavy-smoker (> 20 years)	5 (41.7%)	7 (58.3%)	
Regular exercise (Brisk walking for 30 minutes a day)	Yes	6 (3.9%)	148 (96.1%)	<0.001*
	No	35 (24.0%)	111 (76.0%)	
Sleep (Non-fragmented sleep)	< 6 hours	18 (43.9%)	23 (56.1%)	<0.001*
	≥ 6 hours	23 (8.9%)	236 (91.1%)	
Hypertension	Yes	33 (20.1%)	131 (79.9%)	0.000351*
	No	8 (5.9%)	128 (94.1%)	
Chronic obstructive pulmonary disease	Yes	5 (26.3%)	14 (73.7%)	0.156**
	No	36 (12.8%)	245 (87.2%)	
Diabetes mellitus	Yes	27 (23.3%)	89 (76.7%)	0.000119*
	No	14 (7.6%)	170 (92.4%)	

Continued...

Chronic kidney diseases	Yes	7 (58.3%)	5 (41.7%)	0.000257^{**}
	No	34 (11.8%)	254 (88.2%)	
Cardiovascular diseases	Yes	11 (27.5%)	29 (72.5%)	0.006[*]
	No	30 (11.5%)	230 (88.5%)	
Osteoarthritis	Yes	1 (25.0%)	3 (75.0%)	0.446 ^{**}
	No	40 (13.5%)	256 (86.5%)	
Dyslipidemia	Yes	15 (23.4%)	49 (76.6%)	0.010[*]
	No	26 (11.0%)	210 (89.0%)	
Rheumatoid arthritis	Yes	3 (15.0%)	17 (85.0%)	0.533 ^{**}
	No	38 (13.6%)	242 (86.4%)	

^{*}=Pearson Chi-Square. ^{**}=Fisher's Exact Test

Table 4: Association between frailty and geriatric depression (N = 300)

Geriatric depression Symptoms	Frailty			p
	Not Frail	Vulnerable	Frailty	<0.001^{**}
Present	19 (52.8%)	3 (8.3%)	14 (38.9%)	
Absent	233 (88.3%)	4 (1.5%)	27 (10.2%)	

^{**}=Fisher's Exact Test

Discussion

The prevalence of frailty was estimated to be 28% in cross-sectional research done among 408 elderly residents of Thanjavur district of Tamil Nadu [12]. This number is much higher as compared with the results of our study that estimated a prevalence of 13.6% in the Southern part of Kerala. The cross-sectional study done among 240 elderly individuals residing in Trivandrum district of Kerala revealed a prevalence 29.2% for frailty [13]. The higher prevalence of frailty in this similar study can be attributed to selection of nearly 44 candidates who could not complete their activities of daily living [13]. Our study was done completely among rural population while the study done in Trivandrum had

equal distribution among urban and rural population. Many studies conducted in India have estimated the frailty prevalence ranging from 11 to 59%. This suggests a critical variation across the states [14].

Existing literature suggests that the proportion of people diagnosed with depression as assessed among elderly in India vary between 13% to 54% [15]. A study conducted in Pune revealed a proportion of 52.4% for geriatric depression [16]. A similar study done in rural Maharashtra estimated a proportion of 13% [17]. Proportion of people diagnosed with depression was estimated to be 39% among the aged people residing in Thrissur district of Kerala

[18]. A cross-sectional study that examined the prevalence of depression among elderly residents of Japan concluded that 33.5% of community-dwelling elderly were reported to be mildly depressed [19]. According to these estimations, the screen positive proportion of 12% in this study is lower when compared to other existing literatures carried out in developing and developed countries. Compared to unmarried individuals, married people typically have reduced levels of loneliness, anxiety, and depression. In addition, couples frequently have an impact on one other's lifestyle decisions, promoting better disease management, better nutrition, and regular medical checkups. According to our study, unmarried individuals, individuals living alone and individuals with their spouse lost were more prone to develop frailty. These observations were congruent to the results of the research conducted in Nagasaki Islands of Japan among 614 male individuals where the frailty prevalence of 38.1% was obtained among men living alone [20].

Lack of social safety, insufficient savings, and restricted access to steady pensions, force older people in rural areas to work as daily wage laborers. They are more vulnerable to experience falls which they neglect resulting in deferring the warranted medical care. Pensions are meant to ensure financial stability in old age, but the level of financial independence they offer varies widely based on living costs, family dynamics, and health issues. In our study population, nearly 43% were not dependent on pension schemes and were daily wage workers. They had physical fitness to do work so the chance of them becoming frail was less. This can be attributed as reason for higher prevalence of frailty among participants solely dependent on

pension for their financial needs. Contrary to this, a study from Mexico [21] concluded that people who were paid monthly pension used it as a support to improve their health.

One of the major known factors for frailty in older persons is smoking. Smokers are more prone to have heart problems, respiratory disorders, and low bone density, all of which raise risk of frailty. Our study found a significant association with smoking and frailty. This is similar to the results of the study done among 2049 Mexican Americans, where smoking was identified as a predictive factor for frailty [22]. Development of frailty is significantly associated to disturbed sleep pattern such as insomnia [23]. Regular exercise improves cardiovascular fitness and muscle strength. Exercise is a protective factor from developing frailty [22]. Our study draws similar conclusion.

Existing literature identifies a higher prevalence of frailty among participants with lifestyle diseases like diabetes, dyslipidemia and hypertension [24-26]. These lifestyle diseases when not detected early and treated properly can lead to major complications such as chronic kidney diseases and cardiovascular diseases. Therefore, it is essential to integrate greater awareness among elderly about various screening programs offered by the government for early detection and treatment. Existing studies do not compare in depth about the various lifestyle diseases and its complicated stages. Our study identified increased incidence of frailty among the elderly having chronic kidney diseases and cardiovascular diseases. Similar findings were seen in a research done among participants with diagnosed chronic kidney diseases and patients vulnerable for developing cardiovascular diseases [27-28].

Healthy aging depends heavily on mental health,

and elderly are more vulnerable to disorders like depression, anxiety and insomnia. Frailty may interfere with day-to-day functioning and increase social isolation, both of which lead to the emergence of depressive symptoms. Contrary to this, depression can hasten frailty by worsening physical deterioration through factors like low quality diet, reduced routine physical activity and disturbed sleep. Thus, there exist a bidirectional relationship between frailty and geriatric depression. Elderly with frailty are more prone to develop depression, while elderly who experience depression are likely to eventually become frail, based on existing international literatures [29-30] which is in par with our results. To break the cycle and improve the quality of life among elderly, it is crucial to provide

comprehensive assessment and therapy that addresses both physical function and mental health.

Conclusion

This study highlights a notable prevalence of frailty among elderly. Screening for geriatric depression also identified a substantial proportion of participants at risk of depressive symptoms. Taken together, the findings of our study, frailty and geriatric depression are multifactorial conditions, underlining the urgent need for integrated interventions to improve the health standards of the elderly.

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