Frailty syndrome among oldest old individuals in a health macro-region of Minas Gerais

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Abstract

Objective: to identify frailty conditions and their associated factors among oldest old individuals living in the urban area of a health macro-region of Minas Gerais state. *Methods:* a cross-sectional study of 314 oldest old from a health macro-region in Minas Gerais state, Brazil, was conducted. Data were collected from households by applying instruments validated for use in Brazil. Descriptive and multinomial logistic regression analyses ($p<0.05$) were carried out. *Results:* In the sample assessed, 44.3% of the oldest old were frail, 44.3% pre-frail and 11.4% non-frail. The pre-frail condition was associated with living alone ($p=0.047$) and very poor/poor physical performance ($p=0.026$), while frailty was associated with very poor/poor physical performance ($p<0.001$), the presence of depressive symptomatology ($p=0.029$) and of ≥5 morbidities ($p=0.003$). *Conclusion:* pre-frail and frail conditions predominated among the oldest old assessed. Maintaining physical performance is an aspect that can be targeted by health professionals in oldest old to delay pre-frailty and frailty.

Keywords: Aged, 80 and over. Frail Elderly. Frailty. Geriatric Nursing.

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INTRODUCTION

Greater life expectancy is accompanied by an increasing relative importance of older adults and more advanced age groups, which are growing at a rapid pace[1]. Oldest old, defined as individuals aged ≥80 years, currently represent 2.0% of the Brazilian population, a proportion set to rise to an estimated 8.8% by 2060[1,2].

During the aging process, there is often a decline in physiological reserves, e.g. muscle mass, whose decrease is a strong predictor of adverse health outcomes in the older population, such as frailty syndrome[3]. This multifactorial biological syndrome is characterized by a reduction in muscle strength and resistance and in physiological function, leading to increased vulnerability of the individual and risk for developing functional dependence and/or death[4].

The prevalence of frailty syndrome is significantly greater in the oldest old, with rates of 11.2-84.7%[5-7] reported in the international literature and 14.8-58.0%[8-10] in national studies. However, investigations in oldest old reveal that, besides more advanced age[6,9], frailty syndrome is associated with being female [6,11]; having no partner[12]; high number of morbidities[13]; presence of depressive symptoms[5,14,15], poor physical performance[5,16] and with functional disability for performing activities of daily living (ADLs)[7,15].

Identifying the presence of clinical factors that negatively impact the health of older people associated with rigorous assessment of frailty markers can allow proper management of the syndrome by devising effective care interventions for this age group[8-10]. To this end, studies analyzing frailty conditions and their associated factors in oldest old are vital to inform health priorities and interventions.

With an emphasis on the growing population of oldest old[1,2], a group more vulnerable to frailty syndrome[5-10], the current investigation sought to help further the knowledge on this subject. There is a dearth of studies addressing the sociodemographic and health factors associated with frailty conditions in oldest old individuals[14] and, hence, the study findings can support improvements in the healthcare service for the older population.

Therefore, the study objective was to identify frailty conditions and their associated factors among oldest old individuals from an urban area of a health macro-region of Minas Gerais state, Brazil.

METHOD

A cross-sectional analytical investigation, guided by the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) tool, was carried out in a health macro-region of Minas Gerais state. This macroregion comprises 3 health microregions encompassing 27 cities with a population of 806,172 individuals. Of this population, 15.6% are aged ≥ 60 years and, within this subgroup,14.8% are oldest old individuals[2].

The study sample consisted of oldest old living in an urban area of the 27 cities making up the health macroregion of Minas Gerais state (MG), Brazil. The calculation of sample size was based on the prevalence of frailty in oldest old of 14.8%[9], an accuracy of 5% and a 95.0% confidence interval, giving a sample of 277 oldest old individuals. Allowing for sample loss of 20.0%, the maximum number of attempted interviews was 332.

The sample of oldest old was selected using multi-stage cluster sampling. In the first stage, randomization of 50% of census sectors of each city of the health macroregion was performed using systematic sampling. Subsequently, for each city, the number of households to be selected, proportional to the total number of older residents in the 27 cities of the health macroregion, was calculated. The number of households was then divided by the number of census sectors, yielding a similar number of older people to be interviewed in each census sector. Lastly, in each census sector, the first household was randomly selected, while the rest of the households were selected in a standardized clockwise fashion until the sample for the sector was saturated.

The inclusion criteria were: participant age ≥80 years; and living in the health macro-region of Minas Gerais state (MG). Exclusion criteria were: being institutionalized; presenting cognitive decline, as measured by the Mini-Mental State Exam (MMSE)[17]; severe stroke complications involving loss of muscle

strength in upper and lower limbs and aphasia; advanced stage or unstable Parkinson´s disease and impaired movement, speech and/or affectivity.

A total of 320 oldest old individuals were interviewed, of which 6 had cognitive impairment. Thus, the final study sample comprised 314 oldest old participants.

Data collection was carried out at the households of participants between May 2017 and June 2018 through direct interview. The interviews were conducted by 10 interviewers from the health area who underwent training and education including awareness of the ethical aspects of the study.

Sociodemographic data and morbidities were collected by applying a structured questionnaire devised by members of the Public Health Research Group.

Physical performance was measured using the Brazilian version of the Short Physical Performance Battery (SPPB) according to the sum of points on tests of balance, gait speed and repeated chair stand test (5 times). Total score ranges from 0-12 points, classified as: very poor performance (0-3 points); poor performance (4-6 points), moderate performance (7-9 points) and good performance (10-12 points)[18].

Depressive symptoms were assessed using the short form of the Geriatric Depression Scale, validated for use in Brazil, comprising 15 items and scored on a scale ranging from 0 to 15 points[19]. A score greater than 5 on the scale indicated the presence depressive symptoms[19].

Functional capacity was measured using basic activities of daily living (BADLs)[20] and instrumental activities of daily living (IADLs)[21]. The Katz Index, adapted for the Brazilian context, was used to assess BADLs, a 6-item scale measuring the subject´s performance for self-care activities[20]. Lawton & Brody´s scale, validated for use in Brazil, was used to assess IADLs. Scores on the scale range from 7 (greater level of dependence) to 21 (full independence), rating the individual as totally dependent (7 points), partially dependent (8-20 points) or independent (21 points)[21].

The frailty syndrome was identified based on the 5 components of the frailty phenotype: (1) unintentional weight loss; (2) self-reported exhaustion and/or fatigue; (3) reduced muscle strength; (4) slow gait speed; (5) low level of physical activity[3]. The first component was assessed by the question: "In the past year, have you unintentionally lost more than 4.5kg or 5% of your body weight?". The second component was measured by 2 questions from the Brazilian version of the Center for Epidemiological Studies Depression Scale, items 7 ("I felt that everything I did was an effort") and 20 ("I could not get "going")[22]. For the third component, hand-grip strength was measured using a Jamar Saehan® (SH5001 – 973) hydraulic hand dynamometer. Three measures were obtained, expressed in kilograms/force (kgf), with a 1-minute interval between tries. The mean value was recorded and cut-offs were applied according to gender and body mass index[3]. Regarding the fourth component, timed gait (seconds) was performed. The participant walked a total distance of 8.6 meters, where the first and last 2 meters were disregarded for the calculation of gait time. Three measurements were made, with the average time recorded and cut-off points adjusted by gender and height[3]. The fifth component was measured using the long form of the International Physical Activity Questionnaire (IPAQ), adapted for use in older adults[23]. Individuals engaging in physical activity for ≥150 minutes a week were classified as active, and those performing 0-149 minutes as inactive[24]. Participants exhibiting impaired performance for ≥ 3 items were classified as frail, 1-2 items as pre-frail and no impairments as non-frail[24].

The sociodemographic variables studied included sex (male, female), age group in full years (80-89; ≥90). marital status [with/without partner], living arrangement [living alone; living with others], education, in full years of formal study (0-4; ≥5), monthly individual income, in minimum wages (≤1; >1); health variables: physical performance (very poor/poor; moderate/good), presence of depressive symptoms (yes; no), functional capacity for BADLs (independence; dependence) and IADLs (independence; partial/total dependence); number of morbidities (0-4; ≥5); and outcome variable: frailty conditions (non-frail, pre-frail and frail).

The data were keyed into a database using the Excel® program and double data entry was used. The two resultant databases were cross-referenced for inconsistencies, with subsequent correction where applicable.

After checking for completeness, the data were submitted to analyses of absolute and relative frequencies. Multinomial logistic regression was performed to determine factors associated with frailty conditions, preceded by bivariate analysis, using the chi-square test. Variables that met the established criteria ($p \leq 0.10$) were included in the multinomial logistics regression model, with frailty conditions as the outcome. The independent variables studies included sex, age group, marital status, education, living arrangement, individual monthly income, physical performance, depressive symptomatology, functional capacity for BADLs and IADLs, and number of morbidities. A 95% confidence interval and 5% level of significance of $p<0.05$ were adopted.

The project was approved by the Ethics Committee for Research involving Humans under permit no. 2.053.520. The participants received the study objectives and signed the Free and Informed Consent Form, and were provided with all pertinent information. The interviews were conducted after participants had agreed to take part and signed the consent form.

RESULTS

The mean age of participants (n=314) was 84.81 (±4.12; min. 80 and max. 101) years. The sample comprised predominantly individuals who were female, aged 80-89 years, without a partner, living with others, 0-4 years of education, individual monthly income of ≤1 minimum wage, good/moderate physical performance, no depressive symptomatology, independence for BADLs, total/partial dependence for IADLs, and ≥5 morbidities (Table 1).

The distribution of sociodemographic and health variables of the oldest old from a health macro-region (MG) is presented in Table 1.

With regard to frailty conditions, most participants were classified as either frail (44.3%) or pre-frail (44.3%), and the remainder as non-frail (11.4%).

Preliminary bivariate analysis was performed to identify factors associated with frailty conditions. Variables that met the established criteria ($p \leq 0.10$) were included in the final multinomial logistics regression model, namely: age group ($p=0.090$); living arrangement ($p=0.047$); physical performance ($p<0.001$); presence of depressive symptoms ($p<0.001$); IADLs ($p=0.010$), and number of morbidities ($p<0.001$) (Table 2).

The distribution of sociodemographic and health variables according to frailty conditions of the oldest old from a health macro-region (MG) is presented in Table 2.

The final multinomial logistic regression model for the variables associated with frailty conditions of the oldest old from a health macro-region (MG) is presented in Table 3.

The pre-frail condition was associated with living arrangement, living alone ($p=0.047$), and very poor/poor physical performance ($p=0.026$. The frail condition was associated with very poor/poor physical performance ($p<0.001$), the presence of depressive symptoms ($p=0.029$) and of ≥5 morbidities ($p=0.003$) (Table 3).

Table 1. Distribution of sociodemographic and health variables of oldest old from a health macro-region, Minas Gerais state, Brazil, 2021.

Variables	n (%)
Sex	
Female	205 (65.3)
Male	109 (34.7)
Age group (in full years)	
80-89	272 (86.6)
≥90 years	42 (13.4)
Marital status	
With partner	78 (24.8)
Without partner	236 (75.2)
Living arrangement	
Living with others	239 (76.1)
Living alone	75 (16.9)
Education (full years of formal study)	
0-4	261 (83.1)
≥5	53 (16.9)
Individual monthly income (in minimum wages)	
≤ 1	179 (57.0)
>1	135 (43.0)
Physical performance	
Moderate/Good	179 (56.1)
Very poor/poor	135 (43.9)
Presence of depressive symptomatology	
No	234 (74.5)
Yes	80 (25.5)
Basic activities of daily living	
Independence	275 (87.6)
Dependence	39 (12.4)
Instrumental activities of daily living	
Independence	48 (15.3)
Partial/total dependence	266 (84.7)
Number of morbidities	
0-4	116 (12.4)
≥5	198 (87.6)

Table 2. Distribution of sociodemographic and health variables according to frailty conditions of oldest old from a health macro-region, Minas Gerais state, Brazil, 2021.

Variables	Non-frail	Pre-frail	Frail	
	n (%)	n (%)	n (%)	*p**
Sex				
Female	25 (12.2)	83 (40.5)	97 (47.3)	0.181
Male	11 (10.1)	56 (51.4)	42 (38.5)	
Age group (in full years)				
80-89	31 (11.4)	126 (46.3)	115 (42.3)	0.090
≥90	5 (11.9)	13 (31.0)	24 (57.1)	
Marital status				
With partner	9 (11.5)	35 (44.9)	34 (43.6)	0.990
Without partner	27 (11.4)	104 (44.1)	105 (44.5)	
Living arrangement				
Living with others	31 (13.0)	97 (40.6)	111 (46.4)	0.047
Living alone	5 (6.7)	42 (56.0)	28 (37.3)	
Education (full years of formal study)				
0-4	27 (10.3)	114 (43.7)	120 (46.0)	0.242
≥5	9 (17.0)	25 (47.2)	19 (35.8)	
Individual monthly income (in minimum wages)				
≤ 1	18 (10.1)	74 (41.9)	86 (48.0)	0.274
>1	18 (13.3)	64 (47.9)	53 (39.3)	
Physical performance				
Moderate/Good	33 (18.8)	95 (54.0)	48 (27.3)	<0.001
Very poor/poor	3 (2.2)	44 (31.9)	91(65.9)	
Presence of depressive symptomatology				
No	35 (15.0)	112 (47.9)	87 (37.2)	<0.001
Yes	1 (1.3)	27 (33.8)	52 (65.0)	
Basic activities of daily living				
Independence	34 (12.4)	125 (45.5)	116 (42.2)	0.109
Dependence	2 (5.1)	14 (35.9)	23 (59.0)	
Instrumental activities of daily living				
Independence	9 (18.8)	27 (56.3)	12 (25.0)	0.010
Partial/total dependence	27 (10.2)	112 (42.1)	127 (47.7)	
Number of morbidities				
0-4	22 (19.0)	57 (49.1)	37 (31.9)	<0.001
≥5	14 (7.1)	82 (41.4)	102 (51.5)	

Table 3. Final multinomial logistic regression model for variables associated with frailty conditions of oldest old from a health macro-region, Minas Gerais state, Brazil, 2021.

Variables	Pre-frail			Frail		
	OR*	(CI)**	*p****	OR*	(CI)**	*p****
Age group (in full years)						
80-89	1			1		
≥90	0.49	(0.15-1.61)	0.244	0.84	(0.25-2.78)	0.781
Living arrangement						
Living with others	1			1		
Living alone	2.89	(1.01-8.28)	**0.047**	1.53	(0.49-4.79)	0.458
Physical performance						
Moderate/Good	1			1		
Very poor/poor	2.94	(2.25-3.84)	**0.026**	2.54	(1.75-3.68)	**<0.001**
Presence of depressive symptomatology						
No	1			1		
Yes	1.80	(1.37-2.34)	0.102	1.93	(1.45-2.55)	**0.029**
Instrumental activities of daily living						
Independence	1			1		
Partial/total dependence	1.07	(0.42-2.71)	0.875	1.48	(0.51-4.27)	0.467
Number of morbidities						
0-4	1			1		
≥5	2.13	(0.96-4.71)	0.060	3.57	(1.52-8.40)	0.003

1 – reference category; *OR: Odds Ratio; **CI: Confidence interval (95%); ***p<0.05.

DISCUSSION

In the present study, the pre-frail and frail conditions predominated among the oldest old participants. The pre-frail condition was associated with living arrangement, living alone and very poor/poor physical performance, whereas the frail condition was associated with very poor/poor physical performance, the presence of depressive symptoms and of ≥5 morbidities.

Regarding frailty conditions, both national[8,9,25] and international[7] studies of community-dwelling older adults[7-9] and patients enrolled at Primary Care services[25] reported a higher prevalence of pre-frail and non-frail[7-9,25] status compared with the rates found in the present study. Notably, pre-frail participants represented almost half of the study sample and, according to the scientific literature, this condition has a greater chance of improving than frailty[26]. In addition, the characteristics of the pre-frail participants, such as living alone[9,12] and the presence of morbidity[13], may also negatively impact the components of the frailty phenotype.

With regard to the prevalence of frail participants, higher rates were reported in studies conducted in Erval Seco city (Rio Grande do Sul state) (58%)[8], India (84.7%)[5] and in Portugal (71.8%)[6], whereas lower rates were found in Curitiba city (Parana state)[9] and Vietnam (11.2%)[7]. In a national survey, a higher rate of frailty was observed in oldest old individuals, particularly among more senior age groups, such as nonagenarians and centenarians[10], consistent with the results of the current study. In this context, it is vital to devise care plans for frail and pre-frail older adults that involve a multi-professional team, early screening by Primary Care nurses, and interventions that attenuate the adverse effects of frailty[7].

Nurses, particularly those in Primary Care, when assessing and classifying older people according to their frailty status[8], can adapt the care prescribed according to the specific traits and needs of oldest old

patients[25]. During nursing visits, the identification of sociodemographic and health characteristics which represent the greatest risk, besides detection of impairment of components of the frailty phenotype, can provide the basis for an individualized care plan incorporating effective interventions. These health actions, at all levels of care, should guarantee integrality of care and social support for the older patient and their family[25]. Such initiatives can help identify priorities, maintain and/or recuperate functional capacity and prevent frailty[8].

The current finding of an association between pre-frail status and living arrangements contradicts a national study in oldest old[9] but corroborates others. Older individuals that live alone can have lower social interaction and levels of engagement in everyday and physical tasks, activities which help maintain muscle strength[9,12]. This lower activity can result in greater risk of impairment of the components of the frailty phenotype and development of pre-frail status[9,12]. Therefore, older individuals should develop or maintain social ties and support networks[9], even when living alone, as these help maintain health and facilitate the adoption of adaptive behaviors in situations of adverse advents[9].

Akin to the current investigation, studies among oldest old in India[5] and China[16] found an association of pre-frail and frail conditions with very poor/poor physical performance. Specifically among frail individuals, a study found that this group exhibited low physical and muscular performance[5], negatively impacting performance of lower limbs, as measured by the SPPB. Moreover, the oldest old have a greater likelihood of developing sarcopenia compared with younger old and thus can have worse physical performance and frailty[5]. These findings, backed by evidence in the scientific literature[5,16], highlight the need for assessing physical performance to help implement health actions that can improve clinical condition.

The association between frailty and presence of depressive symptoms is consistent with studies of oldest old in India[5] and centenarians in Portgual[27]. Conversely, a study of Chinese older adults observed that frail individuals had less chance of developing depressive symptoms[28]. It is noteworthy that the relationship between depressive symptoms and frailty may be bidirectional in nature[14]. Exhaustion and/or fatigue are often seen in frail older adults, whereby depressive symptoms can worsen with progression of frailty[14]. Additionally, depressive symptoms may serve to worsen the negative impact on frailty syndrome components, such as slowed gait speed, unintentional weight loss, fatigue and declines in physical activity and muscle strength[3], predisposing these individuals to pre-frailty and frailty[5,27]. In this context, the assessment and identification of factors associated with the condition of frailty becomes vital in clinical practice, given that both depressive symptoms and frailty negatively impact quality of life, increase demand for health services, as well as the number of morbidities and mortality[13]. Co-occurrence of these factors can exacerbate the adverse effects on health[5,27].

The association between frailty and multimorbidity was also identified in a systematic review with meta-analysls[13], although conflicting results were found in a Brazilian study of oldest old [8]. Another investigation identified a bidirectional relationship between frailty and the presence of multimorbidities[29]. During the human aging process, morbidities often occur in older individuals due to the accumulation of specific biological deficits[30]. Also, chronic diseases interact with each other potentializing the negative effects and/or development of further clinical signs and symptoms[17]. Concomitant with the presence of multimorbidity[13,29-30] and accumulation of deficits[29], there can be both an increase in stressors exacerbating decline in physiological reserves across multiple systems, as well as homeostatic imbalance[3,29]. In this clinical state, older individuals can become locked into a negative cycle of adverse outcomes with difficulty recovering homeostasis, increased risk of developing further morbidities, and worsening of frailty status[29].

Few guidelines are available providing a broad global analysis of multimorbidity for the development of interventions in clinical practice that embrace the individual needs of older adults according to frailty status [29]. Most guidelines involve actions centered on specific diseases and fail to address frail or pre-frail conditions[29]. This can lead to ineffective treatment of patients with comorbidities [29] *and/or those who are frail.*

This study has the limitation of self-reporting of morbidities. However, strengths of the study include its representative sample from a health macroregion of Minas Gerais and the findings which add to the scientific knowledge on conditions of frailty and their associated factors in oldest old individuals. Finally, these results help pave the way for future research, such as multi-center and national cohort studies involving representative samples of the older population age ≥80 years from different Brazilian states, in an effort to enhance the quality of healthcare delivered to the oldest old population.

CONCLUSION

The pre-frail and frail conditions predominated among the oldest old individuals assessed. The pre-frail condition was associated with living arrangement, living alone and with very poor/poor physical performance, whereas the frail condition was associated with very poor/poor physical performance, the presence of depressive symptoms and of ≥5 morbidities.

Physical performance is an aspect which can be targeted by health professionals and should be addressed in oldest old patients with the aim of delaying pre-frailty and frailty. Furthermore, the findings elucidate the factors associated with the conditions of frailty, results which can inform actions of both the multiprofessional team and nursing team for the assesment and delivery of care to oldest old in primary health, as well as help devise public policies governing health care for older adults.

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