

Prevalence of Frailty Syndrome in the Elderly and Associated Factors in Brazil

Anna Ferla Monteiro Silva Passos¹, Iris do Céu Clara Costa², Fábila Barbosa de Andrade³, Maria do Carmo Eulálio⁴, Anita Liberalesso Neri⁵, Rômulo Lustosa Pimenteira de Melo⁴, Adrianna Ribeiro Lacerda¹

¹Postgraduation Program in Health Sciences, Federal University of Rio Grande do Norte, Natal, Brazil

²Department of Dentistry, Federal University of Rio Grande do Norte, Natal, Brazil

³Nursing, Faculty of Health Sciences of Trairi/Federal University of Rio Grande do Norte, Santa Cruz, Brazil

⁴Department of Psychology, State University of Paraíba, Campina Grande, Brazil

⁵Department of Educational Psychology, State University of Campinas, Campinas, Brazil

Email: annaferla@ig.com.br, iris_odontoufrn@yahoo.com.br, fabiabarbosabr@yahoo.com.br, carmitaeulalio@terra.com.br, anitalbn@uol.com.br, romulo.psiq@gmail.com, adriaribeiro.cg@bol.com.br

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Abstract

This paper aims to identify the prevalence of frailty syndrome and its association with demographic, economic, health, psychological and functional variables in Brazilian population. The study was cross-sectional and composed of 385 elderly aged from 65 years, an average age of 73.92 years. A multivariate Poisson regression was used to check for conditions associated with frailty and to determine the prevalence ($\alpha = 0.05$). The prevalence of frailty was 8.7% and pre-frailty of 50.4%. The frail and pre-frail older adults showed larger and increasing prevalence ratios for marital status, difficulty performing instrumental activities of daily living, old age, involuntary loss of feces, depression and negative affections. These results can guide the establishment of preventive measures and the development of intervention strategies aimed at minimizing the adverse effects of frailty in elderly people.

Keywords

Aging, Frail Elderly, Frailty, Frailty Syndrome

1. Introduction

Numerous demographic and epidemiological studies have demonstrated the increasing elderly population

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worldwide, putting government and society on its own medical and socioeconomic challenges of population aging [1]. According to the World Health Organization (WHO) in 2025, Brazil will be the sixth country in number of elderly in the world, reaching about 32 million seniors. As a consequence, this will increase the impact on the social and economic sphere of the country, which promotes the interest of the scientific community, especially for those considered more fragile and vulnerable [2].

According to the national literature, the prevalence of frailty varies from 5% to 58%, and this increases proportionally with age [3]. Accordingly, a substantial portion of the elderly population is a carrier of health conditions that make them vulnerable to a large number of adverse events. These individuals are about to pass the barrier of cognitive and functional preservation, developing various frameworks of dependence, being classified as carriers of frailty syndrome—clinical syndrome identified by unintentional weight loss, decreased level of physical activity, reduced palm grip strength, sensation of fatigue and reduced gait velocity. Those characterized as fragile, suffering from three of these symptoms such as pre-frail of one or two non-frail those without symptoms [4].

Although there is no consensus on the definition of frailty in the elderly, there are common markers that indicate that this concept is broad and dynamic. It is characterized by both biomedical and psychosocial factors and is associated with age, decreased lean body mass, muscle strength and endurance, flexibility, balance, coordination, mobility, level of physical activity and cognitive function, increasing the risk for falls, functional decline, worsening of chronic and acute illness, hospitalization, absent or slow recovery from a clinical stage and death [3]-[6].

With the increasing elderly population, studies in health intensified, in particular those related to frailty, so that the identification of the instruments used to characterize the fragile state and enable the indication of relevant clinical markers [6] [7]. The prevalence of the elderly population's frailty has been stated in some studies through a descriptive analysis. In this study the multivariate analysis model was highlighted, in addition to increasing the association of frailty with psychological variables (negatives affections) and health variables (fecal incontinence). The early identification of characteristics associated with frailty syndrome can trigger measures to improve the quality of life of older people and prevent adverse events. Thus, the aim of this study was to identify the prevalence of Frailty Syndrome and its association with demographic, economic, health, psychological and functional variables in Brazilian population.

2. Methods

A cross-sectional study in 2009, conducted by Network FIBRA, acronym for “Frailty in Elderly Brazilians”. The sample was randomly selected by cluster sampling, with the sampling unit of the urban census sectors a northeastern Brazilian city randomly selected. Subjects were recruited at their homes.

2.1. Sampling

We estimated the sample size needed to have a proportion of 50% of occurrence of a certain characteristic of the elderly population (value at which the sample size is the maximum possible for $p = 0.50$ and $q = 0.50$). The formula used was: $n = \left\{ z^2 \times \left[p \times q / (d)^2 \right] \right\}$ [8]. The calculation indicated a population of 385 elderly.

2.2. Data Collection Procedures

Data collection was performed at the agreed place during recruitment, lasting 40 - 80 minutes. Later, they were asked to sign a Statement of Form Informed Consent (SFIC). The project was approved by the Ethics Committee of the College of Medical Sciences, State University of Campinas No. 208/2007.

Through a structured questionnaire, demographics, self-reported health problems, variables functionality and psychological distress were collected. The Mini Mental State Examination (MMSE) [9], in order to identify seniors who presented cognitive deficits, which could adversely affect the reliability of answers - to the psychological measures of the cognitive screening test was used.

The criteria for inclusion and exclusion were the same used in the Cardiovascular Health Study and Women's Health and Aging Study [10] and based on studies by Fried *et al.* [11].

2.3. Techniques and Tools to Measure the Variables

To associate with the frailty phenotype four groups of variables were considered. The first demographic charac-

teristics, with the following variables: sex, age, literacy, currently works. The second was composed of self-reported health problems, and asked if they have had a medical condition diagnosed as having hypertension and/or diabetes mellitus or if it happens to have involuntary loss of urine or feces frequently.

The third group of variables worked with tools from the Basic Activities of Daily Living (BADL) [12], Instrumental Activities of Daily Living (IADL) [13] and Advanced Activities of Daily Living (AADL) [14]. Finally, a last group of variables of psychological malaise composed by the Geriatric [15] Depression Scale and a measure of affections [16]. These instruments are described below.

The performance was evaluated using the BADL to the Independence in Activities of Daily Living developed by Sidney Katz [12], which consists of a list of six items organized hierarchically, which asked the seniors if they were totally independent, if they needed help or if they needed help to complete activities related to survival. For IADL, Instrumental Activities of Daily Living created by Lawton and Brody was used to scale on the maintenance of independent living in the household and neighborhood contexts, containing seven activities where the elderly were evaluated according to their performance and/or participation [13]. Already in assessing AADL, an inventory made based on the literature on Advanced Activities of Daily Living, which contained 12 self-report questions on the participation of older people in social roles and social life was more widely used [14].

The Geriatric Depression Scale (GDS) is recommended by the World Health Organization instrument that makes a survey of depressive disorder. His reduced form [15] consists of 15 items that verified the mood and the feeling of the subject in the last two weeks. Scores above 5 points suggests likely depression [16].

The scale of positive and negative affects consists of 14 adjectives, with response options ranging from 1 (nothing) to 5 (extremely). Six of the adjectives related to positive affects (eg. Happy, satisfied, fun, optimistic) and eight related to negative affective states (eg. Depressed, frustrated, angry). Thus, for example, the more the elderly person has experienced the negative affections in recent weeks, the higher their score. The sum of scores in positive affect could range between 5 and 30 and the sum of negative scores could range between 5 and 40 [17].

2.4. Techniques to Measure the Phenotype of Frailty

According to the Cardiovascular Health Study and the Women's Health and Aging Study [10], there are five elements of the operational or phenotype definition of frailty syndrome: 1) unintentional weight loss self-report: ≥ 4.5 kg or 5% of the body weight in the previous year; 2) assessed by self-report the fatigue evoked by two questions of a scale for depression screening, being considered the manifestation of fatigue assertion that in three or more days of the week, the elder felt it needed to make a lot of effort to account for the tasks; 3) low grip strength measured with a portable hydraulic dynamometer in the dominant hand, adjusted for sex and Body Mass Index (BMI); 4) low energy expenditure measured in metabolic equivalent (MET) and adjusted for gender, assessed from self-report physical exercise and housework performed in the last seven days, based on items from the Minnesota Leisure Time Activity Questionnaire validated for Brazil by Lustosa and adapted for this study; 5) Low gait speed indicated by the average time spent to complete three times the distance of 4.6 m, with adjustments for sex and height. For the last three criteria, frailty score for individuals that got results located between 20% of the sample [11] [18]-[22]. All self-reported measures were considered reliable, since the MMSE was used.

2.5. Data Analysis

The data were tabulated in Microsoft Excel software, being exported to the R language, version 2.15.1 and R Commander package, *epicalc*, *lmtest* and *Sandwich*. Initially, we tested the factor structure of the Geriatric Depression measures and Affections, with the use of measures adjustment (χ^2/df ; GFI; AGFI; CFI, RMSEA) and the internal consistency of the factors, verified by Cronbach's Alpha (α).

Subsequently, a bi-variant chi-square test (χ^2) was performed and a one way ANOVA with post hoc Tukey's test. The tests showed that less than or equal to 5% probability ($p \leq 0.05$) not to exclude the null hypothesis, were taken into account in a multivariate model, which was developed by two Poisson regressions, one where the dependent variable was not frail/pre-frail and another non frail/frail. For keeping variables in the multivariate model, we adopted the stepwise method. A robust estimator was used in the covariance matrix for more robust standards errors. The magnitude of the effects of the regressions was interpreted as a Prevalence Ratio (PR) with

confidence intervals of 95%. Those who remained were in the multivariate model variables with less than or equal to 0.05 ($\alpha = 0.05$) significance.

3. Results

Most of the sample is composed of females (70.12%) with an average age of 73.92 years. Regarding marital status, 46.58% of them were married and 38.23% widowed. In addition, 61.77% are literate and most (85.32%) reported they were employed.

3.1. Adjustment Measures of Affections and Geriatric Depression

Table 1 shows that the scale of affections exposes plausible fit ($\chi^2/\text{gl} = 2.00$, GFI = 0.92, AGFI = 0.89, CFI = 0.94 and RMSEA = 0.064), corroborating the two-dimensional structure. The two factors (Positive and Negative Affections) had both alphas of $\alpha = 0.85$. Similarly, the depression scale showed acceptable fit, even with the CFI Below that recommended by literature. The other parameters were within the recommended ($\chi^2/\text{gl} = 1.49$, GFI = 0.93, AGFI = 0.91, CFI = 0.81 and RMSEA = 0.046). The alpha of the scale was of $\alpha = 0.68$.

3.2. Description and Prevalence Ratios of the Frailty Phenotype

The sample exposed prevalence of pre-frail elderly of 50.4% [95% CI (45.63 - 55.36)] and the frail elderly of 8.7% [95% CI (6.33 - 11.87)]. **Table 2** presents the association between frailty profiles (non frail, pre-frail and frail) with the demographic profile. Of the five variables, only gender showed no significant association ($p > 0.05$) with the pre-frailty and frailty, even with women representing 71.4% of frail people. It adds to the pre-frail elderly, with significant gender being 0.07, approaching that which is accepted in this work and the majority of the literature in this area, still a consensus does not exist, it was decided by not including it in the multivariate models. The other variables, with the exception of marital status that provided no significance for the group of the pre-frail, showed significance for both groups of frailty (**Table 2**).

Table 1. Parameters of adjustment of the measurement of the affection and geriatric depression scales.

	Model	χ^2 (gl)	GFI	AGFI	CFI	RMSEA (IC 90%)
Scale of Affections	Bifactorial	150.68 (75)	0.92	0.89	0.94	0.064 (0.049 - 0.078)
Geriatric Depression Scale	Unifactorial	131.21 (88)	0.93	0.91	0.81	0.046 (0.028 - 0.062)

Notes: N = 785. χ^2 = chi-square, gl = degrees of liberty, GFI = Goodness-of-Fit Index, AGFI = Adjusted Goodness-of-Fit Index, CFI = Comparative Fit Index, RMSEA = Root-Mean-Square Error of Approximation, IC90% = Interl of Trust 90%.

Table 2. Association of the phenotype of frailty with demographic variables.

VARIABLES		NON FRAIL		PRE-FRAIL		p	FRAIL		
		F	%	F	%		F	%	p
Demographics and economics									
Sex	Male	55	35.0	53	26.1	0.07	10	28.6	0.46
	Female	102	65.0	150	73.9		25	71.4	
Age groups	65 - 69	63	40.1	48	23.6	<0.001	9	25.7	0.03
	70 - 74	50	31.8	64	31.5		8	22.9	
	75 - 79	24	15.3	40	19.7		7	20.0	
	≥80	20	12.7	51	25.1		11	31.4	
Marital Status	Married of lives with companion	85	54.1	87	42.9	0.15	12	34.3	0.03
	Single	10	6.4	19	9.4		3	8.6	
	Divorced, separated	12	7.6	14	6.9		2	5.7	
Literate	Widow	50	31.8	83	40.9	0.01	18	51.4	0.002
	Yes	111	70.7	118	58.1		15	42.9	
	No	46	29.4	85	41.9		20	57.1	
Currently Working	Yes	31	19.7	25	12.3	0.05	2	5.7	0.05
	No	126	80.3	178	87.7		33	94.3	

Table 3 shows the association between the variables of health, functionality and psychological malaise. Those that were statistically significant were the involuntary loss of urine, involuntary loss of stool (specifically for the pre-frail phenotype), difficulties in IADL, depression, and positive and negative affections.

The variables that showed significance in the bi-variant tests were considered for the multivariate model. For the model with the outcome of non frail/pre-frail, with three variables remained significant (**Table 4**). The age

Table 3. Association of the phenotype of frailty with health, functional and psychological variables.

VARIABLES		NON FRAIL		PRE-FRAIL			FRAIL		
		F	%	F	%	p	F	%	p
Health Issues									
Hipertension	Yes	96	61.1	134	66.0	0.11	20	57.1	0.76
	No	60	38.2	65	32.0		15	42.9	
Diabetes Mellitus	Yes	17	10.8	22	10.8	0.60	7	20.0	0.098
	No	91	58.0	98	48.3		16	45.7	
Urinary Incontinence	Yes	18	11.5	41	20.2	0.002	9	25.7	0.015
	No	91	58.0	79	38.9		14	40.0	
Fecal Incontinence	Yes	3	1.9	18	8.9	0.001	3	8.6	0.065
	No	106	67.5	102	50.2		20	57.1	
Functional Capacity									
Dificulties in BADL	Little	97	61.8	101	49.8	0.18	19	54.3	0.48
	Much	12	7.6	21	10.3		4	11.4	
Dificulties in IADL	Little	104	66.2	107	52.7	0.038	13	37.1	<0.01
	Much	5	3.2	15	7.4		10	28.6	
AADL	0.00	17	10.8	20	9.9	0.49	3	8.6	0.36
	1.00	25	15.9	24	11.8		4	11.4	
	2.00	22	14.0	27	13.3		6	17.1	
	3.00	15	9.6	23	11.3		1	2.9	
	4.00	17	10.8	10	4.9		4	11.4	
>5	13	8.3	18	8.9	5	14.3			
Psychological Variables									
Depression	m (dp)	2.72 (2.02) ^a		4.28 (2.55) ^b			5.39 (2.80) ^b		<0.001
Positive Affections	m (dp)	22.27 (3.63) ^a		21.16 (4.02) ^a			20.04 (3.22) ^b		0.013
Negative Affections	m (dp)	15.15 (5.11) ^a		17.74 (5.50) ^b			20 (5.13) ^b		<0.001

BADL: Basic Activities of Daily Living; IADL: Instrumental Activities of Daily Living; AADL: Advanced Activities of Daily Living; a, b, c: different letters, represent significant differences, verified by the post hoc Turkey test ($p < 0.05$).

Table 4. Multivariate model for the non frail/pre-frail outcomes.

	Pre frAil	B	Std. Error	Sig.	RP	95% IC	
						Lower	Upper
Age Group	Between 65 - 69 years	0 ^a	.	.		.	.
	Between 70 - 74 years	0.10	0.05	0.05	1.10	1.00	1.21
	Between 75 - 79 years	0.15	0.05	0.01	1.16	1.037	1.30
	Less than 80 years	0.15	0.06	0.02	1.16	1.029	1.31
Literate	Yes	0 ^a	.	.		.	.
	No	0.07	0.04	0.09	1.07	0.98	1.16
Fecal incontinence	No	0 ^a	.	.		.	.
	Yes	0.13	0.05	0.01	1.14	1.029	1.26
Depression		0.03	0.01	0.01	1.03	1.017	1.05

0^a: Parameter of Reference.

groups of older exposed higher prevalence of pre-frail group of the elderly between 65 and 69 years. The elderly who reported involuntary loss of feces also were significantly more prevalent, and finally, the data shows that the higher the scores on depression, the more frequent are the pre-frail.

The data relating to the multivariate model for non frail/frail outcome are shown in **Table 5**. In it, four variables remained statistically significant. The single, married and widowed had a higher prevalence of frailty compared to separate elderly. In addition, older people have more difficulty in IADL and showed a higher prevalence in frailty, as well as higher scores of depression and negative affections.

4. Discussion

Frailty Syndrome was found in 59.1% of the elderly studied. A systematic review [6] observed in the analysis of 18 studies, a wide variation in prevalence of frailty in general from 6.9% to 21% for the frail state and 33% to 55% for pre-frail state. The prevalence of frailty (8.7%) and pre-frailty (50.4%) values were slightly above those observed in a survey of elderly North Americans: pre-frail (7%) and frail (47%) [10]. An investigation on 993 Spanish elderly over 70 years showed much higher results for the weakness (16.9%) [23]. Similar numbers were found in a study involving 601 community-dwelling elderly in the Brazilian city of Belo Horizonte (8.7%) [24]. This wide variation may be attributed to the use of different models and methodology for identifying weak phenotypes, in addition to existing social and economic realities in different samples.

Among the demographic variables, a higher prevalence of pre-frailty in elderly people with older ages was identified. These data corroborate the national level [24] investigations and international [11] [23]-[25] linking the fragility of old age. Its association with advancing age has no explanation for the characteristic of the aging process, in which physiological changes in neuro-muscular-skeletal function and all body systems suffer losses and occur both in the structural and functional aspects [25]. It was also observed that poor socioeconomic and educational conditions, little formal education and low income characteristics are present in most debilitated people [26].

Association between frailty and marital status was found, since, single, widowed and married elderly had a higher prevalence to be a frail elderly when compared to separate ones. In the scientific literature, studies to a discussion of the relationship between these variables were not found.

The relationship between frailty and comorbidities can be determined by immunological dysfunction, neuro-endocrine deregulation and chronic inflammatory processes, as well as organic structural changes predisposing individuals to diseases such as hypertension, diabetes mellitus, cerebral vascular accident, renal failure, osteoarthritis and depression [4] [11].

Among the conditions associated with a significantly higher prevalence of frailty and pre-frailty have fecal incontinence and depression. Unpublished data found in this study was the association between frailty and involuntary loss of stool in the elderly indicating a significance not reported in the literature on the topic: high prevalence of pre-frailty (1.14 times) among the elderly who have fecal incontinence compared to elderly people who have the same condition. Among morbidities investigated in a cross-sectional descriptive Brazilian survey

Table 5. Multivariate model for the non frail/frail outcomes.

FRAILITY	B	Std. Error	Sig	RP	IC 95%	
					Lower	Upper
Marital Status	Separated	0 ^a	.	.	.	.
	Single	0.50	0.18	0.01	1.64	2.32
	Married	0.34	0.11	0.01	1.41	1.75
	Widow	0.43	0.13	0.01	1.54	1.97
Fecal incontinence	No	0 ^a	.	.	.	.
	Yes	0.27	0.18	0.10	1.31	1.84
Difficulty in IADL	Little	0 ^a	.	.	.	.
	A lot	0.45	0.13	0.01	1.57	2.03
Depression	0.05	0.02	0.01	1.06	1.01	1.10
Negative Affections	0.02	0.01	0.04	1.02	1.00	1.03

0^a: Parameter of Reference; IADL: Instrumental Activities of Daily Living.

[27] the following prevalence were found: 13.4% for depression and 5.6% for fecal incontinence.

The true incidence of this disorder channel is not accurate, however, it is estimated that may affect up to 5% of the general population, with higher prevalence in the elderly and women [28]. Chronic morbidities, particularly those associated with pain and/or loss of function, often added in the elderly and are most commonly involved with the occurrence of frailty [29].

More research is needed to examine the prevalence of fecal incontinence with frailty, since few studies have been found in the scientific literature and the pathogenesis of this condition may be present in old age or diseases associated with belonging to the clinical and surgical areas.

Depressive symptoms were strongly associated with frailty syndrome. Elderly people with depression had higher prevalence for frailty and pre-frailty compared with those who did not have depression. The growing trend of depression and weakness is reinforced by several studies [24] [30].

Depression is considered as one of the most frequent agents of emotional distress and significant decrease in the quality of life in old age. The occurrence of psychiatric symptoms increases with age and both levels of satisfaction with the levels of positive and negative emotions are influenced by biological, social and intra-psychoic vulnerability inherent in the elderly [26].

In this sense, considering a possible psychosocial or psychological component as a predisposing factor of frailty, there seems to be a relationship between negative affections and the prevalence of the same. This study reveals an innovative way that elderly people that have a higher score in negative affections are more prevalent to be a frail elderly. Although negative affect components and frailty in the elderly has not been disclosed previously, it is remarkable that their respective theoretical concepts are different but interrelated.

The findings of this study corroborate international studies [5] [11] and national [24] the extent that they also found a significant association between difficulty in performing IADL with frailty. In a study in the United States, the results suggested that, the beginning of the frailty syndrome, it affects the more complex routine activities and less so the simplest routine activities [11]. In it the authors found 59.7% of frail elderly with difficulty to perform IADL.

In the current research, those with difficulty performing IADL showed a higher prevalence of frailty. The relationship between disability and frailty is evident primarily in IADL and a loss in these contributes to the reduction of advanced activities of daily living related to the social environment, cultural, religious, political and labor with tendency to isolation, corroborating research conducted in different populations [5] [24].

In the studied population, the prevalence of frailty in numbers is similar to other studies found. Among elderly surveyed, we identified factors associated with frailty syndrome, as that in the presence of it have higher chances for adverse health conditions.

5. Conclusions

Understanding relationships with certain variables that showed significance was limited. In this sense, it is suggested to conduct further research to allow other interpretations. Importantly, the investigation will continue, this is the first study of a longitudinal research on indicators of frailty. The multivariate model used shows that it is necessary to consider not only biological, but also psychological factors for understanding Frailty Syndrome.

The results show that the apprehension of signs and symptoms that are predictors of frailty in elderly aids in the development of strategies and interventions aimed at minimizing the adverse effects to the health of the elderly, which represents an essential step in the quest for improved quality of life.

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Disclosure

I declare that neither I nor the other authors or any first degree relative, possess financial and personal interests in the subject matter discussed in the manuscript. No potential conflicts of interest were disclosed.

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