Revista Brasileira de Enfermagem
REBEn

Factors associated with vulnerability and fragility in the elderly: a cross-sectional study

Fatores associados à vulnerabilidade e fragilidade em idosos: estudo transversal

Factores relacionados a la vulnerabilidad y fragilidad en ancianos: estudio transversal

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How to cite this article:
Sousa CR, Coutinho JFV, Freire Neto JB, Barbosa RGB, Marques MB, Diniz JL. Factors associated with vulnerability and fragility in the elderly: a cross-sectional study. Rev Bras Enferm. 2022;75(2):e20200399. https://doi.org/10.1590/0034-7167-2020-0399

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Submission: 07-09-2020 **Approval:** 05-27-2021

ABSTRACT

Objectives: to assess factors associated with vulnerability and fragility in the elderly. **Methods:** crosssectional study with 384 elderly people in Fortaleza, Ceará. The Vulnerable Elders Survey and Clinical-Functional Vulnerability Index – 20 were used. Chi-square and Fisher's exact tests were used for associations. In the analysis of the combined influence of risk factors, the stepwise logistic regression and multinomial regression methods were adopted. **Results:** 251 (65.4%) non-vulnerable and 133 (34.6%) vulnerable elders. From the vulnerable elders analyzed, 42 (30.9%) are at high risk for frailty. Factors associated with vulnerability: age, gender, presence of comorbidities, hypertension, diabetes, osteoporosis and use of polypharmacy. There is a 30% increase in the chance of vulnerability for each additional drug. Physical activity reduces the chance of vulnerability by 60%. Factors associated with frailty: educational level; self-perception of health; comorbidities; polypharmacy. **Conclusions:** it is important to pay attention to the presence of arterial hypertension, osteoporosis, polypharmacy, and encourage the practice of physical activity.
Descriptors: Vulnerability Study; Fragility; Aged; Primary Health Care; Nursing.

RESUMO

Objetivos: avaliar fatores associados à vulnerabilidade e fragilidade em idosos. **Método:** estudo transversal, com 384 idosos em Fortaleza, estado do Ceará. Utilizou-se o *Vulnerable Elders Survey* e Índice de Vulnerabilidade Clínico-Funcional – 20. Empregaram-se testes qui-quadrado e exato de Fisher para associações. Na análise da influência conjunta dos fatores de risco, adotou-se o método de regressão logística s*tepwise* e multinomial *stepwise*. **Resultados:** 251 (65,4%) não vulneráveis e 133 (34,6%) vulneráveis. Dos vulneráveis analisados, 42 (30,9%) têm alto risco para fragilidade. Fatores associados à vulnerabilidade: idade, sexo, presença de comorbidades, hipertensão, diabetes, osteoporose e uso de polifarmácia. Há aumento de 30% na chance de vulnerabilidade para cada medicamento adicional. A atividade física reduz em 60% a chance de vulnerabilidade. Fatores associados à fragilidade: escolaridade; autopercepção de saúde; comorbidades; polifarmácia. **Conclusões**: atentar-se para a presença em idosos de hipertensão arterial, osteoporose, polifarmácia e incentivar a prática de atividade física.
Descritores: Vulnerabilidade em Saúde; Fragilidade; Idoso; Atenção Primária à Saúde; Enfermagem.

RESUMEN

Objetivos: evaluar factores relacionados a vulnerabilidad y fragilidad en ancianos. **Métodos:** estudio transversal, con 384 ancianos en Fortaleza, Ceará. Utilizó el *Vulnerable Elders Survey* e Índice de Vulnerabilidad Clínico-Funcional – 20. Emplearon testes chi-cuadrado y exacto de Fisher para relaciones. En el análisis de la influencia conjunta de los factores de riesgo, adoptó el método de regresión logística *stepwise* y multinomial *stepwise*. **Resultados:** 251 (65,4%) no vulnerables y 133 (34,6%) vulnerables. De los vulnerables analizados, 42 (30,9%) hay alto riesgo para fragilidad. Factores relacionados a vulnerabilidad: edad, sexo, presencia de comorbilidades, hipertensión, diabetes, osteoporosis y uso de polifarmacia. Hay aumento de 30% en la chance de vulnerabilidad para cada medicamento adicional. La actividad física reduce en 60% la chance de vulnerabilidad. Factores relacionados a la fragilidad: escolaridad; autopercepción de salud; comorbilidades; polifarmacia. **Conclusiones**: Atentarse para la presencia en ancianos de hipertensión arterial, osteoporosis, polifarmacia e incentivar la práctica de actividad física.
Descriptores: Vulnerabilidad en Salud; Fragilidad; Anciano; Atención Primaria de Salud; Enfermería.

INTRODUCTION

Aging leads to the development of vulnerability and fragility. Vulnerability derives from the Latin *vulnerare*, which means "the possibility of being hurt"; it has a biological, socioeconomic, and psychosocial nature. Frailty, on the other hand, is characterized as a multifactorial syndrome, which involves dysregulation of the neuroendocrine system and immune system dysfunction, resulting in weight loss, muscle weakness, low resistance, decreased mobility speed and a reduced level of physical activity[1-2].

Vulnerability can induce frailty in the elderly. Thus, it is understood that every frail elderly person is vulnerable. However there are elderly people in a vulnerable situation who are not frail. It is estimated that 10% to 25% of the population over 65 years of age is in a fragile situation; and, for people aged 85 or over, 45%[3-4].

Vulnerability and fragility increase the prevalence of pathologies and disabilities, in addition to being burdens for the family and raising the costs of health services. This results in complex demands that require specific care, involving the elderly, families, communities, health professionals, and managers[5-6].

The assessment of elderly people in terms of vulnerability and fragility is recommended by international and national organizations, as it makes it possible to identify the biological, physical, cognitive and psychological determinants related to these conditions and, thus, to promote appropriate measures[7].

There are studies about vulnerability and fragility, but most of them do not analyze the factors associated with each condition independently[8-11]. Thus, studies capable of tracking vulnerable elderly people, identifying the frail elderly and evaluating the associated aspects in each condition are needed. Investigations of this nature are relevant, as they facilitate the implementation of measures aimed at identifying and monitoring both vulnerable and frail elderly people, in order to promote functionality, independence, good lifestyle habits, and reduce functional decline[5-6].

OBJECTIVES

To evaluate the factors associated with vulnerability and fragility in the elderly.

METHODS

Ethical aspects

This research was developed in accordance with Resolution 466/2012 by the National Health Council and was approved by the Research Ethics Committee of the Federal University of Ceará.

Design, study location and period

Cross-sectional observational study, following the guidelines of the EQUATOR network, using the instrument Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) [12]. It was carried out from May 2018 to June 2019, in five Primary Health Care Units (UAPS) in Fortaleza, in the state of Ceará.

Population or sample; inclusion and exclusion criteria

To calculate the sample, a cross-sectional study formula with an infinite population was used, resulting in 384 elderly people registered at the UAPS in Fortaleza.

Inclusion criteria were individuals over 60 years old attended at the UAPS. The following were excluded: elderly people who, after a cognitive assessment performed through the Mini-Mental State Examination (MMSE), had a score lower than 13 for illiterate seniors and a score lower than 17 for literate ones[13]; and elderly people with a confirmed diagnosis of dementia, regardless of the type. Cognitively compromised elderly people were excluded to eliminate information bias. 435 elderly people were enrolled; 30 were excluded for not reaching the score determined on the MMSE, 5 for having a confirmed diagnosis of Alzheimer's, and 25 for not completing the instruments. In the end, the study had 384 participants.

Study protocol

Data collection was carried out through an interview, lasting 20 minutes. The elders were approached while waiting for care at the units. The instruments were completed by the researchers, and the collection took place in three stages: collection of sociodemographic, clinical, and anthropometric data; vulnerability assessment; and assessment of the frailty of vulnerable elderly people.

The sociodemographic variables collected were gender, age, educational level, marital status, and race. The clinical variables were self-reported comorbidities, medications in use and physical exercise. Anthropometric variables were weight, height, body mass index and calf circumference.

Vulnerability assessment was performed using the Vulnerable Elders Survey (VES-13), developed to identify vulnerable elderly people living in the community. The VES-13 was translated and adapted for Brazil and proved to be a reliable instrument regarding the stability and internal consistency of its measurements[14]. It consists of four items: age, self-perception of health, physical limitations, and disabilities, which are evaluated in 13 questions. The survey classifies vulnerability as such: elders with a score between 0 and 2 are not considered vulnerable, so they can be followed up in the Primary Health Care Units (UAPS), without any related intervention; when the score is equal to or greater than 3, the elder must be evaluated more specifically, since they have a 4.2 times greater risk of functional decline[14].

Regarding frailty, the Clinical-Functional Vulnerability Index – 20 (IVCF20) was used, which addresses multidimensional characteristics of the elderly, consisting of 20 questions distributed in the following eight domains: age, self-perception of health, activities of daily living, cognition, mood/behavior, mobility, communication, and presence of multiple comorbidities[15].

The classification of the clinical and functional condition of the elderly is found through the following criteria: with a score from 0 to 6, the elderly person is considered robust and can be monitored by Primary Health Care; with a score from 7 to 14, the elderly person is considered at risk of frailty, being referred to an intermediate multidimensional assessment to be carried out in

Primary Health Care; and with a score equal to or above 15 points, the elderly person is considered to be in a fragile condition, and must be assisted in Secondary Care with preventive, curative or palliative follow-up[15].

Analysis of results and statistics

Data were grouped and statistically analyzed using the Statistical Package for Social Sciences program (version 22.0). Descriptive statistical analysis was performed. The chi-squared and Fisher's exact tests were used to assess the association between the outcome variables (vulnerability and frailty) and the independent variables. The significance level adopted was 5% ($p < 0.05$).

In the analysis of the joint influence of risk factors for vulnerability, the stepwise logistic regression method was used, in which the Wald test was applied to identify the variables to compose the model. An omnibus test was carried out to globally fit the model, and the Hosmer-Lemeshow test was used to compare the frequencies observed in the sample and those expected when applying the logistic model found. In addition, the Nagelkerke R^2 was calculated to measure the global vulnerability determination capability.

As for frailty, the stepwise multinomial logistic regression method was used, in which the Wald test was applied to identify the variables that compose the model; the likelihood ratio test was used for the global fit of the model; and the Pearson's chi-square test for adjustment, to compare the frequencies observed in the sample with those expected when applying the logistic model found. Furthermore, Nagelkerke's R^2 was also calculated to measure the ability to determine global frailty, based on the variables included in the final model.

RESULTS

The mean age of the 384 elders was 70.2 years (±7.32); and their mean years of formal education studying were 6.52 (±4.54). Most were female, 264 (67.4%); 126 were married (32.8%), 205 (53.4%) did not practice physical activity, 333 (86.7%) had some comorbidity, and 94 (24.5%) used five or more medications daily. Their mean weight was 66.6 kg (±27.40) mean height 1.56 m (±8.37); mean body mass index 26.08 kg/cm; and mean calf circumference 34.64 cm (±3.56).

In the assessment of vulnerability, individuals over 85 years (3.1%) stood out for being already considered vulnerable (100%), with an association between age and vulnerability ($p < 0.001$). The older the participant, the greater the chance that the individual is vulnerable.

Regarding self-perception of health, from the 185 who reported their health as regular, 85 (45.9%) were vulnerable, and from the 39 (10.20%) who reported it as bad, 19 (48.7%) were vulnerable. Although 27 (7%) elderly people considered their health to be excellent, 3 (11.1%) were rated as vulnerable. A negative self-perception of health is related to vulnerability ($p < 0.001$).

In the domain of physical limitations, of the 133 vulnerable, 85 (69.9%) had more difficulty in "Bending, squatting or kneeling", followed by 78 (58.6%) who had difficulty "Lifting or carrying objects weighing approximately 5 kg" and 57 (50.7%) who had difficulty "Doing heavy housework such as mopping the floor". Regarding vulnerability, there was a significant association in these three activities ($p < 0.001$), with the activity of "Bending, squatting or kneeling" having the largest number of vulnerable elderly (85 of the elderly reported having a lot of difficulty or to be incapable).

In "Doing heavy housework such as mopping the floor", the 67 (51.5%) who responded that they had a lot of difficulty or were unable to do it were vulnerable. In "Lifting or carrying objects weighing approximately 5 kg", from the 99 who answered having a lot of difficulty or being unable to do so, 78 (78.8%) were vulnerable. It was evident that a greater difficulty in activities that required strength and physical effort was associated with vulnerability.

Regarding disabilities, 61 (15.9%) had more difficulty in making their personal purchases, with 58 (95.1%) considered vulnerable. 35 (9.4%) had no autonomy over their money, from which 32 (91.4%) were vulnerable.

Of the total, 133 elderly (34.6%) were classified as vulnerable and 251 (65.4%) as non-vulnerable. Table 1 shows the sociodemographic and clinical variables associated with vulnerability.

There was an association of vulnerability with age ($p = 0.001$), gender ($p = 0.010$), educational level ($p = 0.008$), marital status ($p = 0.004$), skin color ($p = 0.003$), physical activity ($p = 0.002$), presence of comorbidities ($p = 0.007$), having hypertension ($p = 0.001$), diabetes ($p = 0.001$), osteoarthritis ($p = 0.008$), osteoporosis ($p = 0.003$) and using polypharmacy ($p = 0.001$).

The association between body mass index and vulnerability revealed that 52 (39.1%) of the vulnerable elders had an appropriate weight, while 34 (25.6%) were obese, 35 (26.3%) were underweight, and 12 (9%) were overweight. Furthermore, there was a significant association between calf circumference and vulnerability ($p = 0.010$), in which 108 (81.2%) individuals had an adequate circumference, while 25 (18.8%) had a circumference below 31 cm.

Table 2 shows that five variables are related to the occurrence of vulnerability among the elderly.

It was identified that vulnerability grows among the elderly and among those who do not engage in physical activity, increasing the chance of presenting vulnerability for each year of age by 7%. Furthermore, it was found that the probability of being vulnerable increases by more than twice if the elderly person presents arterial hypertension and osteoporosis. In addition, there is a 30% increase in the chance of vulnerability for each additional medication used. On the other hand, performing physical activity reduces by almost 60% the chance of an elderly person being classified as vulnerable.

After stratifying the elderly into vulnerable and non-vulnerable, the frailty of 133 vulnerable elders was evaluated, from which 38 (10.2%) had low risk, classified as robust elders; 56 (41%) were at moderate risk, classified as at risk of frailty; and 42 (30.9%) showed high risk, classified as frail elders.

Considering the domains of the IVCF-20, 38 (29.3%) were between 75 and 84 years old, and 12 (8.3%) were 85 years old or more. Regarding self-rated health, 104 (78.2%) considered their health to be fair or poor. In Activities of Daily Living, 48 (36.1%) stopped doing the groceries because of their health. Regarding cognition, 70 (52.6%) reported that a family member said they were forgetful. In the mood domain, 87 (65.4%) reported being sad and discouraged. In the mobility domain, 34 (25.6%) reported

some difficulty in walking that interferes with daily activities, 42 (31.6%) had two or more falls in the last year, 47 (35.3%) reported reduction of urine or feces. Regarding communication, there was a prevalence of elderly people (54.1%) with changes in vision that hinder daily activities. More than half, 67 (50.4%), responded they do have multiple comorbidities. The most prevalent condition was the regular use of five or more medications (44.4%), followed by hospitalizations in the last six months (7.5%) and having five or more chronic diseases (4.5%).

There was an association of the IVCF-20 domains with the risk of frailty in the elders who have clinical-functional vulnerability (Table 3).

The domain in which the elderly at risk of frailty scored the most was self-perceived health, while the domain in which the frail elderly scored the most was multiple comorbidities. There was an association in the following domains: self-perceived health ($p = 0.018$), Activities of Daily Living ($p < 0.001$), cognition ($p < 0.001$), mood ($p = 0.001$) and multiple comorbidities ($p < 0.001$).

Table 4 shows the multinomial regression analysis of risk factors for frailties in vulnerable elderly people, according to the domains of the IVCF-20.

The chance of presenting a moderate to high risk of frailty is lower among those younger, with a reduction of around 99% for each year of age. A self-perceived poor health increases the moderate and high risk of frailty.

The ability to develop Activities of Daily Living was statistically related to a reduction in the moderate or high risk of frailty among the elderly. Similarly, mobility capacity and the absence of multiple morbidities were associated with a reduction in the chance of being classified as moderate or high risk of frailty. On the other hand, the absence of cognitive or mood problems was only associated with a reduction in the high risk of frailty. These two variables showed no difference in risk between elderly people with low or moderate risk of frailty. The communication domain is not shown in Table 4, as it did not influence the three levels of risk of frailty among the elderly.

The sociodemographic and clinical factors associated with clinical-functional vulnerability regarding the risk of frailty were verified, as shown in Table 5.

In terms of education, there was a significant association ($p = 0.008$) according to which most illiterate people were at risk of becoming frail (45.5%) or were frail (31.8%). As for the clinical variables in relation to the practice of physical activity, there was an important association ($p = 0.063$), as the non-practice of physical exercise can influence the development of frailty, since most elderly people were at risk of frailty (44.9%) or were frail elderly (33.7%).

The presence of comorbidities was relevant regarding the development of clinical-functional vulnerability, with a significant association ($p = 0.020$), as 40.8% and 33.1% of the elderly evaluated were at risk of frailty or were frail, respectively. As for the elderly at risk, there was a higher prevalence of hypertensive patients (42.1%), patients with osteoarthritis (47.7%) and osteoporosis (44.7%). In frail individuals, there was a higher prevalence of elderly people with depression (66.7%) and diabetes (38.7%). Another factor for clinical-functional vulnerability is polypharmacy ($p = 0.001$), which also increases the tendency of individuals to develop fragility (53.3%).

Table 1 - Sociodemographic and clinical factors associated with the vulnerability of the elderly assisted in the Primary Health Care Units, Fortaleza, Ceará, Brazil, 2019 (N = 384 elderly)

Variable	Vulnerability		*p* value
	Non-vulnerable	Vulnerable	
Age			0.001*
60-79	234 (69.6%)	102 (30.4%)	
80-100	17 (35.4%)	31 (64.6%)	
Gender			0.010*
Female	158 (61%)	101 (39%)	
Male	93 (74.4%)	32 (25.6%)	
Educational level			0.008*
More than 6 years	122 (69.7%)	53 (30.3%)	
1 to 5 years	112 (65.9%)	58 (34.1%)	
Illiterate	17 (43.6%)	22 (56.4%)	
Marital status			0.004*
Married	82 (65.1%)	44 (34.9%)	
Single	69 (78.4%)	19 (21.6%)	
Widow	58 (55.8%)	46 (44.2%)	
Divorced	40 (67.8%)	19 (32.2%)	
Stable union	2 (28.6%)	5 (71.4%)	
Skin color			0.003*
White	70 (77.8%)	20 (22.2%)	
Brown	139 (64.1%)	78 (35.9%)	
Indigenous	0	2 (100%)	
Black	39 (54.2%)	33 (45.8%)	
Yellow	3 (100%)	0	
Physical activity			0.002*
Yes	132 (73.7%)	47 (26.3%)	
No	119 (58.0%)	86 (42%)	
Comorbidities			0.007*
Yes	209 (62.8%)	124 (37.2%)	
No	42 (82.4%)	9 (17.6%)	
Hypertension			0.001*
Yes	140 (56.2%)	109 (43.8%)	
No	111 (82.2%)	24 (17.8%)	
Diabetes			0.001*
Yes	82 (53.6%)	71 (46.4%)	
No	169 (73.2%)	62 (26.8%)	
Osteoarthritis			0.008*
Yes	48 (53.3%)	42 (46.7%)	
No	203 (69%)	91 (31%)	
Osteoporosis			0.003*
Yes	50 (69.6%)	45 (47.4%)	
No	201 (52.6%)	88 (30.4%)	
Medications			0.001*
0-4	216 (74.5%)	74 (25.5%)	
5 or more	35 (37.2%)	59 (62.8%)	
Physical activity			0.002*
Yes	132 (73.7%)	47 (26.3%)	
No	119 (58.0%)	86 (42%)	

**Chi-square and Fisher's exact test, considering $p < 0.05$.*

Table 2 – Logistic regression model for predictor variables of vulnerability in elderly patients assisted in Primary Health Care Units, Fortaleza, Ceará, Brazil, 2019 (N = 384)

Variables	B	Wald	gl	Sig.	OR	CI95% for OR	
Age	0.069	15.93	1	< 0.001	1.07	1.04	1.11
Physical activity	-0.857	11.76	1	0.001	0.42	0.26	0.69
Hypertension	0.832	7.70	1	0.006	2.30	1.28	4.13
Osteoporosis	0.711	6.57	1	0.010	2.04	1.18	3.51
Medication	0.271	20.51	1	< 0.001	1.31	1.17	1.47
Model adjustment:							
Omnibus test: $\chi^2 = 92.2$; gl = 5; $p < 0.001$		Hosmer-Lemeshow: $\chi^2 = 2.90$; gl = 8; $p = 0.941$			$R^2 = 0.295$		

Table 3 – Association of the domains of the Clinical-Functional Vulnerability Index – 20, in relation with the risk of frailty of vulnerable elderly people cared for in the Primary Health Care Units, Fortaleza, Ceará, Brazil, 2019 (n = 133)

Domain	Clinical-Functional Vulnerability Index – 20			*p* value
	Robust	Frailty risk	Frail	
Age				0.143
Did not score	22 (26.5%)	29 (34.9%)	32 (38.6%)	
Scored	13 (28.2%)	27 (51.3%)	10 (20.5%)	
Self-Perception of Health				0.018*
Did not score	24 (23.1%)	41 (39.4%)	39 (37.5%)	
Scored	11 (37.9%)	15 (51.7%)	3 (10.3%)	
Daily Living Activities				**< 0.001***
Did not score	27 (42.2%)	30 (46.9%)	7 (10.9%)	
Scored	8 (11.8%)	25 (36.8%)	35 (51.5%)	
Cognition				**< 0.001***
Did not score	22 (43.1%)	21 (41.2%)	8 (15.7%)	
Scored	13 (16%)	34 (42%)	34 (42%)	
Mood				0.001*
Did not score	20 (48.8%)	15 (36.6%)	6 (14.6%)	
Scored	15 (16.7%)	39 (43.3%)	36 (40%)	
Mobility				**< 0.001***
Did not score	23 (67.7%)	9 (26.5%)	2 (5.9%)	
Scored	12 (12.1%)	47 (47.5%)	40 (40.4%)	
Communication				0.106
Did not score	13 (27.1%)	25 (52.1%)	10 (20.8%)	
Scored	22 (26.5%)	30 (36.1%)	31 (37.3%)	
Multiple comorbidities				**< 0.001***
Did not score	28 (43.1%)	32 (34.8%)	5 (77%)	
Scored	7 (10.6%)	23 (34.8%)	36 (54.4%)	

**Chi-square and Fisher's exact test, considering p < 0.05.*

Table 4 – Multinomial logistic regression model for predictor variables of the risk of frailty among vulnerable elderly people cared for in Primary Health Care Units, Fortaleza, Ceará, Brazil, 2019 (n = 133)

	B	Wald	df	Sig.	Exp(B)	CI95%	
Moderate risk							
Age							
Did not score	-4.19	6.28	1	0.012	0.015	0.001	0.401
Scored	-3.99	5.12	1	0.024	0.018	0.001	0.586
Self-Perception of Health							
Poor (scored)	5.80	6.10	1	0.014	329.4	3.306	32810.9
Regular (scored)	4.67	5.78	1	0.016	107.1	2.369	4845.1
Good (did not scored)	4.33	4.60	1	0.032	75.64	1.451	3944.2
Very goof (did not scored)	4.57	4.67	1	0.031	96.63	1.531	6098.4
Daily Living Activities							
Did not score	-2.86	5.24	1	0.022	0.057	0.005	0.662
Cognition							
Did not score	-1.15	1.73	1	0.188	0.317	0.057	1.753
Mood							
Did not score	-16.16	0.00	1	0.994	9.6e-8	0.000	--
Scored	-12.45	0.00	1	0.995	3.9e-6	0.000	--
Mobility							
Did not score	-5.90	13.74	1	< 0.001	0.003	0.000	0.062
Multiple comorbidities							
Did not score	-4.53	9.76	1	0.002	0.011	0.001	0.185
High risk							
Age							
Did not score	-5.03	5.18	1	0.023	0.007	8.6e-5	0.496
Scored	-7.02	7.93	1	0.005	0.001	6.7e-6	0.118
Self-Perception of Health							
Scored (Poor)	4.72	3.19	1	0.074	112.2	0.631	19955.1
Scored (Regular)	4.01	3.18	1	0.075	55.23	0.670	4552.5
Did not Scored (Good)	3.59	2.00	1	0.157	36.19	0.251	5216.2
Did not scored (Very Good)	4.29	1.50	1	0.221	73.23	0.075	71037.1

To be continued

There was a considerable association between clinical-functional vulnerability and calf circumference (p = 0.066). Frail elderly (48.1%) and those at risk of frailty (37%) had decreased calf circumference, suggesting a decrease in muscle mass.

DISCUSSION

The prevalence of vulnerable elderly people found in this study is similar to that found in international studies[16-17]. However, it differs from national studies, in which the prevalence is higher[18-20]. The divergence between national findings may reflect both age — because, in this study, young elderly people predominated — and socioeconomic differences between Brazilian cities. Individuals with a higher socioeconomic level have access to health care, and may, therefore, develop healthy habits such as physical activity and, consequently, have fewer comorbidities; thus, they use a smaller amount of medication and, in turn, have better health conditions[21-22].

The practice of physical activity had a strong influence on vulnerability[23-24], and it is important that health professionals and managers encourage and promote this practice in the daily lives of elderly people. However, stronger actions mediated by public policies aimed at the practice of physical activity in the elderly population need and must be implemented[25]. Examples of strategies are outdoor gyms, the introduction of physical educators in health units, among others. In this context, in the city under study, there has been a Firefighter and Citizenship project for 17 years, which organizes physical activities such as dances and physical stretching in public spaces in the city[26], actions that could be replicated in other states to strengthen practices of health promotion for the elderly population.

The comorbidities most associated with vulnerability in this study were hypertension and osteoporosis. These conditions are also positively affected by the practice of physical activity, which, in turn, generates even better health conditions for its practitioners. This reveals that this is not something linear, but a cycle in which physical activity plays a protective role with the potential to stop the development of vulnerability[27].

Early identification of vulnerability and knowledge of associated factors helps in detecting the triggering aspects of the frailty syndrome and, thus, aids in the decision making about the functional and specific parameters of the elderly. Such actions contribute to the reduction of damage caused by poor health conditions and by external factors, such as lack of social, financial and family support[18].

Table 4 (concluded)

	B	Wald	df	Sig.	Exp(B)	CI95%	
Daily Living Activities							
Did not score	-5.48	13.29	1	0.000*	0.004	0.000	0.080
Cognition							
Did not score	-3.16	6.29	1	0.012	0.042	0.004	0.501
Mood							
Did not score	-9.68	37.90	1	0.000*	6.3e-5	2.9e-6	0.001
Scored	-3.67	--	1	--	0.026	0.026	0.026
Mobility							
Did not score	-9.03	20.69	1	0.000*	0.000	2.4e-6	0.006
Multiple comorbidities							
Did not score	-9.28	26.10	1	0.000*	9.3e-5	2.6e-6	0.003
Model adjustment:							
Likelihood Ratio Test: $\chi^2 = 172.3$; gl = 26; $p < 0.001$	Adjustment test: $\chi^2 = 130.5$; gl = 142; p = 0.746					$R^2 = 0.829$	

Table 5 - Sociodemographic and clinical factors associated with clinical-functional vulnerability, regarding the risk of frailty in vulnerable elderly people treated in Primary Health Care Units, Fortaleza, Ceará, Brazil, 2019 (n = 133)

Variable	Clinical-Functional Vulnerability Index – 20			*p* value
	Robust	Frailty risk	Frail	
Age				0.96
60-79	32 (28.3%)	42 (37.2%)	39 (34.5%)	
80-100	7 (26.9%)	15 (57.7%)	4 (14.4%)	
Gender				0.187
Female	27 (25%)	44 (40.7%)	37 (34.3%)	
Male	12 (38.7)	13 (41.9%)	6 (19.4%)	
Educational level				0.008*
Illiterate	5 (22.7%)	10 (45.5%)	7 (31.8%)	
1 to 5 years	17 (27%)	28 (44.4%)	18 (28.6%)	
More than 6 years	17 (31.5%)	19 (35.2%)	18 (33.3%)	
Marital status				0.424
Single	7 (29.2%)	7 (29.2%)	10 (41.7%)	
Married	14 (31.8%)	16 (36.4%)	14 (31.8%)	
Stable union	0	4 (80%)	1 (20%)	
Widow	12 (25.5%)	23 (48.9%)	12 (25.5%)	
Divorced	6 (31.6%)	7 (36.8%)	6 (31.6%)	
Skin color				0.222
White	4 (19%)	6 (28.6%)	11 (52.4%)	
Brown	26 (31.7%)	32 (39%)	24 (29.3%)	
Indigenous	1	1	0	
Black	8 (23.5%)	57 (41%)	8 (23.5%)	
Yellow	0	0	0	
Physical activity				0.063
Yes	20(40%)	17 (34%)	13 (26%)	
No	19(21.3%)	40 (44.9%)	30 (33.7%)	
Comorbidities				0.020*
Yes	34 (26.2%)	53 (40.8%)	43 (33.1%)	
No	5 (55.6%)	4 (44.4%)	0	
Medications				0.001*
0-4	33 (41.8%)	35 (44.3%)	11 (13.9%)	
5 or more	6 (10%)	22 (36.7%)	32 (53.3%)	

**Chi-square and Fisher's exact test, considering $p < 0.05$.*

The prevalence of frailty in vulnerable elderly in this study did not differ from national studies[28-29]. It is noteworthy that age is a major factor in the occurrence of frailty; thus, it is interesting for health professionals to plan their actions and care based on the ages of the elderly, with a more precise look with each passing year. This points to a care not only by groups, but also by stratification within this population[30].

It is pointed out that the poor self-perception of health is associated with moderate and high risk of frailty in the elderly; the negative perception of health is mainly associated with loss of autonomy and functional decline[14]. In this sense, it is mandatory to introduce this aspect during consultations and approaches to elderly people.

From a sociodemographic point of view, females are associated with frailty (a fact corroborated in this study), since they live longer, increasing the probability of triggering chronic and disabling conditions, which provide bodily changes that accelerate deterioration[31].

Education has a negative impact on the functionality of the elderly, but the results found showed that education did not vary in relation to the level of frailty — this finding needs further investigation to establish a cause-and-effect relationship.

In this research, the nutritional status directly influenced the clinical-functional vulnerability at the extremes of the BMI: underweight and obese elderly. This relationship is proven by another research and is explained by changes in body composition over aging, added to the factors that lead to dependence and affect the autonomy of the elderly[32]. Thus, the use of specific anthropometric data for the elderly population should be part of the care for this population. Since it has a good correlation with morbidity and mortality indicators, it is low cost and easily applicable, the specific BMI for the elderly can be a good indicator of nutritional status, as long as professionals associate these data with the composition and distribution of the body fat[33].

The more diseases the elderly have, the greater their chance of functional decline and frailty[34-35]. The literature reveals a strong association between functional decline and diabetes, respiratory, cardiac and osteoarticular diseases, linked to obesity, sedentary lifestyle and insulin resistance[36-38]. The presence of comorbidities leads to drug treatment, with a tendency to polypharmacy, exposing these individuals to more adverse effects, weight loss or gain, functional and cognitive impairment, frailty, and hospitalizations, which confirms the increased chance of being classified as vulnerable. The rational use of medicines by the elderly population is a major challenge for public health. Educational and administrative measures are necessary to guarantee the geriatric population a quality pharmacotherapy[39].

Finally, the maintenance of functional capacity has important implications for the quality of life of the elderly, since the physical limitations resulting from loss of strength, comorbidities and falls generate disabilities that influence Basic Activities of Daily

Living (BADLs) and Instrumental Activities of Daily Life (IADLs). The greater the functional decline, the greater the weakness and the development of disabilities[40].

Study limitations

The cross-sectional design does not allow for the establishment of a causal relationship. Also, some independent variables were self-reported, so there may be differences between actual and reported data.

Contributions to the health area

The assessment of vulnerability and frailty is necessary in Primary Health Care, as it allows stratifying, capturing, welcoming, developing actions, establishing a link between the service and the user, and thus ensuring comprehensive and continuous care for the elderly.

CONCLUSIONS

Vulnerability was associated with age, gender, education, marital status, physical activity, presence of hypertension, diabetes, osteoarthritis, osteoporosis and use of polypharmacy. In addition, it has associations with activities that demand strength. As for frailty, there was an association with low education, self-perceived health and bad mood, presence of comorbidities, use of polypharmacy, decreased mobility and calf circumference, all affecting their activities of daily living.

The perspectives are the development of longitudinal studies that can infer causal factors for frailty and vulnerability.

FUNDING

The *Coordenação de Aperfeiçoamento de Pessoal de Nível Superior* – CAPES (Coordination for the Improvement of Higher Education Personnel) funded this research through a master's degree scholarship.

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