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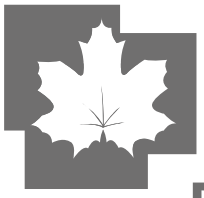

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Quality of life and social support of older adults caregivers and care recipients in high social vulnerability

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Abstract

Objective: to compare quality of life and social support between older adults caregivers and care recipients. *Method:* observational, cross-sectional and quantitative study, carried out with 112 older adults registered in five Family Health Units in a context of high social vulnerability in a city in the interior of São Paulo, Brazil. Sociodemographic, care and health variables, social support by the *Medical Outcomes Study* Social Support Scale and quality of life by the WHOQOL-*bref* and WHOQOL-*old* were evaluated. For data analysis, Pearson's Chi-Square, Mann-Whitney and *Spearman's* Correlation tests were used. *Results:* There was a significant difference between the participants for material support (p=0.004) and physical domain of the quality of life scale (p=0.002). Older adults caregivers have lower material support scores and better perception of the physical domain of the quality of life scale when compared to care recipients. Furthermore, there was a direct and moderate correlation between quality of life and social support of older adults (p<0.001), that is, the higher the score on the social support scale, the higher the score on the quality of life scale. *Conclusion:* adults caregivers presented lower material support scores and better perception of the physical domain of the quality of life scale compared to care receptors. Actions related to expanding the amount of significant relationships of caregivers can be useful for improving social support, with consequent improvement of the other aspects involved in quality of life.

Keywords: Social Support. Quality of Life. Aged. Caregivers. Social Vulnerability.

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INTRODUCTION

Amid increased longevity and a predominance of chronic diseases, older individuals can experience difficulties carrying out activities of daily living (ADLs) and, consequently, may require the help of caregivers[1]. Caregivers provide support and encouragement to perform these ADLs[2]. On a national level, there is a growing number of older individuals who care for other older people, where the spouse is often the only option for delivering care[3].

Older caregivers in a situation of high social vulnerability are more exposed to a lack of resources, where this can negatively impact their health and quality of life, besides affecting the care provided[4].

In the context of care, older adults may have specific health needs, highlighting the need to study aspects that can improve quality of life and health in aging. In this respect, social support is an important determinant of health and disease[5] and can enhance quality of life in both older caregivers and care recipients[6].

Quality of life (QoL) is fundamental for humans throughout all stage of the life span and is associated with well being, health, satisfaction and perception on life in psychological, physical and social domains[7]. Remaining active, enjoying social support and performing activities with autonomy are important elements contributing to good quality of life[8]. However, when these aspects are lacking, this can negatively impact older caregivers, leading to depressive symptoms, lack of social interaction and difficulty performing self-care[9]. Thus, studies investigating this subject are imperative.

Evidence in the literature suggests that social support can optimize quality of life, promoting a reduction in negative feelings and loneliness[10] and improvements in cognitive performance [11,12], with greater effects when this support is derived from family as opposed to friends or others[13].

Corroborating these findings, both national and international literature show that social support is associated with positive perceived quality of life among older people. However, no studies investigating social support and quality of life in the older caregiver-care recipient dyad were found in the literature, prompting the present study.

Thus, understanding the interaction of these variables in this population group is pertinent, especially amid situations of high social vulnerability, where lack of resources may negatively impact quality of life and social support of those involved[14]. The objective of this study was to compare the quality of life and social support of older caregivers and care recipients.

The initial hypothesis holds that older caregivers have lower perceived social support and better perceived quality of life compared to care recipients.

METHOD

A cross-sectional, observational, quantitative study drawing on data from the investigation "Factors associated with poor sleep quality in older caregivers" was conducted. The study project was approved by the Research Ethics Committee of the Federal University of São Carlos (permit no. 3.275.704, 22/04/2019) and complied with Resolution no. 466/2012. Participation was voluntary and all participants of the study read and signed the Free and Informed Consent Form in duplicate.

The study was carried out between July 2019 and March 2020 and involved older adults enrolled at 5 Family Health Units (USFs) situated in areas of high social vulnerability, according to the Paulista Social Vulnerability Index (IPVS) of a city in the interior of São Paulo state.

The IPVS reflects demographic and socioeconomic aspects of people living in São Paulo State and is categorized into 7 levels of vulnerability: Group 1 (extremely low vulnerability), Group 2 (very low vulnerability), Group 3 (low vulnerability), Group 4 (moderate vulnerability), Group 5 (high vulnerability – urban sectors), Group 6 (very high vulnerability) and Group 7 (high vulnerability – rural sectors)[15]. In 2019, the city of São Carlos had 9 USFs located in areas of high social vulnerability (IPVS= 5), of which, 5 agreed to take part in the study.

The sample comprised all individuals that met the following inclusion criteria: age ≥ 60 years; living with another older adult in the same household; located by the researchers at the household within 3 attempts on different days and times; and living within the catchment area of the USF, according to the address provided by the professionals of the USF. Criteria for inclusion in the caregiver group were: being the primary caregiver of the care recipient; performing the role of caring on an informal basis; being a relative of the care recipient, who was dependent for at least one basic activity of daily living (BADL), as measured by the Katz Index[16,17] or instrumental activity of daily living (IADL), as measured by the Lawton & Brody scale[18,19]. The exclusion criteria adopted were: severe speech and/or hearing deficit perceived at time of data collection potentially hampering or preventing communication during application of the scales; and incomplete data on the variables of interest.

The sample was selected from a total of 168 households listed by professionals of the 5 USFs, each with a dyad of older residents. All households were visited. Of the overall sample, 49 refused to take part in the study, 32 were not found by the researchers after 3 attempts on different days and times, 18 were no longer residing at the address given, 3 had died and, for 1 of the households, the older residents were independent for BADLs and IADLs. Data collection included the dyads of older people from the 65 households visited, However, after analysis of the database, 9 dyads were later excluded for not having all data on the variables of interest. Therefore, the final study sample included 56 older caregivers and 56 care recipients.

Interviews took place at the participants´ homes and were conducted individually during a single session averaging 2 hours duration, in a room made available by the residents. Data collection was performed by 8 previously trained graduate and postgraduate students.

The variables of interest were investigated for the following parameters:

- Sociodemographic and health characteristics of participants: sex (female or male), age (years), marital status (with or without partner), education (years), race (brown, white, black, yellow or indigenous), family and individual income (BRL), retirement (yes or no), currently working (yes or no), deem income sufficient (yes or no), private health plan (yes or no), multimorbidities (yes or no), number of medications in use, falls and hospital admissions in last year (yes or no), alcohol use (yes or no), and tobacco use (yes or no).

- Care context characteristics: degree of kinship with older person cared for (spouse, father/mother, mother/father-in-law, brother/sister or other), time in role as carer (years), number of hours and days per week dedicated to caregiving, undertaken preparatory course for caring for older person (yes or no), and help received for the task of caring (yes or no).

- Functional capacity for BADLs: determined using the Katz Index[16,17] which measures the capacity to perform basic activities such as bathing, dressing, toileting, transferring, continence and feeding. Upon completion, the interviewer checks for how many activities the individual displays independence and dependence. One point is given for each item the individual reports independence, and zero points for dependence. The final score ranged from 0-6 points. For the purposes of analysis, 6 points indicated independent and ≤ 5 points dependent.

- Functional capacity for IADLs: determined using the Lawton Brody Instrumental Activities of Daily Living Scale[18,19], which measures the degree of dependence for performing instrumental activities such as housekeeping, handling finances, using telephone, managing medications, using transportation, shopping, and preparing food. Upon completion, the score is summed to give a total of between 7 and 21 points. For the purposes of analysis, a score of 21 points indicated independence and 7-10 points dependence.

- Social support, assessed using the Social Support Scale of the Medical Outcomes Study, which comprises 19 items covering 5 functional dimensions of social support: tangible,

affectionate; emotional; positive social interaction and informational. For each item, the participants indicate how often they consider each type of support is available on a frequency scale of options ("never" to "always"). The values are standardized on a scale ranging from 20-100 points, where higher scores indicate better level of social support[20].

- Quality of life (QoL): assessed using questionnaires devised by the World Health Questionnaires – WHOQOL-*bref*[21] and WHOQOL-*old*. The WHOQOL-*bref* [22] comprises 26 questions, of which 2 are general domain and the others represent each of the 24 facets making up the original QoL scale. The domains assessed (Physical health, Environmental health, Social relationships and Psychological health) comprise questions scored from 1 to 5 on a response scale. Final scores on each domain are calculated by syntax, which quantifies the global quality of life and the quality of life domains on scales with scores ranging from 0 to 100, where 100 implies higher QoL. The WHOQOL-*old* questionnaire comprised 24 questions divided into 6 domains: sensory abilities; autonomy; past, present and future activities; social participation; death and dying; and intimacy. This questionnaire is also scored according to the syntax defined by the WHOQOL group[21,22]. Quality of life was considered the dependent variable of this study.

For the descriptive analysis of data, distributions of frequency, medians, means and standard-deviation were estimated for numeric variables. Proportions were estimated for categorical variables. The Kolmogorov-Smirnov test was used to test for normality of variables and a non-parametric distribution was confirmed. Differences between groups were estimated using Pearson´s chi-square and Mann-Whitney tests. Analysis of correlation between QoL score and social support was carried out using Spearman´s correlation test. The magnitude of correlation was classified as weak (<0.30); moderate (0.30-0.59); strong (0.60-0.99) and perfect (1.0)[23]. A significance level of 5% was adopted.

RESULTS

The study sample comprised 56 older caregivers and 56 care recipients. The sociodemographic characteristics of participants are given in Table 1. The sample consisted predominantly of individuals who were female, aged 60-74 years, with low educational level and living with partner.

Information on the health situation of the participants is given in Table 2.

Regarding care context, 91.1% of caregivers were spouses of the care recipient and time in role of caregiver averaged 11.8±13.41 years. Time dedicated to care averaged 17.4±8.5 hours a day, 4.9±0.5 days a week. Most caregivers had no previous training (98.2%) and received no help with the task of caring (58.9%).

Regarding social support network, caregivers had a mean of 10.0±14.1 and median of 5.5 people in their network. Care recipients had a mean of 16.4±34.0 and median of 5.0 people in their social support network. There was no statistically significant group difference in number of people comprising the respective social support networks (p=0.905).

A comparison of social support of caregiver versus care recipients is shown in Table 3.

Caregivers scored lower for tangible support compared to care recipients (p=0.004).

Differences in perceived QoL of caregivers and care recipients are presented in Table 4.

A statistically significant relationship was found between the Physical health domain of the QoL scale among participants, where caregivers had better perceived physical health than care recipients (p=0.002).

The correlation between QoL and social support of caregivers is presented in Table 5.

A moderate direct correlation was found between social support and QoL of caregivers, i.e. high score on social support scale was associated with high score on QoL scale.

Table 1. Distribution of participants according to demographic aspects (N=112). São Carlos, São Paulo state, 2019-2020.

Variables	Caregiver	Care recipient	*p-value*
	n (%)	n (%)	
Age			0.257ǂ
60-74 years	46 (82.1)	41 (73.2)	
≥ 75 years	10 (17.9)	15 (26.8)	
Sex			0.705ǂ
Female	31 (55.4)	29 (51.8)	
Male	25 (44.6)	27 (48.2)	
Education			0.622ǂ
0-4 years	45 (80.4)	47 (83.9)	
≥ 5 years	11 (19.6)	9 (16.1)	
Marital status			0.499ǂ
With partner	53 (94.6)	51 (91.1)	
Without partner	3 (5.4)	5 (8.9)	
Race			0.535ǂ
Brown	28 (50.0)	24 (42.9)	
White	19 (33.9)	20 (35.7)	
Black	6 (10.7)	11 (19.6)	
Yellow	2 (3.6)	1 (1.8)	
Indigenous	1 (1.8)	0 (0.0)	
Currently working			0.001ǂ
No	42 (75.0)	54 (96.4)	
Yes	14 (25.0)	2 (3.6)	
Retired			0.065ǂ
No	16 (28.6)	8 (14.3)	
Yes	40 (71.4)	48 (85.7)	
Personal income*			0.847ǂ
0-1 minimum wage	27 (50.0)	28 (51.9)	
>1 minimum wage	27 (50.0)	26 (48.1)	
Family income*			0.801ǂ
0-1 minimum wage	6 (11.1)	5 (9.6)	
>1 minimum wage	48 (88.9)	47 (90.4)	
Sufficient income			0.848ǂ
No	33 (58.9)	32 (57.1)	
Yes	23 (41.1)	24 (42.9)	

Source: Data from Study, 2020. SD = Standard Deviation; ǂChi-square; *Some participants gave no answer.

Table 2. Distribution of participants according to health aspects (N=112). São Carlos, São Paulo state, 2019-2020.

Variables	Caregiver	Care recipient	*p-value*
	n (%)	n (%)	
Polypharmacy	38 (67.9)	28 (50.9)	0.069ǂ
No (0-4 medications)	18 (32.1)	27 (49.1)	
Yes (≥ 5 medications)			
Health plan			0.768ǂ
No	49 (87.5)	50 (89.3)	
Yes	07 (12.5)	6 (10.7)	
Multimorbidity			0.558ǂ
No	2 (3.6)	1 (1.8)	
Yes	54 (96.4)	55 (98.2)	
Functional capacity for BADLs			0.031ǂ
Independent	41 (73.2)	30 (53.6)	
Dependent	15 (26.8)	26 (46.4)	
Functional capacity for IADLs			<0.001ǂ
Independent	21 (37.5)	1 (1.8)	
Dependent	35 (62.5)	55 (98.2)	
Falls in last year			0.425ǂ
No	35 (62.5)	39 (69.6)	
Yes	21 (37.5)	17 (30.4)	
Hospital admission in last year			1.000ǂ
No	46 (82.1)	46 (82.1)	
Yes	10 (17.9)	10 (17.9)	
Engagement in physical activity			0.403ǂ
No	42 (75.0)	38 (67.9)	
Yes	14 (25.0)	18 (32.1)	
Alcohol use			0.607ǂ
No	46 (82.1)	48 (85.7)	
Yes	10 (17.9)	8 (14.3)	
Tobacco use			0.450ǂ
No	45 (80.4)	48 (85.7)	
Yes	11 (19.6)	8 (14.3)	

Source: Data from Study, 2020. SD = Standard Deviation; ǂChi-square.

Table 3. Comparative analysis of social support of participants (N=112). São Carlos, São Paulo state, 2019-2020.

Dimension of social support	Caregiver		Care recipient		*p-value**
	Mean (SD)	Median	Mean (SD)	Median	
Tangible support	82.95 (18.31)	90.00	91.70 (13.29)	100.00	0.004
Affectionate support	89.29 (17.46)	100.00	89.52 (17.75)	100.00	0.974
Emotional support	77.95 (22.84)	85.00	80.45 (21.03)	87.50	0.564
Informational support	80.27 (20.81)	85.00	79.38 (21.74)	85.00	0.960
Positive social interaction	77.77 (20.40)	82.50	76.71 (22.02)	80.00	0.962
Total score	81.64 (17.09)	85.67	83.53 (16.18)	86.83	0.501

Source: Data from Study, 2020. SD = Standard Deviation; *Mann-Whitney

Table 4. Comparative analysis of quality of life of participants (N=112). São Carlos, São Paulo state, 2019-2020.

Domains of WHOQOL-bref	Caregiver		Care recipient		*p-value**
	Mean (SD)	Median	Mean (SD)	Median	
Physical health	64.16 (13.97)	64.29	54.97 (16.66)	53.57	0.002
Environmental health	55.02 (14.31)	56.25	55.58 (13.29)	56.25	0.581
Social relationships	66.07 (17.56)	70.83	64.66 (17.21)	66.67	0.577
Psychological health	61.90 (15.06)	62.50	67.71 (18.47)	70.84	0.075
Total score	61.79 (11.37)	62.75	60.73 (12.31)	60.75	0.434
Domains of WHOQOL-old	Caregiver		Care recipient		p-value*
	Mean (SD)	Median	Mean (SD)	Median	
Sensory abilities	69.20 (25.36)	75.00	67.08 (23.88)	75.00	0.538
Autonomy	58.26 (20.92)	59.38	55.92 (17.61)	56.25	0.391
Past, present and future activities	61.72 (18.19)	62.50	61.38 (15.41)	62.50	0.701
Social participation	64.17 (17.13)	68.75	61.05 (16.47)	62.50	0.243
Death and dying	67.97 (24.34)	75.00	64.06 (26.28)	75.00	0.418
Intimacy	66.63 (19.95)	68.75	68.42 (21.23)	75.00	0.393
Total score	71.73 (11.86)	73.75	70.39 (10.07)	69.17	0.303

Source: Data from Study, 2020. SD = Standard Deviation; *Mann-Whitney

Table 5. Analysis of correlation between QoL and social support in caregivers (N=56). São Carlos, São Paulo state, 2019-2020.

QoL domains	Tangible support		Affectionate support		Emotional support		Positive Social Interaction		Informational support		Total social support score	
	Rho	p*	Rho	p*	Rho	p*	Rho	p*	Rho	p*	Rho	p*
Physical health	0.207	0.125	0.026	0.850	0.050	0.716	0.147	0.278	0.085	0.532	0.130	0.340
Environmental health	0.324	0.015	0.250	0.063	0.298	0.026	0.282	0.035	0.389	0.003	0.366	0.005
Social relationships	0.341	0.010	0.268	0.046	0.251	0.062	0.389	0.003	0.182	0.180	0.388	0.011
Psychological health	0.287	0.032	0.313	0.019	0.232	0.085	0.423	0.001	0.236	0.080	0.370	0.005
Total QOL(bref)	0.141	0.137	0.261	0.050	0.252	0.007	0.317	0.001	0.294	0.002	0.340	<0.001
Sensory abilities	0.444	0.001	0.456	<0.001	0.425	0.001	0.343	0.010	0.247	0.066	0.428	0.001
Autonomy	0.306	0.022	0.194	0.152	0.265	0.048	0.135	0.321	0.292	0.029	0.298	0.026
Past, present and future activities	0.255	0.057	0.256	0.057	0.390	0.003	0.224	0.098	0.248	0.065	0.344	0.009
Social participation	0.238	0.078	0.196	0.148	0.100	0.462	0.100	0.465	0.201	0.138	0.176	0.195
Death and dying	-0.061	0.656	0.024	0.863	0.106	0.438	0.169	0.214	0.013	0.924	0.070	0.607
Intimacy	0.327	0.014	0.336	0.011	0.324	0.015	0.245	0.069	0.233	0.083	0.342	0.010
Tot QOL (Old)	0.348	0.009	0.323	0.015	0.407	0.002	0.321	0.016	0.267	0.046	0.402	0.002

Source: Data from study, 2020.

QoL = Quality of life; Total QoL (Old) = Total quality of life score on WHOQOL-OLD. *Spearman Correlation Coefficient..

DISCUSSSION

This study compared the quality of life and social support of older caregivers versus care recipients. Caregivers scored lower for tangible support and had better perceived physical health on the QoL scale compared to care recipients.

With regard to social support networks of the dyads, caregivers had a mean of 10 people in their network, while care recipients had 16. In a previous Brazilian study of 85 caregivers and 84 non-caregivers seen at Family Health Clinics (USF) of a city situated in the interior of São Paulo state found that mean number of individuals in the social support network was higher in the non-caregivers[24].

Social support is a determinant of health aging[25], where informal support networks consolidate social relationships, interaction and affectionate, instrumental and tangible support, helping to promote the health and quality of life of older people. Among individuals with less financial means and in situations of social vulnerability, this type of help is even more important. Under circumstances of illness and problems accessing medication and treatment, this group may become more dependent on an informal support network[26], where people tend to help each other cope with the many everyday struggles[24].

In the present study, older caregivers had lower score for tangible support compared to care recipients. A cross-sectional study of 962 community-dwelling older adults in Minas Gerais also found that the highest score for social support was for the tangible support dimension[27]. Tangible support encompasses physical support for practical services and material resources, such as performing activities of daily living (ADLs). The fact that care recipients received more tangible support than caregivers should be interpreted from a demand perspective. Older people who need care generally have functional limitations, rendering this age group more dependent on others, having greater demands. Thus, it follows that these individuals receive more tangible support because they have greater needs[28].

In this investigation, caregivers had better perceived physical health on the QoL scale compared to care recipients. Another Brazilian study of 100 older adults aged ≥ 80 years and their family caregivers (mean age 0.63±14.53 years) in a city of Rio Grande do Sul state assessed QoL of the participants. For the physical domain of QoL, results revealed that care recipients had lower mean scores on this domain (51.76) compared to caregivers (82.61)[29].

The physical domain of QoL is related to many facets, such as pain and discomfort; energy and fatigue; sleep and rest; mobility; activities of daily living; dependence on medicational substances and medical aids; and work capacity[21]. Given QoL involves a subjective concept and depends on the feeling of well being and level of satisfaction with life, care recipients are believed to have a negative view of the physical component because of lack of autonomy and dependence on caregivers for some daily tasks, a scenario which might produce negative feelings of stress and dissatisfaction which, in turn, lead to worse quality of life[30].

In the present study, a moderate direct correlation between social support and QoL of caregivers was identified. The literature shows that the importance of social support increases in late life, constituting a predictor of greater well being and QoL in caregivers[31].

In Brazil, a study of 148 older adults who were caregivers of other older adults found that those with better perceived QoL also rated emotional support received from family members as satisfactory. The authors revealed that satisfaction with emotional support can have a positive direct influence on perceived burden of care, a variable strongly associated with QoL[32].

Conversely, the literature shows that a lack of and/or insufficient social support can trigger caregiver overload and stress, culminating in a lessened capacity to respond to physical and emotional stressors, poorer self-perceived health and resultant worse quality of life[32,33]. Another aspect which might potentially confer poor quality of life is the unpreparedness to perform the role of caring, where many caregivers report a feeling of reduced self-efficacy[33].

A decrease in social and family contacts can occur during the course of the aging process and lead to social isolation, especially in situations of high social vulnerability. The lack of social support due to "family insufficiency" (recognized geriatric syndrome which can stem from conflicting relationships over the life course) can render older adults more dependent on Primary Care professionals, placing greater demand on health services. However, a closer relationship between older individuals and health professionals can be helpful in attenuating the impact of social vulnerability to which they are exposed[34].

Amid the context of high social vulnerability, characterized by lack of resources of all kinds, and care delivered to older people within Primary Care, it is imperative that health professionals offer care involving assertive and individualized actions based on the actual needs of older people, centered on the individual integrated with the family and the community. Taking into account the aspects specific to the older population, adopting a humanized integrated care approach, bringing a qualified ear to bear and showing empathy, can be pivotal in the successful resolution of each case[34].

This study has some limitations. The dearth of similar studies investigating older caregivers and their respective care recipients hampered comparison of the present findings against the national and international literature. In addition, the small, highly specific sample limits the generalization of the study findings. Also, the composition of the sample may also represent a limitation, in that the sample comprised older participants from only a third of the total households listed by the health center professionals. The cross-sectional design precludes any inferences regarding cause and effect relationships for the variables investigated. Lastly, the data obtained may not be fully reliable because it was collected by self-report, although the literature has confirmed the potential of self-reported measures[35]. Future longitudinal studies, including older people in different situations of social vulnerability, are warranted.

CONCLUSION

Caregivers scored lower for tangible support and had better perceived physical health on the QoL scale compared to care recipients. These findings serve as an alert to health professionals on the need to assess both social support and QoL of older people, thereby allowing individualized interventions to be offered to this group.

Identifying the key members of the social support network of caregivers is paramount, given it is these individuals who provide the necessary support in the event of unexpected situations involving care recipients. Moreover, getting these caregivers involved in health promotion activities and disease prevention, e.g. groups engaged in organized walks, stretching, manual activities, or workshops on health education and caregiving, can be helpful in increasing the number of significant relationships, with consequent improvement in QoL of all involved.

Primary Care professionals should also undergo continual training to enable delivery of optimal support to family caregivers, because this group can often have doubts regarding care management and typically lacks any specific guidance. Assertive actions to promote social support can be useful to improve the QoL of this dyad. Lastly, public policies targeting older caregivers in the Primary Health setting should be devised.

AUTHOR CONTRIBUTIONS

Mayara M. Yazawa - Writing – First Draft and Methodology; Ana C. Ottaviani - Writing – Review and Editing; Ana L.S. Silva - Writing – First draft and Methodology; Keika Inouye - Formal Analysis and Writing – Review and Editing; Tábatta R.P. Brito - Writing – Review and Editing; Ariene A. Santos-Orlandi – Administration of Project, Methodology, Securing funding and Writing - Review and Editing.

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Association of clinical parameters of sarcopenia and cognitive impairment in older people: cross-sectional study

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Abstract

Objective: To associate clinical parameters of sarcopenia with cognitive impairment in older people. *Method:* Cross-sectional study with 263 older adults (≥60 years) treated at a specialized public health facility. Sociodemographic and clinical variables were used to characterize the sample and the clinical parameters of sarcopenia (muscle strength, muscle mass and physical performance) were assessed based on handgrip strength (HGS), calf circumference (CC) and the Timed Up and Go (TUG) test. The Mini-Mental State Examination (MMSE) was used to evaluate cognitive status. Associations were analyzed by simple and multiple linear and logistic regression considering the clinical parameters of sarcopenia (independent variables) and cognitive status (dependent variable), adjusted for age, sex, years of schooling, number of medications, nutritional status and functional capacity. *Results:* Of participants with cognitive impairment, 59.6% exhibited low muscle strength. In simple linear regression, cognitive status was explained by muscle strength in 21.5% of cases, muscle mass in 12.3% and physical performance in 7.6%, with muscle strength and muscle mass as explanatory variables for cognitive status in non-adjusted multiple regression and muscle strength alone for adjusted analyses. Only muscle strength remained significantly associated with cognitive status in adjusted multiple logistic regression (OR=0.846; [95%CI: 0.774 – 0.924] p<0.001). *Conclusion:* Low muscle strength was the sarcopenia parameter independently associated with cognitive impairment. This information is useful in highlighting the likelihood of cognitive impairment when poor muscle strength is identified in older people.

Keywords: Aged. Sarcopenia. Cognitive impairment. Functional dependence.

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INTRODUCTION

Sarcopenia and cognitive impairment are worrisome issues related to aging and public health due to the high risk of functional disability, hospitalization and death[1,2]. In community-dwelling older people, sarcopenia has a global prevalence ranging from 10 to 27%, with a progressive increase with advancing age and in rehabilitation units[3]. Cognitive impairment, on the other hand, has been experiencing an exponential increase, with estimates that 65 million older people will have dementia worldwide by 2030, also with higher prevalence in advanced age[4].

Sarcopenia is a disease that causes progressive loss of strength and muscle mass in older people[5,6]. It can be explained by the interaction of multiple risk factors, in particular, aging itself, with a reduction in cell metabolism and hormones that participate in myogenesis[5]. Furthermore, the presence of comorbidities, sedentary lifestyle, poor diet and bad habits are risk factors that are involved in the production of high concentrations of inflammatory cytokines, causing apoptosis[6] and reduction in the structure and function of systems involved in both sarcopenia and cognitive impairment[7], with the possibility of coexistence of both[8,9].

Sarcopenia has been shown to be associated with cognitive impairment[8–10]. A systematic review identified a higher prevalence of sarcopenia in participants with cognitive impairment in most of the included studies[8]. It has also been noted that the concomitant presence of sarcopenia and cognitive impairment is a common finding[9]. In addition, researchers have specifically pointed out physical performance and muscle strength as clinical parameters of sarcopenia independently associated with cognitive impairment[11,12]. However, results for muscle mass measurements so far are inconsistent[12–15]. Additionally, there are still uncertainties about this interaction due to the great methodological heterogeneity of the studies[8,12–16].

In this context, the objective of the study was to associate the clinical parameters of sarcopenia with cognitive impairment in older people who use a public specialized care service. The results of this study will contribute to elucidate which clinical parameters of sarcopenia are associated with cognitive impairment. Considering that the clinical parameters of sarcopenia are modifiable outcomes[17], with this information, the entire multidisciplinary team will be able to better direct the investigation for the screening of older people at risk of cognitive impairment and implement interventions aimed at its primary and secondary prevention[8].

METHODS

This is a cross-sectional study. The research is in accordance with Resolution n. 466/2012 and Resolution n. 510/2016. The study was approved by the Research Ethics Committee of the Faculty of Ceilândia of the University of Brasília (UnB) – CEP/FCE (Opinion 3,650,491) and all participants signed the Free and Informed Consent Form (ICF).

Participants were 281 older people selected for convenience and assessed in a public specialized care service in the western health region of the Federal District (DF) between the years 2020 and 2021. This specialized care service is composed of a multidisciplinary team that performs a multidimensional assessment of older people who require geriatric care referred by primary care services. Older people who are 80 years old or older are assisted, regardless of complaint or health condition, and older people under 80 years old who have at least one of the following criteria: dependence on basic activities of daily living; cognitive disability; parkinsonism; urinary or fecal incontinence; partial or total immobility; postural instability, falls or low-impact fractures; polypathology; polypharmacy and clinical decompensations or frequent hospitalizations. In the present study, older people were included and those with missing data on the Mini-Mental State Examination (MMSE) and/or on the three assessments of the clinical parameters of sarcopenia (muscle strength, muscle mass and physical performance) were excluded.

The sample size required for analyzing the variables in this study was estimated by performing a sample calculation based on the *odds ratio (OR)* value found in a meta-analysis of the association

between sarcopenia and cognitive status (OR=2.926 [2.297– 3.728])[9]. Using the Logistic Regression Test and considering an OR of 2.926, a power of 80% and an alpha error of 0.05, it was estimated that a sample size of 138 older people would be sufficient to identify the investigated associations.

Initially, the older people were assessed to collect sociodemographic variables such as age (in complete years), gender (female or male) and education (in years of study). These data were collected through a form prepared by the researchers.

Then, the following clinical data were collected: nutritional status (by means of the Body Mass Index – BMI), amount of continuous use medication (checked by means of a medical prescription), practice of physical exercise, depressive symptoms and functional capacity. Based on the BMI data, the participants were grouped into underweight (BMI<22 Kg/m²), eutrophic (BMI 22–27 Kg/m²) and overweight (BMI>27 Kg/m²)[18]. Regular physical exercise was considered to be those lasting at least 150 minutes per week of moderate-intensity activity[19], with participants categorized as active or inactive. Depressive symptoms were assessed using the *Geriatric Depression Scale (GDS-15)*, and participants were categorized into severe depression (≥11 points), with depressive symptoms (from 6 to 10 points) or without depressive symptoms (<6 points)[20]. Functional capacity was assessed using the Pfeffer questionnaire[21] for the older people with cognitive impairment and the Lawton and Brody scale[22] for the older people without cognitive impairment. Older people who scored between 6 and 30 on the Pfeffer questionnaire[21] and between 7 and 20 on the Lawton and Brody scale[22] were considered dependent. This information was self-reported by the older person and confirmed by the companion.

Cognitive status was assessed using the MMSE and cognitive impairment defined as a score below the recommended level, according to education level. Participants with more than 7 years of schooling who totaled <28 points, between 4 and 7 years of schooling who totaled <24 points, between 1 and 3 years of schooling who totaled <23 points and illiterates who totaled <19 points were classified as having cognitive impairment[23].

The clinical parameters of sarcopenia were evaluated and defined according to Cruz-Jentoft et al.[5]. A Saehan® manual hydraulic dynamometer *(Saehan Corporation, 973, Yangdeok-Dong, Masan, Korea)* was used to obtain muscle strength through handgrip strength (HGS). It is a valid instrument with excellent test-retest reliability for use in older people with questionable to moderate dementia[24]. The collection took place in the dominant upper limb, with the older person sitting, elbow flexed at 90°, forearm in a neutral position, thumb up and feet flat on the floor. Considering the average of three attempts[25], muscle weakness was identified for values <27 Kgf for men and <16 Kgf for women[5].

Muscle mass was obtained by measuring the calf circumference (CC), using a non-elastic measuring tape, with the older person sitting, legs and ankles positioned at 90°, measuring the circumference of the largest diameter of the dominant leg. Measurements smaller than 31 centimeters (cm) characterized low muscle mass[5,13].

The *Timed Up and Go Test (TUG)* was used as a measure of physical performance. The participant got up from an armless chair, walked a distance of three meters at their usual pace, turned 180 degrees and returned the same way until they sat down again. The execution time of the test was timed and those who performed the TUG in ≥20 seconds were considered to have low physical performance[5].

Descriptive analyzes (mean, median, standard deviation, 25 and 75 percentiles, absolute frequency and percentage) were performed with data on sample characteristics and sarcopenia parameters. Data distribution was investigated using the *Kolmogorov Smirnov Test*. Independent Student's t-test (parametric numerical data), U Mann Whitney (non-parametric numerical data) or chi-square test (categorical data) were used to compare sociodemographic, anthropometric, clinical and functional capacity variables including sarcopenia parameters between groups with and without cognitive impairment.

Quantitative measures of sarcopenia parameters were included in simple linear regression analysis with the aim of investigating the existence of a relationship with the output variable (cognitive status - MMSE score). Additionally, multiple

linear regression analysis was performed including the three sarcopenia parameters as independent variables and the MMSE score as a dependent variable. This analysis was carried out with the aim of determining whether the individual importance of these parameters was maintained to explain possible variations in the MMSE score when combined with the others. Next, a multiple linear regression analysis was performed, adjusted for possible confounding variables: sex, years of study, number of medications, nutritional status, practice of physical exercise and functional capacity.

Simple binary logistic regressions were performed between each of the quantitative sarcopenia parameters (independent variables) and cognitive status (dependent variable). Additionally, a multiple logistic regression analysis including the three quantitative sarcopenia parameters was performed to investigate the joint association of these factors with cognitive status. Then, a multiple logistic regression analysis was performed, adjusted for possible confounding variables: age, sex, years of study, number of medications, nutritional status, practice of physical exercise and functional capacity.

In multiple linear regression analyses, variables not identified as predictors were removed and the model with the highest adjusted R^2 value or that explained a greater percentage of the output variable was presented. *Odds Ratios (ORs)* with 95% confidence intervals and *Beta* were calculated for each independent variable. For each linear and logistic regression analysis, the principles of independence between residuals were respected *(Durbin-Watson)*, normality of the residuals, presence of homoscedasticity, absence of multicollinearity between the variables (*VIF* <10 and *Tolerance* >0.1), minimum number of cases in each variable and, therefore, guaranteed the assumptions for carrying out the regression by the *stepwise-forward* method. No imputations were performed for missing data. In cases of participants with missing data, the data were analyzed using *pairwise* exclusion, so that available data could be included in the analyses.

Cohen f values were calculated as a measure of effect size from linear regression and results were interpreted as small (>0.02), medium (>0.15), and large (>0.35) for f^2[6]. A significance level of 5% was considered.

RESULTS

In total, 263 older people were included in the study, of which 234 (89%) had cognitive impairment, as shown in Figure 1.

Study participants were aged between 60 and 98 years, mostly women, with low education, inactive, overweight, depressive symptoms and functional dependence. The characterization of the sample is represented in Table 1.

The comparison of sarcopenia parameters and the diagnosis between older people with and without cognitive impairment is shown in Table 2. It was shown that, on average, older people with cognitive impairment had lower muscle mass than those without impairment [t(247)=3.463; p=0.001]; that the cognitive status had an effect on muscle strength (U=850.50; p<0.001) and physical performance (U=1845.50; p=0.036) of the older people and that there was an association between the cognitive status and the frequency of diagnosis of muscle weakness [X^2(1)=16.646, p<0.001].

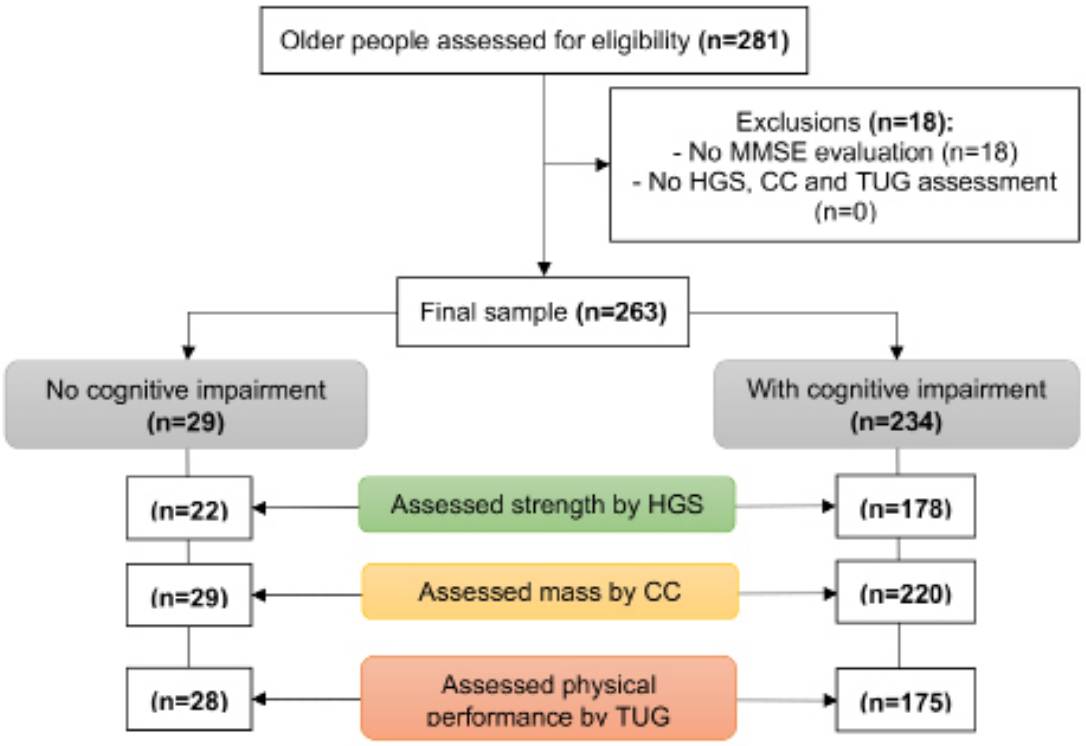

Figure 1. Flowchart referring to the composition of the study sample. Brasilia, DF, 2020-2021.

Table 1. Sample characterization according to sociodemographic and clinical characteristics (N=263). Brasilia, DF, 2020-2021.

Variables	Global Sample	No cognitive impairment (n=29)	With cognitive impairment (n=234)	Mean difference (95% CI)	*p*-value
Sociodemographic Characteristics					
Age (years)[b]	78.40 ± 7.52	77.21 ± 6.11	78.55 ± 7.68	-1.34 (-4.26 to 1.57)	0.365
Sex (female)[a]	197 (73.2%)	21 (72.4%)	172 (73.5%)	-	0.900
Years of schooling[c]	3 (0; 4)	4 (0; 4)	3 (0; 4)	-	0.239
Clinical Characteristics					
BMI (Kg/m²)[b]	27.32 ± 5.32	28.43 ± 5.57	27.17 ± 5.28	1.26 (-0.84 to 3.37)	0.238
Underweight[a]	33 (13.5%)	2 (7.1%)	30 (14.1%)	-	0.179
Eutrophic[a]	95 (38.9%)	8 (28.6%)	85 (39.9%)	-	
Overweight[a]	116 (47.5%)	18 (64.3%)	98 (46%)	-	
Physical activity level (inactive)[a]	245 (91.1%)	27 (93.1%)	212 (90.6%)	-	0.659
Number of medications[c]	5 (3; 7)	6 (5; 7)	5 (3; 8)	-	0.209
MMSE (score)[c]	17 (11; 22)	26 (25; 27)	16 (9; 20)	-	<0.001*
GDS-15 (total score)[c]	6 (4; 8)	5 (3; 7)	6 (4; 8)	-	0.233
Normal[a]	104 (42.3%)	17 (58.6%)	87 (40.1%)	-	0.141
Depressive symptoms[a]	121 (49.2%)	11 (37.9%)	110 (50.7%)	-	
Severe depression[a]	21 (8.5%)	1 (3.4%)	20 (9.2%)	-	
Functional capacity (dependent)[a]	208 (77.9%)	22 (75.9%)	180 (77.6%)	-	0.816

[a]Absolute frequency (percentage) compared with chi-square test. [b]Mean (Standard Deviation) compared with Independent Student's t-test. [c]Median (P25; P75) compared with Mann Whitney U Test. *p<0.05. BMI: Body Mass Index. MMSE: Mini-Mental State Examination. GDS-15: *Geriatric Depression Scale*.

Table 2. Comparison of sarcopenia parameters between older people with and without cognitive impairment (N=263). Brasilia, DF, 2020-2021.

Variables	Global Sample	No cognitive impairment (n=29)	With cognitive impairment (n=234)	Mean difference (95% CI)	*p*-value
HGS (KgF)[c]	17 (11; 20.83)	21.66 (19; 30)	16 (10.3; 20)	-	<0.001*
HGS normal[a]	91 (45.5%)	19 (86.4%)	72 (40.4%)	-	<0.001*
Low HGS[a]	109 (54.5%)	3 (13.6%)	106 (59.6%)	-	
CC (cm) [b]	32.23 ± 4.89	35.12 ± 5.48	31.85 ± 4.68	3.27 (1.41 to 5.13)	0.001*
CC normal[a]	176 (66.9%)	23 (79.3%)	153 (65.4%)	-	0.148
Low CC[a]	87 (33.1%)	6 (20.7%)	81 (34.6%)	-	
TUG (s) [c]	14.32 (11.94; 19.83)	12.44 (10.95; 14.62)	14.96 (12.06; 20.06)	-	0.036*
TUG - good performance[a]	154 (75.9%)	24 (85.7%)	130 (74.3%)	-	0.239
TUG - poor performance[a]	49 (24.1%)	4 (14.3%)	45 (25.7%)	-	

[a]Absolute frequency (percentage) compared with chi-square test. [b]Mean (Standard Deviation) compared with Independent Student's t-test. [c]Median (P25; P75) compared with Mann Whitney U Test.*p<0.05. HGS: Handgrip Strength; CC: Calf Circumference

TUG: *Timed up and Go.*

It was observed that the cognitive status was explained by muscle strength in 21.5%, muscle mass in 12.3% and physical performance in 7.6%. Multiple analysis including the three sarcopenia parameters resulted in a statistically significant model [$F(1.145)=25.379$, $p<0.001$; $R^2=0.261$], maintaining strength and muscle mass as explanatory variables of the cognitive state. Multiple analysis adjusted for possible confounding variables also resulted in a statistically significant model [$F(4.131)=24.412$, $p<0.001$; $R^2=0.427$], maintaining only muscle strength as an explanatory variable of the cognitive state, adjusted for years of study, number of medications and functional capacity. The results of the linear regression analyzes are shown in Table 3.

The results of the simple and multiple binary logistic regression analyzes are presented in Table 4. The simple analyzes showed that muscle strength (in KgF), muscle mass (in cm) and physical performance (in seconds) were associated with the cognitive state. In the multiple analysis including the three quantitative sarcopenia parameters, muscle strength (in KgF) and muscle mass maintained an association with cognitive status ($p=0.005$ and $p=0.038$, respectively). In the multiple logistic regression analysis with the three quantitative parameters of sarcopenia adjusted for covariates, only muscle strength, adjusted for gender ($p=0.018$) remained significantly associated with cognitive status.

Table 3. Single and multiple linear regression analyzes between sarcopenia parameters (independent variables) and cognitive status (dependent variable) (N=263). Brasilia, DF, 2020-2021.

Independent Variable	Simple Regression[a]		Non-adjusted Multiple Regression				Adjusted Multiple Regression			
	R^2 (R^2_{adj})	p-value	R^2 (R^2_{adj})	Cohen's f^2 (power)	Standardized coefficient (ß) (95% CI)	*p*-value	R^2 (R^2_{adj})	Cohen's f^2 (power)	Standardized coefficient (ß) (95% CI)	*p*-value
Muscle strength (KgF)[d]	0.215 (0.211)	<0.001	0.261 (0.250)	0.35 (100%)	0.451 (0.265 to 0.516)	<0.001		0.74 (100%)	0.356 (0.181 to 0.414)	<0.001
Muscle mass (cm)[d]	0.123 (0.119)	<0.001			0.167 (0.031 to 0.430)	0.024			-	-
Physical Performance (s)[d]	0.076 (0.071)	<0.001			-	-			-	-
Age (years)[d]	-	-			-				-	-
Sex[e]	-	-			-				-	-
Years of Education[d]	-	-			-		0.427 (0.410)		0.332 (0.449 to 1.086)	<0.001
Number of medications[d]	-	-			-				0.134 (0.003 to 0.560)	0.047
Nutritional Status (BMI)[d]	-	-			-				-	-
Practice of physical exercise[e]	-	-			-				-	-
Functional capacity[e]	-	-			-				-0.207 (-5.120 a -1.038)	0.003

[a]Simple linear regression analysis between each sarcopenia parameter and cognitive status. [b] Multiple linear regression analysis between the three parameters of sarcopenia (independent variables) and unadjusted cognitive status (dependent variable) (*Stepwise Forward* method). [c] Multiple linear regression analysis between the three sarcopenia parameters and cognitive status (dependent variable) adjusted for possible confounding variables (*Stepwise Forward* Method). [d]Numerical data. [e]Categorical data.

Table 4. Simple, multiple, adjusted and unadjusted logistic regression analysis between sarcopenia parameters (independent variables) and cognitive status (dependent variable) (N=263). Brasilia, DF, 2020-2021.

Variáveis	Simple Logistic Regression[a]			Non-adjusted Multiple Logistic Regression[b]			Adjusted Multiple Logistic Regression[c]		
	OR [95% CI]	ß	*p*-value	OR [95% CI]	ß	*p*-value	OR [95% CI]	ß	*p*-value
Muscle strength (Kgf)[d]	0.898 [0.52 – 0.947]	-0.108	<0.001	0.920 [0.867 – 0.975]	-0.084	0.005	0.846 [0.774 – 0.924]	-0.167	<0.001
Muscle mass (cm)[d]	0.859 [0.784 – 0.940]	-0.152	0.001	0.898 [0.811 – 0.994]	-0.108	0.038	-	-	-
Physical performance (s)[d]	1.080 [1.003 – 1.163]	0.077	0.041	-	-	-	-	-	-
Age (years)[d]	-	-	-	-	-	-	-		-
Sex (ref: male)[e]	-	-	-	-	-	-	7.707 [1.410 – 42.128]	2.042	0.018
Years of Education[d]	-	-	-	-	-	-	-	-	-
Number of medications[d]	-	-	-	-	-	-	-	-	-
Nutritional Status (BMI)[d]	-	-	-	-	-	-	-	-	-
Practice of physical exercise (ref: active)[e]	-	-	-	-	-	-	-	-	-
Functional capacity (ref: dependency)[e]	-	-	-	-	-	-			

[a]Simple logistic regression analysis between each sarcopenia parameter and cognitive status; [b] Unadjusted multiple logistic regression analysis between the three sarcopenia parameters (independent variables) and cognitive status (dependent variable) (*Stepwise Forward* method); [c]Multiple logistic regression analysis between the three sarcopenia parameters (independent variables) and cognitive status (dependent variable) adjusted for possible confounding variables (*Stepwise Forward* Method) [d]Numerical data. [e]Categorical data.

DISCUSSION

This study associated the clinical parameters of sarcopenia (strength, muscle mass and physical performance) with cognitive impairment in older people who use a public specialized care service. Although the three parameters were associated with cognitive status, in the multiple adjusted analyses, only low muscle strength remained independently associated with cognitive impairment.

It was observed that 59.6% of older people in the group with cognitive impairment had low muscle strength, with a significant difference in HGS between groups. HGS explained by 21.5% the cognitive status presented by the older people in the MMSE and 1 KgF of HGS more reduced by 15.4% the chance of the older person to present cognitive impairment at the time of assessment. Our results are consistent with previous studies that identified an association between muscle strength and cognitive status, which demonstrated that low muscle strength almost doubles the risk for cognitive impairment[12,27–29] and that HGS suffers a greater reduction in the simultaneous presence of cognitive and physical impairment[27]. The main mechanism that explains this relationship is the sharing of pathophysiological pathways, involving oxidative stress and chronic inflammation, resulting from aging, physical inactivity, increased visceral fat and chronic diseases[6,7,30]. These factors lead to a metabolic imbalance with the activation of inflammatory pathways, which produce oxidative damage on muscle cells and brain structures[30]. However, it has been discussed that the strength of this association depends on the cognitive tool used[27], the cutoff points to identify muscle weakness and the different HGS measurement protocols, which interfere with its reproducibility[8,25].

In the adjusted analyses, we found no association between low muscle mass, represented by calf circumference, and cognitive impairment. Previous investigations also showed that the individual effect of low muscle mass was not significant for cognitive impairment, even when measured by more specific measurement instruments, corroborating our findings[11,27,31]. However, on the contrary, data indicate an association of low muscle mass (measured by bioimpedance) with specific cognitive domains[31] and that calf circumference was a significant predictor of cognitive impairment using several cognitive tests in a cross-sectional analysis[15]. Meta-analyses[8,9] have argued that the inconsistencies in the association between muscle mass and cognitive impairment may be related to different body composition measurement devices. It has been suggested that not muscle mass, but adipose tissue may be directly related to cognitive impairment[32]. This is because metabolically adipocytes actively participate in the central nervous system, altering insulin sensitivity, responsible for synaptic failure, brain atrophy and cognitive decline, so that infiltration of adipose tissue macrophages causes the activation of a network of inflammatory pathways that results in in apoptosis[30,32].

Physical performance is a third parameter described by Cruz-Jentoft et al.[5] and classifies the severity of sarcopenia. Analyzing the execution time (in seconds) of the TUG, we found that the older people with cognitive impairment took longer to execute the TUG. However, in the adjusted analyses, physical performance was not associated with cognitive impairment. Evaluating physical performance as a sarcopenia parameter also lacks standardization of the tool used and measurement protocols for better reproducibility8. We used the TUG, but the physical performance measure most used in the literature was gait speed, which has been shown to contribute to more than doubling the risk of cognitive impairment[12,16]. Kubicki[33] justifies this predilection for gait speed due to the fact that the test execution commands are simpler than those of the TUG and, in addition, are subject to less measurement bias. Previous studies have found an association between physical performance when assessed using gait speed[12,16,30] and the *Short Physical Performance Battery* tool[11], noting that cognitive impairment is not only associated with, but is preceded by, a reduction in physical function[29,34]. This relationship is not so clear, but it is known that inflammatory markers, hormones, insulin resistance and oxidative stress are negatively correlated with muscle strength, physical performance and cognitive function[11,30,35].

As a strong point, this study used instruments and cutoff points recommended by consensus to

measure muscle strength, muscle mass and physical performance of the older people[5], thus facilitating its reproducibility. However, some limitations can be listed. Due to the cross-sectional design of the study, it was not possible to identify a causal relationship between sarcopenia parameters and cognitive impairment. Considering that the studied population had a medical condition that could affect their ability to self-report, sociodemographic and clinical information was confirmed with the respective caregivers, usually a family member or a trained professional. There was a high prevalence of cognitive impairment in our sample, because the participants were older people referred by primary care services, most of them with complaints of functional dependence and cognitive impairment, and, because of this, this limitation could not have been avoided. We also use calf circumference to measure muscle mass and this tool has been questioned. However, a strong correlation between calf circumference and skeletal muscle mass index was previously observed in both men (r=0.78) and women (r=0.75) and circumference measurement was inversely associated with sarcopenia in both genders (men: OR= 0.62; 95%CI: 0.56 – 0.69 and women: OR= 0.71; 95%CI: 0.65–0.78)[13]. In addition, this measure is considered low-cost and easy to measure, and can be used in environments with limited resources, making it a viable measure for use in older people with cognitive impairment[5].

CONCLUSION

Low muscle strength was the sarcopenia parameter independently associated with cognitive impairment. This information is useful for the team involved in the multidisciplinary care of the older person to pay attention to the probability of cognitive impairment when low muscle strength is identified. In clinical practice, the information from this study reinforces the importance of monitoring the muscle strength of older people in order to prevent adverse outcomes such as sarcopenia and cognitive impairment. When faced with a probable sarcopenic older person, the multidisciplinary team must be attentive to the possibility of cognitive impairment and, when faced with an older person with cognitive impairment, one cannot fail to evaluate the sarcopenia parameters aiming at preventive intervention and control of the pathophysiological mechanisms shared between both illnesses.

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Timed Up and Go in assessing the frailty of older farmers in Rio Grande do Sul: cross-sectional study

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Abstract

Objectives: To evaluate the sensitivity of the Timed Up and Go test (TUG) as a predictor of frailty syndrome in the elderly (IFS) in the elderly rural population of Rio Grande do Sul (RS) and to identify the prevalence of IFS in this population. Method: Cross-sectional study, carried out with 604 farmers over 60 years of age (321 men and 283 women) identified through clusters structured from the regions of the Federation of Agricultural Workers of Rio Grande do Sul (FETAG-RS) and respective unions. In addition to demographic variables (gender, age), functional mobility was assessed by performing the TUG and reported frailty. The Receiver-Operating Characteristic (ROC) curve was constructed to assess a TUG test cutoff point for frailty. Results: IFS or frailty was identified in 52.5% (n=317) of the surveyed population; 35.1% (n=212) pre-frail and 12.4% (n=75) non-frail. And the mean time to perform the TUG varied according to gender was 11.6 seconds for women and 10.8 seconds for men – (p=0.0001). The progression of age was related to longer time spent on the age test (young elderly - 60-64 years old; older elderly -75-79 and oldest old - 80+ - p=0.0001). The ROC curve indicated 10 seconds in the execution of the TUG test as the best cutoff point for diagnosing the SF frailty syndrome in rural elderly. Conclusion: The frequency of frailty and pre-frailty in this research indicates a condition of vulnerability of rural workers in RS in their aging process. Demonstrating, from the TUG test, characteristics of functional mobility and risk of frailty of older farmers, important for future considerations on the singularities of the health of this population and necessary professional interventions.

Keywords: Rural Population. Frailty. ROC Curve. Health of the Elderly.

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INTRODUCTION

The accelerated process of Brazilian population aging[1-3], so emphasized in research and studies on the subject, has raised concerns about the quality of life of older people. Above all, in offering adequate services for an effective assistance that results in a positive impact on social and health policies[4].

It is a fact that the demographic transition taking place in the country has deserved recognition for the profound changes in the epidemiological profile[5]. And, due to the growing demand for health services, where characteristics that are adverse to those of care models centered on health care for acute illnesses, impose measures with a proposed line of care, focusing on education, health promotion, prevention of preventable diseases, postponement of illnesses, early care and rehabilitation[4].

Recognizing the multifactorial character that influences the health and illness of these people, it is worth noting the living conditions of those who age in rural areas. In this sense, several researches[6-8] draw attention to the specificity of this group, especially the physical and emotional aspects, represented by the use of the body in the work process and the often observed isolation character, in addition to the susceptibility to diseases and disabilities that advance with age. Other factors that contribute to this scenario are the difficulties in accessing the Unified Health System (SUS), due to geographic problems and long distances, which distance the population from social and health services[5,8].

Furthermore, taking into account the recognition of the characteristics of the older person in the multiple facets that permeate their lives, the biological character and the perception of individuals about the health/disease condition in the environment in which they live[5,9,10] stand out. In this regard, research on Frailty Syndrome (FS) in older people has been identified as an important instrument in tracking clinical conditions capable of impacting the quality of life of the older person[11-14].

FS, in its conception, has been identified based on the typology proposed by Fried *et al.*[12], also known as the frailty phenotype in which it recognizes unintentional weight loss[13], reduced gait speed, decreased physical strength, reported fatigue and low physical activity, as clinical conditions that impose greater vulnerability on the subject in relation to the risk of falls, disability, hospitalization and mortality.

Based on the typology of Fried *et al.*[12], Nunes *et al.*[13] validated an instrument for tracking FS by self-reported assessment. This tool makes it possible, in a simple and quick way, to identify the problem in the population and to reduce the negative impact of the effects of FS with appropriate interventions aimed at regional realities.

The search for evaluative tests that can track physiological aspects of vulnerability and health integrity of the older person is extremely important[14]. Especially if we consider those that indicate, in addition to the condition of frailty, other conditions associated with the bodily function of functional mobility, such as the *Timed Up And Go* (TUG) test[14,15].

The TUG is a tool that is easy to apply, low cost and reproducible at different levels of health care. Validated in Brazil since 2016, the test has been indicated for the combination of different capacities and physical abilities and may represent an important instrument in determining the individual's physical and functional fitness profile[16]. And, therefore, with great potential for tracking FS in populations, such as the rural older population, in view of their specificities and particularities in relation to physical abilities.

The identification of rural older people with FS is then built on the prerogative of knowing the multiple faces of the Brazilian aging process, especially those residing in the state of Rio Grande do Sul and the search for epidemiological characteristics that may indicate appropriate interventions by health professionals[1]. Thus, the objectives of this study were to evaluate the sensitivity of the *Timed Up and Go* test (TUG) as a predictor of FS in the rural older population of Rio Grande do Sul (RS) and to identify the prevalence of FS in this population.

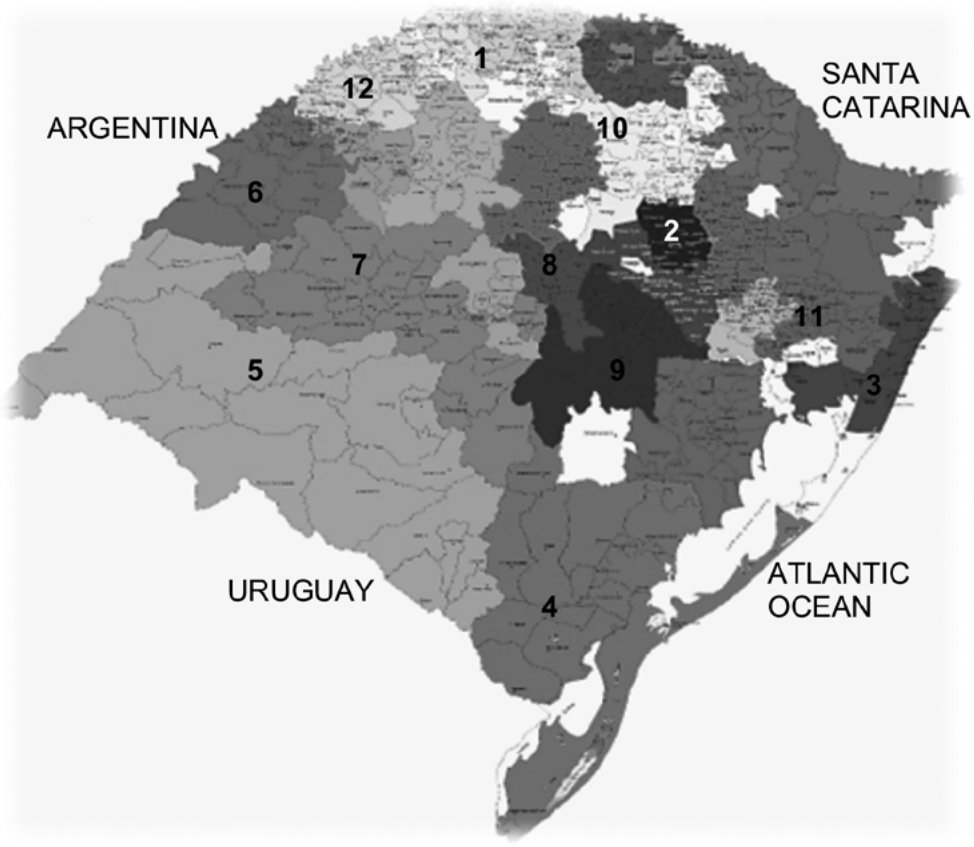
METHOD

Cross-sectional, population-based study, carried out by conglomerates and structured from all the regions (n=24) of the Rural Workers Unions

(STR-N=394), linked to the Federation of Agricultural Workers of Rio Grande do Sul (FETAG -RS), with distribution in the 497 municipalities of the state (Figure 1). 12 regional participants were randomly drawn, observing the dispersion in the territory of the state, in its mesoregions (Northeast; Northwest; Western Center; Eastern Center; Metropolitan Porto Alegre; Southwest and Southeast) and identification of the respective unions with their retired and aged 60+ members (Figure 1).

The sample used in this study was distributed among the population of 54,573 individuals over 60 years of age, affiliated to the state's STR, residing in 33 municipalities in 12 regions of the FETAGRS[18] (Chart 1), with dispersion in the state's mesoregions (Figure 1) and which correspond to 73.52% of retirees from rural work unionized in 2013 (n=74,226).

The calculations to define the population studied in this research considered a confidence level of 95% and a sampling error of 5%, a design effect of 1.5 and correction for a finite population. The initial calculation indicated 576 individuals (384 x 1.5 = 576) and a final sample of 604 older people (Figure 2). The calculation base considered a universe of 387,000 rural older people in 2013[1]. The sample allocation was carried out proportionally to the number of older people in each stratum, observed in the union units of each region elected in the investigation process (Chart 1). This method, often used for the selection of clusters, considers sampling with probability proportional to size (PPS). In this case, the primary units are selected with probabilities proportional to their size. Thus, in addition to being easy to apply, this method has the advantage of contributing to the reduction of variance between selection units[18,19].



Source: Modified from Federation of Agricultural Workers of Rio Grande do Sul (FETAG-RS). Notes: (1) Middle and Upper Uruguay (n=154); (2) Serra do Alto Taquari (n=26); (3) Coast (n=53); (4) South (n=30); (5) Border (n = 20); (6) Missions II (n=50); (7) Santa Maria (n=45); (8) Rio Pardo Valley and Baixo Jacuí (n=33); (9) Camaquã (n=27); (10) Passo Fundo (n=73); (11) Rio dos Sinos Valley and Serra (n=43); (12) Santa Rosa(n=50)

Figure 1. Distribution of regions FETAG-RS and indication of the 12 regional participants in the study with the respective fractions of the sample. 2015.

Chart 1. Discrimination of the STR regions and respective municipalities with distribution of retired older people and indication of proportions used for sampling.2015

Nº	Region	Municipalities	Unionized older people	%	Sample
1	Médio e Alto Uruguai	Liberato Salzano, Nonoai, Novo Xingu, Palmeira das Missões, Palmitinho, Pinhal, Pinheirinho do Vale, **Planalto**, Rio dos Índios, Rodeio Bonito, Ronda Alta, Rondinha, **Seberi**, Taquaraçu do Sul, Três Palmeiras, Trindade do Sul, Vicente Dutra, Vista Alegre, Alpestre, Ametista do Sul, Caiçara, Cristal do Sul, Dois Irmãos das Missões, Erval Seco, **Frederico Westphalen**, Gramado dos Loureiros, Irai, Jabuticaba.	13.959	26,63	154
2	Serra do Alto Taquari	Anta Gorda, Arvorezinha, Dois Lajeados, **Encantado**, Guaporé, Ilópolis, Itapuca, Muçum, Nova Brescia, **Putinga**, Relvado, São Valentin do Sul, União da Serra, Vespasiano Correa	2.289	4,37	26
3	Litoral	Gravataí, Mampituba, Maquiné, Morrinhos do Sul, Mostardas, **Osório**, **Terra de Areia**, **Torres**, Três Cachoeiras, Três Forquilhas, Viamão	4.180	7,97	53
4	Sul (Pelotas)	Arroio Grande, **Canguçu**, Herval, Jaguarão, **Pedro Osório**, **Pelotas,** Pinheiro Machado, Piratini, Rio Grande, Santa Vitoria do Palmar, **Santana da Boa Vista**, São José do Norte, **São Lourenço do Sul**, Tavares	2.551	4,87	30
5	Fronteira	**Alegrete**, **Bagé**, Cacequi, Dom Pedrito, Itaqui, Lavras do Sul, Quarai, Rosário do Sul, Santana do Livramento, São Gabriel, **Uruguaiana**	771	1,4	20
6	Missões II	Bossoroca, **Dezesseis de Novembro**, Garruchos, Itacurubi, Pirapó, Porto Xavier, **Roque Gonzáles**, Santo Antônio das Missões, São Borja, **São Luiz Gonzaga**, **São Nicolau**	4.533	8,3	50
7	Santa Maria	**Agudo**, Caçapava do Sul, Formigueiro, Jaguari, Manoel Viana, Mata, Nova Esperança do Sul, Paraiso do Sul, **Santa Maria**, Santiago, São Francisco de Assis, São Pedro do Sul, São Sepé, São Vicente do Sul, Silveira Martins, Tupanciretã, Vila nova do Sul	3.894	7,1	45
8	Vale do Rio Pardo e Baixo Jacuí	**Cachoeira do Sul,** Cerro Branco, General Câmara, Gramado Xavier, Pantano Grande, Rio Pardo, **Santa Cruz do Sul**, Venâncio Aires, Vera Cruz	2.769	5,28	33
9	Camaquã	Amaral Ferrador, Arroio dos Ratos, Barão do Triunfo, Barra do Ribeiro, Butiá, **Camaquã**, Canoas e Nova Santa Rita, Cerro Grande do Sul, Cristal, Dom Feliciano, Guaíba, São Jeronimo, **Sentinela do Sul**, Sertão de Santana	2.365	4,51	27
10	Passo Fundo	Camargo, Casca, Ciriaco, David Canabarro, Ernestina, Ibirapuita, **Marau**, Montauri, Muliterno, Nova Alvorada, Passo Fundo, Pontão, Santo Antônio da Palma, Serafina, Correa, Sertão, **Soledade**, Tapejara, Vanini, Vila Maria	6.735	12,85	73

to be continued

Continuation of Chart 1

Nº	Region	Municipalities	Unionized older people	%	Sample
11	Vale do Rio dos Sinos e Serra	Canela, **Caraa**, Gramado, Igrejinha, Novo Hamburgo, Rolante, Santa Maria do Herval, **Santo Antônio da Patrulha**, **São Francisco de Paula**, Sapiranga, Taquara, Três Coroas	3.834	7,31	43
12	Santa Rosa	Alecrim, Alegria, Boa Vista do Burica, Campina das Missões, Candido Godoi, **Giruá**, Horizontina, Independência, Porto Lucena, **Santa Rosa**, Santo Cristo, São Paulo das Missões, Senador Salgado Filho, Três de Maio, Tucunduva, Tuparendi, Ubiretama	4.529	8,4	50
	Total		54.573	100	**604**

Source: Modified from Federation of Agricultural Workers of Rio Grande do Sul (FETAG-RS).2015

Recruitment of participants took place at random in home visits, facilitated by the local STR and/or at meetings of unionized older people, also randomly. In the image of Chart 1, we can observe the calculated values and the surplus in the sample column, considering a rounding factor and the adoption of a minimum of 20 people per region (Border – 10 +10=20), resulting in a final value of the number of collections carried out in each region. In the "Municipalities" column, the cities in bold are the ones that were visited.

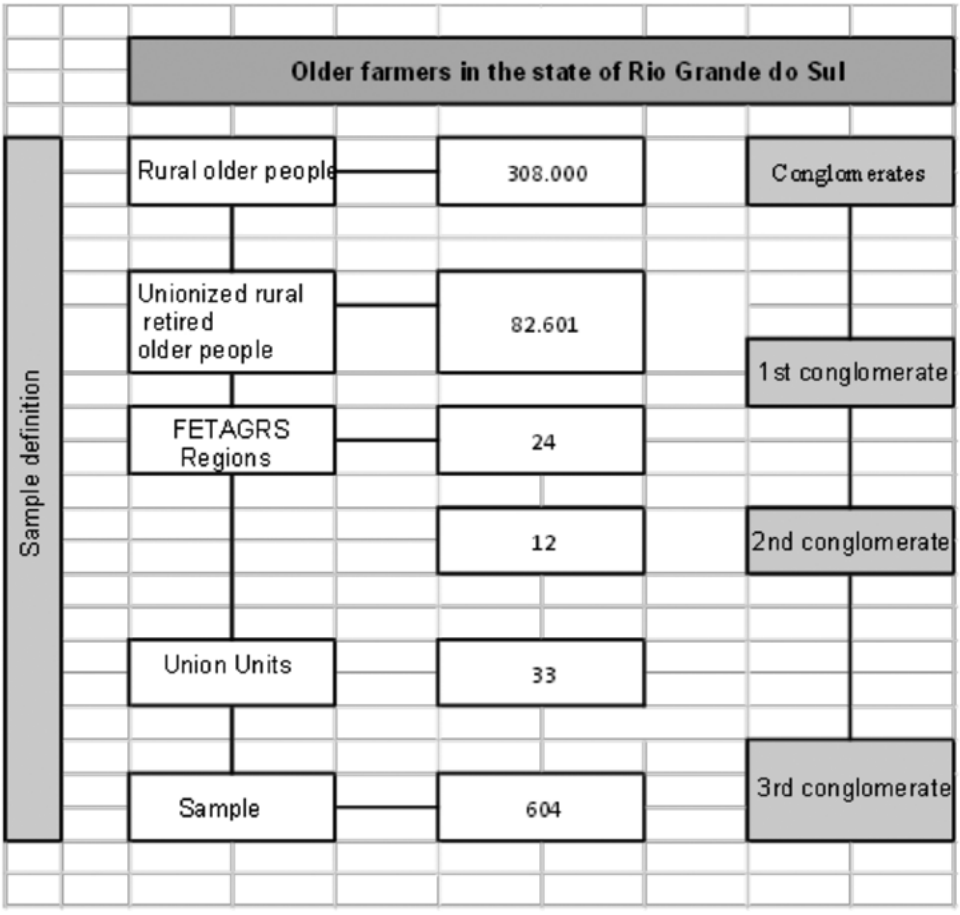


Figure 2. Research flowchart and sample definition – 2018.

The inclusion criterion in the study for the selection of the older people considered the cognitive assessment, in view of the application of a self-reported instrument. To this end, the Mini Mental State Examination (MMSE) was applied in a cut indicated in the literature, which considers 18 points minimum for illiterate older people and 23 points for literate older people with more than one year of schooling[20]. None of the participants fell below the cutoff point. People with communication difficulties and who resided in institutions were excluded.

Data collection took place in the period 2017 and 2018 with duly trained volunteer researchers (physiotherapists, and academics of physical education and physiotherapy).

The research followed Resolution 466/2012 and was approved by the Research Ethics Committee of the Federal University of Rio Grande do Sul, with opinion nº 1,716,579. All participants signed the Free and Informed Consent Form.

In this study, the FS of the rural older population was assessed using the self-reported frailty instrument by Nunes *et al.*[13], which classifies the presence of the elements proposed by Fried *et al.*[12], through the perception of the older people about unintentional weight loss, fatigue, low physical activity, reduced strength and gait speed. Subsequently, it was systematized according to the scores found in the instrument into: non-frail (no element mentioned); pre-frail (one or two elements mentioned) and frail (three or more elements indicated)[12,13].

To test functional mobility, the TUG was used, in which the subject sits in a chair, gets up and walks three meters and returns to the seat. For the purpose of measuring time, the indication of "go" is considered for the beginning and conclusion of the test after the individual has sat down completely. The time for performing the TUG was timed and the parameters indicated in the studies by Podsiadlo; Richardson; Cabral[21] were considered, in which they indicate a time of 11 to 20 seconds as being within the expected range; between 20 seconds and 29 seconds there is impairment of balance, gait speed and functional capacity and results above 30 seconds are predictive of falls. The TUG assessment was performed twice by each participant and the mean values were analyzed[21].

The TUG scores did not present a normal distribution verified through the Kolmogorov-Smirnov test. Comparisons between independent samples were performed using the non-parametric Mann-Whitney and Kruskal-Wallis tests. The associations between the prevalence of gender and age group variables versus frailty classification were examined using Pearson's chi-square test. The *Receiver-Operating Characteristic* (ROC) curve was constructed to assess the TUG test cutoff for frailty. All statistical procedures were performed using the IBM® SPSS® software (version 26), adopting a significance level of $p \leq 0.05$. Sample distribution tests and corrections were used for the test.

RESULTS

604 retired rural workers aged between 60 and 93 years old, with an average of 69.6 +7.1, participated in this research. The female population surveyed comprised 46.9% (n=283) and the male 53.1% (n=321) as we can see in Table 1. In general, the prevalence of FS in this population corresponds to 52.5% (n=317) of the sample and 35% (n=212) reported one or two elements of frailty being classified as pre-frail. Regarding the gender variable, we observed a relatively similar distribution in the groups (p=0.583), however, the distribution in relation to age groups shows a higher prevalence according to age progression (p=0.020).

Table 1. Distribution of gender, age and regional demographic variables in relation to frailty in rural older people in Rio Grande do Sul (N=604), 2018.

Variables		Frailty				*p**
		Non-frail	Pre-frail	Frail	Total	
		n (%)	n (%)	n (%)	n (%)	
Age Group	60 - 64 years	29 (16.5)	71 (40.3)	76 (43.2)	176 (100)	0.020
	65 - 69 years	15 (10.2)	51 (34.7)	81 (55.1)	147 (100)	
	70 - 74 years	20 (14.3)	47 (33.6)	73 (52.1)	140 (100)	
	75 - 79 years	7 (9.7)	27 (37.5)	38 (52.8)	72 (100)	
	80+ years	4 (5.8)	16 (23.2)	49 (71)	69 (100)	
Sex	Female	31 (11)	102 (36)	150 (53)	283 (46.9)	0.583
	Male	44 (13.7)	110 (34)	167 (53)	321 (53.1)	

* Pearson's chi-square test.

Regarding the TUG, men performed the task in a shorter time (10.8 seconds) than women (11.6 seconds), configuring a significant difference between groups (p=0.001).

In Figure 3, we can see a better performance in the execution of the TUG by the younger seniors (60-64 years) and a significant difference (p=0.0001) between the age groups, especially when we compare these and the other age groups with those who are in the 80+ range (p=0.0001).

The analysis of the ROC curve (*Receiver-Operating Characteristic*) indicated a value of >10 seconds in the performance of the TUG test as the best cutoff point for the diagnosis of FS (Figure 4). The sensitivity and specificity of frailty were 62.8% and 65.5%, respectively.

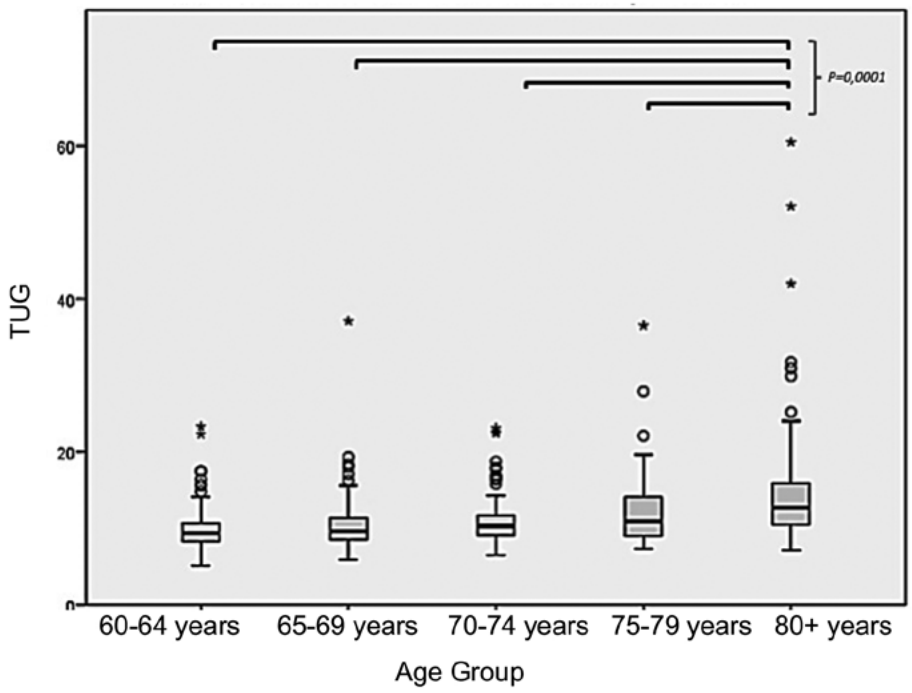


Figure 3. Distribution of rural retired older people in Rio Grande do Sul in relation to performance in the TUG and age group - [Average of 11 seconds and standard deviation +4.7] (n=604) - (p<0.0001), 2018.

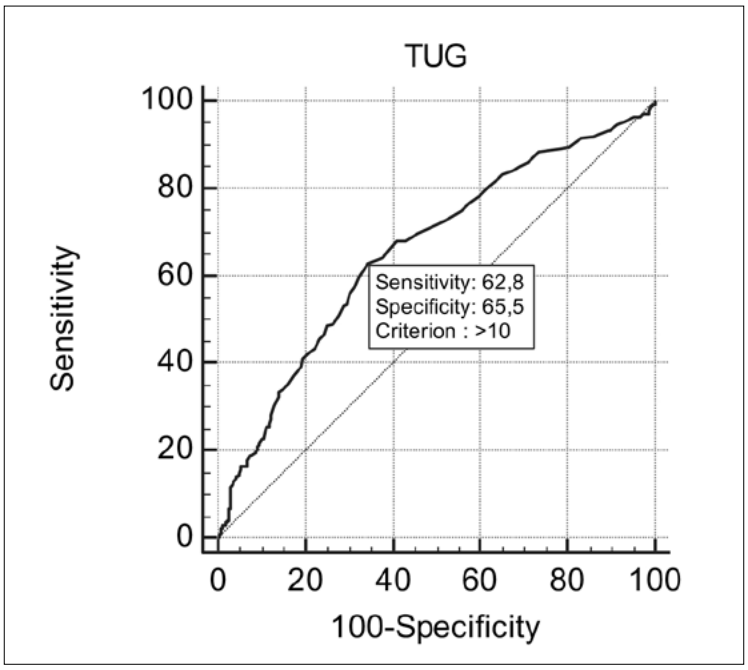


Figure 4. ROC curve (*Receiver-Operating Characteristic*) - (AUC - 0.658) demonstrating the sensitivity and specificity of the cut-off point for predicting Frailty Syndrome in the rural older population of Rio Grande do Sul (n=604) - *p*=0,001, 2018.

DISCUSSION

Assessing the age-related physiological decline, mainly associated with the condition of functional mobility and using simple screening instruments in the older population is a challenge. Sukkriang and Punsawad[22] evaluated the use of the TUG as a marker for the phenotypic definition of frailty in the older population and identified a significant sensitivity of the instrument. Rossi *et al.*[23] identified in their research that frail older people performed worse in the TUG when compared to non-frail older people. It can be observed in recent studies[24,25] that the test captures many aspects of the physiological aging process and predicts adverse outcomes without being specific to any particular disease, such as the functional mobility of older people, considering that its performance is linked to regular physical activity,[3,24] to the overall decline in health, disability in activities of daily living and falls[25,26].

However, there are few studies that assess the functional mobility of older rural workers in the current literature. Some studies carried out in municipalities in the interior[27,28] have appeared in the Brazilian scientific scenario, reiterating the differences between the older people who live in urban and rural areas. The researched sample is located in a young age group, where the subjects begin to perceive the aging process[6,7]. Although many factors that occurred in earlier stages of life can influence aging, biological, cultural or social conditions seem to be unique in the construction of the older person in the countryside, as pointed out by Xu *et al.*[29].

Another question about the rural population and compatible with the findings of this study is the identification of a male population greater than the female, as has been pointed out in the National Household Sample Survey (PNAD), where men represent a contingent of 1.3 million more than women. For Ferraz *et al.*[30], the masculinization of the countryside has been observed due to situations related to the female rural exodus, the growth of the middle-aged population and the consequent tendency for the rural population to age[30]. In this scenario, for Trindade; Moraes; Dias[8], the vulnerabilities of older rural workers are added to an exhausting daily work routine, where there is exposure to several

occupational risk factors, aggravated by the physical weaknesses inherent in the condition of human aging, in addition to exposure to social vulnerability imposed by poor access to health services and other social resources present in the urban community[4,8].

Studies referred to in the State Health Plan[1] show the demographic situation in municipalities in the interior with up to 10,000 inhabitants, showing the concentration of older people in the countryside. Which makes us reflect on physical and functional demands and the entire process of accessibility necessary for a condition of autonomy and quality of life inherent to the stage of life and the multiple realities of rural communities in the state.

The physical condition assessed in this study shows that age is a factor that influences susceptibility to situations inherent to higher TUG scores. TUG is a well-known functional mobility test. Ansai *et al.*[31] highlighted its use as an outcome measure to assess functional mobility in older people.

As observed in this research, Ibrahim *et al.*[32] showed that women and longer-lived older people of both genders took longer to complete the TUG when compared to older males or younger people of both genders. Regarding cognitive condition, sex and age, the highest scores were perceived in female individuals, when compared to younger male individuals who present lower values[32]. In a sample of older people from the interior of the state of RS, Cruz Alta, Hansen *et al.*[33] identified relationships between the TUG and age, as well as functional mobility conditions associated with the risk of falls at higher scores.

From a geographical point of view, no studies were found on the condition of functional mobility of the older rural population within the state of RS. However, research pertinent to the functional health conditions of rural older people in communities in the state, account for relationships between the prevalence of basic activities of daily living (BADL) and instrumental activities (IADL), such as that of Pinto *et al.*[34], which found a prevalence of 81.8% and 54.6% for capacity in the BADL and IADL variables, respectively. They also verified the association of this ability with age between 60-69 years and male sex, as the findings of this research. Llano *et al.*[2] also analyzed an association of functional decline associated with the female gender and advancing age in the rural population, however restricted to a rural community in the state of RS.

In addition to the condition and correlation with other factors, the TUG assessment has been used as a predictor of frailty in different population groups, reinforcing its indication in population diagnoses[23]. Sukkriang and Punsawad[15], for example, found greater sensitivity (72%) and specificity (82.54%) with the same cutoff value (10 seconds) in a Thai population. In Brazil, research by Silveira and Filipin[15] indicated sensitivity (90.0%), specificity (35.5%), PPV (32.6%) and NPV (90.9%) in predicting frailty, with a cutoff point of TUG≥7.21 seconds, indicating the suitability of using the test for screening in active urban populations.-

The practicality of using the TUG to identify vulnerability resulting from FS is extremely relevant for the rural older population, especially if we consider issues inherent to the context of life, access to specialized services and the fact that the test can be applied by any health professional, as demonstrated in other studies[31,35].

The frequency of frailty and pre-frailty in this study indicates a condition of vulnerability of rural workers in RS in their aging process. Demonstrating, from the TUG test, characteristics of functional mobility and risk of frailty of older farmers, important for future considerations on the singularities of the health of this population and necessary professional interventions.

The research presents as a limitation the exclusion of older people with cognitive impairment, which may represent the exclusion of frail older people, as well as the limitation of the number of cities and regions of union coordination offices visited, since it would require more time for data collection and the need for funding. However, this study presents data from a portion of the population for which little information is available about the specificities and particularities in relation to health-disease aspects.

CONCLUSION

Knowing the health/disease condition of the rural population that ages in the countryside brings elements of recognition of a specificity necessary to think about adequate policies for a better life condition of the retired rural worker. Thus, in addition to recognizing the fragile condition of this population, the development of diagnostic tools that are easy to use can be important in the practice of health professionals in the field of Primary Health Care. The *Time Up and Go*, in this sense, constitutes an easy-to-apply test that has demonstrated its relationship with the condition of functional mobility and multidiagnosis related to human mobility, so important for that portion of the population that uses their body as an element of work. In this study, we can identify a significant portion of the sample with perception of elements of frailty in their daily life. And establishing a sensitive cut-off point for the identification of Frailty Syndrome in older people makes it possible to direct preventive and/or therapeutic interventions for this population. However, we observe the need for further studies that consider predictive factors that can influence and characterize contexts of weakened health due to aging and rural conditions.

AUTHORSHIP

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Severe Acute Respiratory Syndrome in older adults amid the COVID-19 pandemic and associated factors

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Abstract

Severe Acute Respiratory Syndrome (SARS) is one of the most worrying respiratory diseases, characterized by a flu-like condition associated with tachypnea or hypoxemia, with saturation below 95% in ambient air. In the context of the new coronavirus (SARS-CoV-2) pandemic, exponential growth in cases was observed, with the elderly being the most affected population group. This study aimed to describe SARS cases, as well as socio-demographic and health-associated factors in the elderly population of a city in the north of Rio Grande do Sul state, Brazil. This is an epidemiological study carried out by Influenza Epidemiological Surveillance Information System. The information was made available by the Municipal Health Department of the Passo Fundo between January 1st and December 31st, 2020. In the descriptive analysis, the distribution of absolute (n) and relative (%) frequencies of the variables of interest was performed. Crude and adjusted odds ratios were estimated using Logistic Regression. A total of 1,268 SARS notifications were observed in the elderly, 72% of which were caused by covid-19. The lethality was high (40.9%), mainly among men and those with low education, with the presence of at least one risk factor, especially chronic kidney disease. It is expected that the associations highlighted in this study can help to develop health policies aimed at the health of the elderly, especially by strengthening actions in primary health care.

Keywords: Severe Acute Respiratory Syndrome. COVID-19. Respiratory diseases. Elderly.

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INTRODUCTION

The demographic and epidemiological transitions associated with shifts in population dynamics driven by an increase in life expectancy require structural changes to cater for the growing older population, a group that has been directly affected by the COVID-19 pandemic, exhibiting the highest morbidity and mortality rates[1]. The pandemic has also impacted the social and psychosocial inequalities existing in this population, worsening the risk of poverty, loss of social support, discrimination and isolation, while exacerbating feelings of anxiety, loneliness and sadness[2].

Severe Acute Respiratory Syndrome (SARS) is one of the most serious respiratory infections affecting older individuals. It is defined as an influenza-like condition accompanied by tachypnea or hypoxemia, with oxygen saturation (SpO2) below 95% in ambient air. Up until 2019, the Influenza A virus had been the most prevalent in Brazil. However, this scenario changed after the confirmation of the first cases of the novel coronavirus in early 2020[3]. SARS notification occurs when individuals present with symptoms of this condition and is compulsory when hospitalization is needed or when the condition leads to death, regardless of hospitalization[4].

The most critical SARS cases involve individuals who have an associated comorbidity, such as diabetes, heart and lung diseases, are older or exposed to external factors, such as stress, work overload, physical inactivity, smoking, which contribute to a lifestyle that favors development of comorbidities and complications[5]. Evidence suggests that the older people constitute the group at highest risk of developing SARS since, in addition to older age, most have pre-existing comorbidities, given the prevalence of chronic diseases tends to rise with age[6]. These chronic conditions may be associated with an impaired immune system and a higher prevalence of chronic degenerative diseases, factors that contribute to faster progression and higher risk of premature death from COVID-19[7].

Population aging is currently more marked in high-income countries. However, it is plausible that low and middle-income countries (LMIC) with poorer access to health networks, together with comorbidities, increase the risk of a worse prognosis amid COVID-19. Between 2020 and mid-August 2022, the number of recorded SARS cases exceeded 2,000,000 in Brazil, with over 90% of these individuals infected by the SARS-CoV-2 virus that causes COVID-19. The number of SARS deaths in the same period exceeded 450,000, with almost 95% related to the novelcoronavirus[8]. In Rio Grande do Sul, by the end of Epidemiological Week (EW) 35 of 2022, over 130,000 SARS cases related to COVID-19 had been admitted to hospitals, of which more than 65,000 died from the disease. It should be noted that the highest rates of hospitalizations, Intensive Care Unit (ICU) admissions and deaths occurred in individuals aged > 60 years, with even higher rates among older people aged > 80 years[9].

Passo Fundo, considered the capital city of the mid-lowlands region of the state of Rio Grande do Sul (RS), Brazil, had one of the highest cumulative hospitalization rates in the state, with estimates ranging from 320 to 410 cases per 100,000 population. Mortality was estimated at 60-90 cases per 100,000 population, where the older population was the most affected group[10]. In 2021, despite the implementation of immunization campaigns prioritizing vaccination of individuals aged ≥ 60 years, this older age group continued to be the worst affected by the morbidity and mortality outcomes associated with SARS-CoV-2. Thus, identifying and monitoring SARS amid the COVID-19 pandemic, as well as the demographic, socioeconomic and health characteristics of the most affected population, becomes paramount for the adoption of preventive measures and strategies to promote health in the older population, with the aim of reducing the magnitude of respiratory infections in this group.

Thus, the aim of the present study was to investigate the sociodemographic and health characteristics associated with deaths from Severe Acute Respiratory Syndrome in older people from a city in the north of Rio Grande do Sul state.

METHODS

This study is part of a larger investigation called "Síndrome Respiratória Aguda Grave (SRAG) em Passo Fundo - RS: prevalência de vírus respiratórios e fatores associados" ["Severe Acute Respiratory Syndrome (SARS) in Passo Fundo – RS: prevalence of respiratory viruses and associated factors"], comprising several investigative arms, one of which is secondary data analysis of notified cases of SARS and influenza syndrome due to the novel coronavirus.

An observational epidemiological study analyzing data from the Influenza Epidemiological Surveillance Information System (SIVEP-Gripe) in Passo Fundo, Rio Grande do Sul state was carried out from April to December 2021. The information was made available by the City Health Department, including cases of SARS confirmed and reported between January 1 and December 31, 2020, a period in which no vaccine was yet available in Brazil. This scenario allowed an analysis of mortality outcome without the influence of immunization. Individuals aged 60 years and over, of both sexes and notified as SARS cases in the period defined for the analysis were included in this study.

The variables of interest comprised sociodemographic aspects, such as gender (male; female), age in full years (≤ 79; ≥ 80), race/skin color (white; other), education in years of formal study (≤ 5; 6-12; > 12). With regard to health variables, the following were assessed: 1) signs and symptoms (fever, cough, sore throat, dyspnea, respiratory distress, O2 saturation < 95%, diarrhea, vomiting, abdominal pain, fatigue, loss of smell and taste); 2) individuals in sample carrying a risk factor, heart disease, liver disease, asthma, diabetes, neurological disease, lung disease, immunodeficiency, chronic kidney disease and obesity; and 3) trajectory of reported cases, including Intensive Care Unit (ICU) admission, use of ventilatory support (no; yes, invasive; yes, non-invasive), outcome (recovery; death), final case classification (unspecified SARS; COVID-19 SARS), and confirmation criteria (laboratory; epidemiological; clinical and imaging).

The main outcome of interest was death from SARS, assessed using the outcome variable (death x recovery). The key exposures involved sociodemographic and health characteristics. In case estimates, the 7-day rolling average was assessed for epidemiological weeks, calculated by adding the number of cases and deaths for each of the seven days and dividing the result by 7, giving weekly average.

Statistical analyses comprised the distribution of absolute (n) and relative (%) frequencies of the variables of interest. For outcome and exposures, crude and adjusted odds ratios (OR) and 95% confidence intervals (95%CI) were estimated using logistic regression. In the adjusted analysis, hierarchical modeling was adopted[11], with a 5-level model constructed by the authors. The first level (more distal) included demographic variables (gender, age and skin color); the second level socioeconomic variables (education); the third level (presence of risk factors); fourth level (pre-existing morbidities such as obesity, asthma, liver disease, neurological disease, immunosuppression and kidney disease); while the fifth level (proximal) encompassed lung diseases, diabetes mellitus and heart diseases. It is noteworthy that the variables were adjusted for those at the same level and for those at a higher level. All variables were included in the adjusted analysis and selected using the backward method, retaining variables with $p < 0.20$. In all tests, the significance level adopted was $p < 0.05$.

The project was approved under permit number 4 405 773 by the Ethics Committee for Research involving Humans of the Federal University of Fronteira Sul, and all statistical analyses were carried out using the PSPP Software version 1.2.0 and Stata, 12.0, licensed under number 30120505989.

RESULTS

The total number of SARS notifications in older people from Passo Fundo, Rio Grande do Sul state in 2020 was 1,268 cases. The notified SARS cases and deaths, together with the rolling average are shown in Figures 1A and 1B, respectively. The results for cases reveal that notifications first peaked on epidemiological week 21 in May, with a second peak occurring in July during weeks 29 and 30, showing

an upward trend until the end of August during weeks 35 and 36, when the highest peak of the series was reached. Subsequently, case notification rates decreased, returning to an upward trend in week 47 which continued until week 53 in November and December, when the year ended.

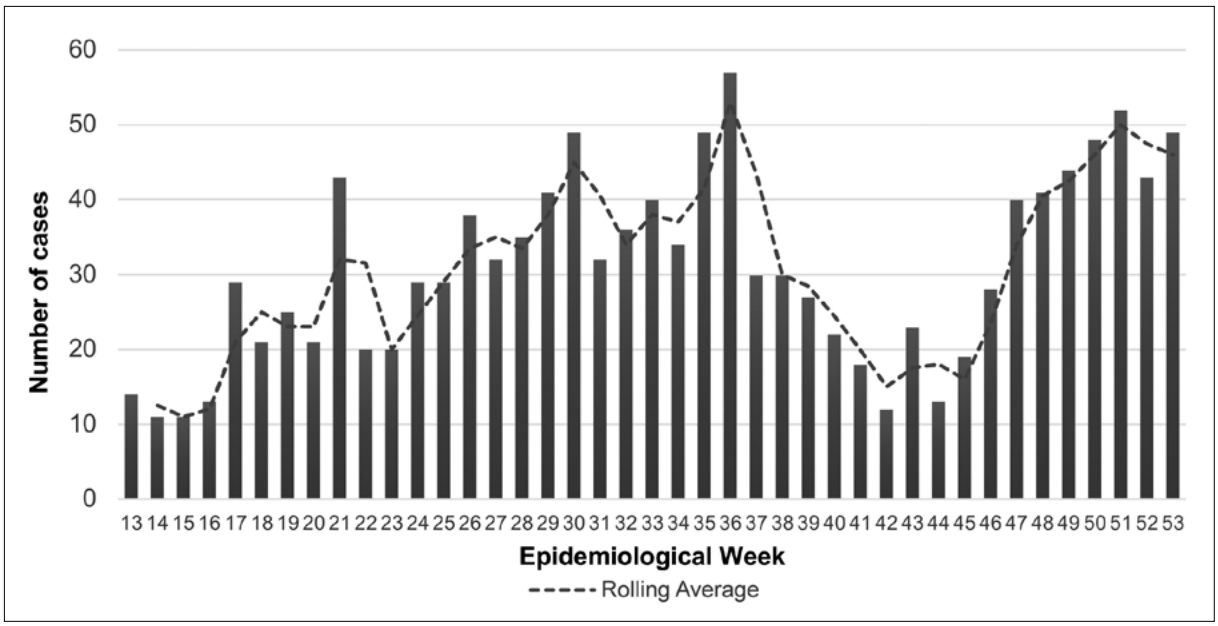

Figure 1A. Notified SARS cases in older adults by epidemiological week in Passo Fundo, Rio Grande do Sul state, 2020 (n = 1,268).

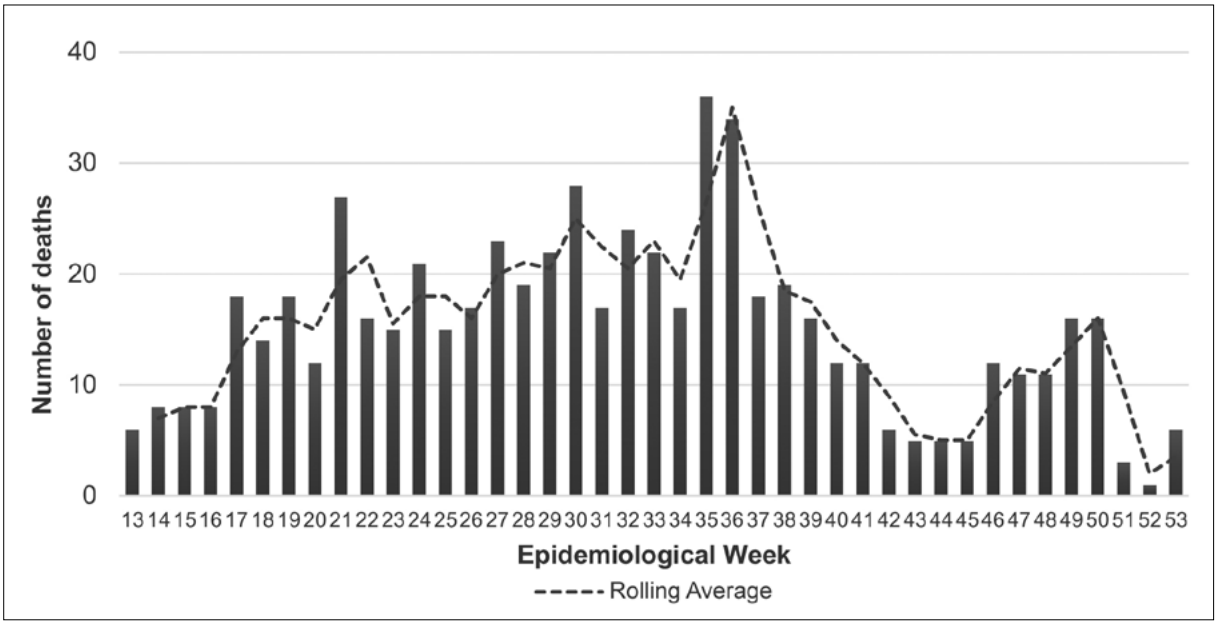

Figure 1B. Notified SARS deaths in older adults by epidemiological week in Passo Fundo, Rio Grande do Sul state, 2020 (n = 619).

Regarding deaths, there was a sharp rise during epidemiological weeks 35 and 36. This is also the period associated with the highest number of cases notified in Passo Fundo, Rio Grande do Sul state. By contrast, at the end of 2020, despite the substantial increase in the number of cases, the number of registered deaths no longer accompanied the rise in notifications.

The sociodemographic characteristics and aspects related to the trajectory of cases are presented in Table 1. The majority of patients were aged ≤ 79 years, over half were male, almost all were white, and most had ≤ 5 years of education. Regarding trajectory of cases, a significant number required ICU admission and non-invasive ventilatory support. Lastly, over 2/3 of SARS cases were due to COVID-19, almost all of which were confirmed by laboratory analyses. Most cases progressed to recovery.

Regarding the main symptoms experienced by the patients infected by SARS, the most frequent were dyspnea and respiratory distress (Figure 2). More than 2/3 of the sample also had saturation below 95% and cough, while just over half of the patients reported fever. Fatigue, diarrhea and sore throat were also reported, while the least common symptoms included vomiting, loss of taste, loss of smell and abdominal pain.

Table 1. Sociodemographic and health characteristics of older adults infected by Severe Acute Respiratory Syndrome (SARS) notified in Passo Fundo, Rio Grande do Sul, 2020 (n=1,268).

Variable	n (%)
Age (full years)	
≤ 79	936 (73.8)
≥ 80	332 (26.2)
Gender	
Male	672 (53.0)
Female	596 (47.0)
Skin color	
White	1,182 (93.2)
Other (black/yellow/brown/indigenous)	86 (6.8)
Education (years of formal study)	
≤ 5	559 (47.5)
6-12	480 (40.8)
> 12	137 (11.7)
ICU admission	
No	773 (61.5)
Yes	483 (38.5)
Ventilatory support	
No	262 (21.0)
Yes, invasive	304 (24.3)
Yes, non-invasive	683 (54.7)
Outcome*	
Recovery	619 (59.1)
Death	428 (40.9)
Case classification	
Unspecified SARS	350 (28.0)
COVID-19 SARS	913 (72.0)
Confirmation criteria	
Laboratory	1,212 (96.5)
Epidemiological	2 (0.2)
Clinical and Imaging	42 (3.3)

*Variable with highest number of missing data items: Outcome = 225

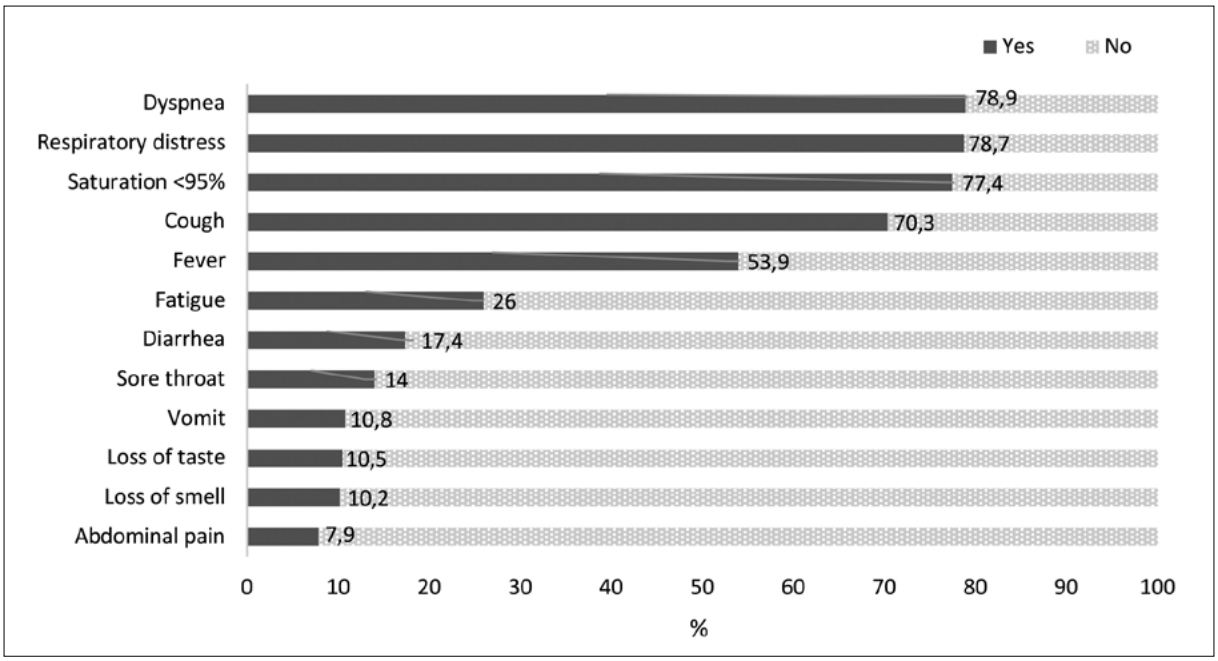

Figure 2. Main symptoms reported by older adults infected by Severe Acute Respiratory Syndrome notified in Passo Fundo, Rio Grande do Sul state, 2020.

Regarding the risk factors related to the health status of older individuals infected by SARS, almost all had a comorbidity, with heart disease and diabetes mellitus being the most prevalent. To a lesser extent, lung disease, neurological disease, obesity and chronic kidney disease were also reported. Asthma, immunosuppressive diseases and liver disease were reported by less than 5% of the population analyzed (Figure 3).

The multivariate analysis, after adjusting for possible confounding factors, revealed the gender variable was associated with outcome, with greater chance of death among men (OR=1.40; 95%CI 1.08-1.81) and patients aged ≥80 years (OR=1.92; 95%CI 1.45-2.55). The likelihood of death was higher in individuals with ≤ 5 years of education (OR=1.83; 95%CI 1.37-2.46) than those who had more education. Having at least one risk factor was significantly associated with outcome (OR=3.63; 95%CI 1.75-7.53) (Table 2).

Regarding comorbidities, only chronic kidney disease remained associated with outcome after adjustment (OR=2.28; 95%CI 1.39-4.05), while individuals with heart disease maintained an inverse association (OR=0.69; 95%CI 0.51-0.92). The results of crude analysis showed that neurological disease was associated with death among the older adults infected by SARS (OR=1.70; 95%CI 1.15-2.52), although this association was not confirmed on the multivariate analysis.

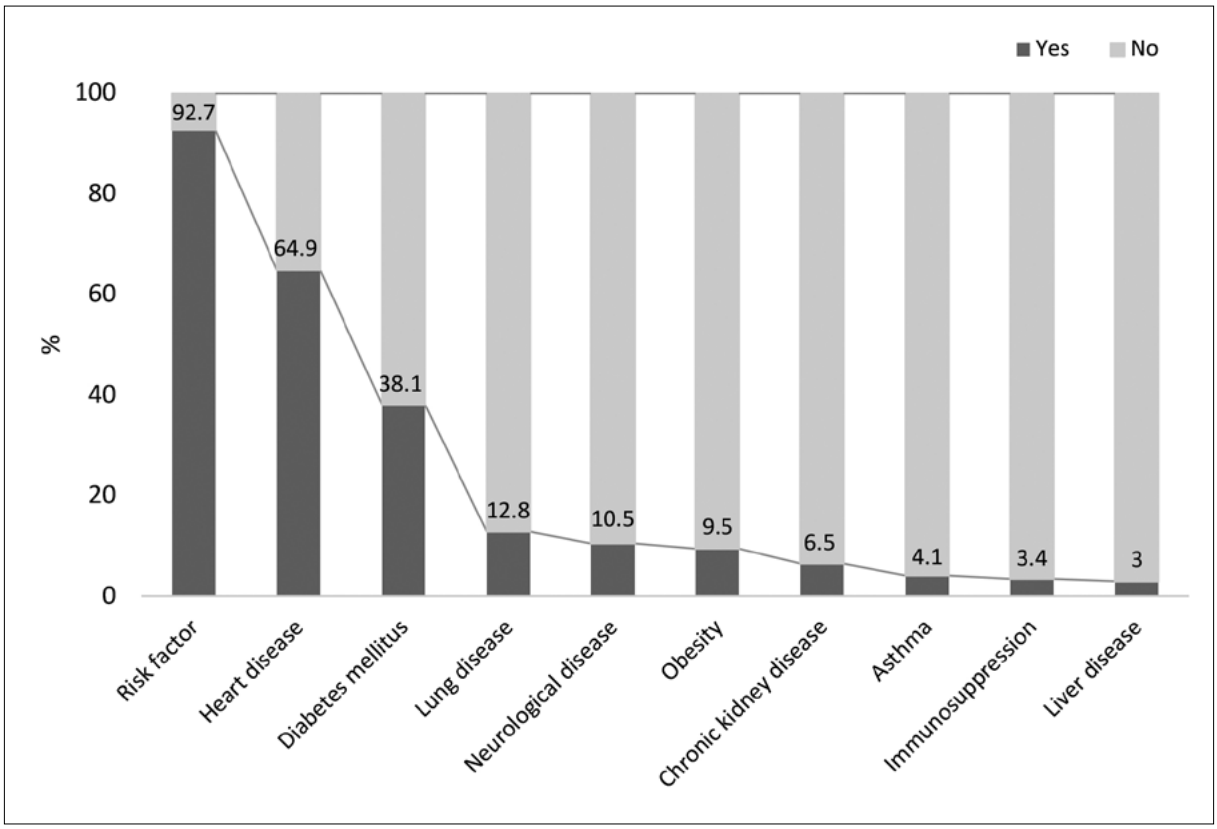

Figure 3. Main risk factors in older adults infected by Severe Acute Respiratory Syndrome (SARS) notified in Passo Fundo, Rio Grande do Sul state, 2020.

Table 2. Crude and adjusted analysis of SARS deaths in older adults according to sociodemographic and health characteristics. Passo Fundo, Rio Grande do Sul state, 2020.

	Crude			Adjusted[a]		
	OR	95% CI	*p*	OR	95% CI	*p*
Gender			0,063			**0,010**
Female	1.00	-		1.00	-	
Male	1.26	0.99 – 1.62		1.40	1.08-1.81	
Age (full years)			<0.001			**<0.001**
≤ 79	1.00	-		1.00	-	
≥ 80	1.84	1.40-2.43		1.92	1.45-2.55	
Skin color			0.184			0.144
White	1.00	-		1.00	-	
Other (black/yellow/brown/indigenous)	1.40	0.85 – 2.31		1.46	0.88-2.42	
Education (years)			**0.018**			**0.041**
≤ 5	1.71	1.08-2.73		1.83	1.37-2.46	
6-12	1.42	0.88-2.30		1.42	0.88-2.29	
>12	1.00	-		1.00	-	
Presence of risk factor			**<0.001**			**0.001**
No	1.00	-		1.00	-	
Yes	4.04	2.03 – 8.01		3.63	1.75-7.53	

to be continued

Continuation of Table 2

	Crude			Adjusted[a]		
	OR	95% CI	*p*	OR	95% CI	*p*
Heart disease			**0.043**			**0.013**
No	1.00	-		1.00	-	
Yes	0.75	0.57 – 0.99		0.69	0.51-0.92	
Liver disease			0.051			0.087
No	1.00	-		1.00	-	
Yes	2.09	1.00 – 4.39		1.95	0.91-4.21	
Asthma			0.776			0.749
No	1.00	-		1.00	-	
Yes	0.91	0.45 – 1.80		0.88	0.40-1.94	
Diabetes mellitus			0.204			0.095
No	1.00	-		1.00	-	
Yes	1.18	0.91 – 1.53		1.28	0.96-1.69	
Neurological disease			**0.008**			0.125
No	1.00	-		1.00	-	
Yes	1.70	1.15 – 2.52		1.39	0.91-2.13	
Pneumopathy			0.788			0. 959
No	1.00	-		1.00	-	
Yes	1.05	0.73 – 1.50		0.99	0.67-1.46	
Immunosuppression			0.331			0.234
No	1.00	-		1.00	-	
Yes	1.38	0.72 – 2.64		1.54	0.76-3.12	
Chronic kidney disease			**0.002**			**0.001**
No	1.00	-		1.00	-	
Yes	2.27	1.36 – 3.78		2.28	1.39-4.05	
Obesity			0.996			0.707
No	1.00	-		1.00	-	
Yes	1.00	0.66 – 1.50		1.09	0.70-1.70	

[a] adjusted for sex, age, education, presence of risk factors, liver disease, neurological disease, chronic kidney disease, diabetes, and heart disease.

DISCUSSION

The present study identified a greater number of cases of SARS in older people aged ≥ 79 years, although the worst prognosis was observed among individuals aged > 80 years. The highest prevalence of cases was found in men with ≤5 years of education. The occurrence of comorbidities and aggravating factors for respiratory infections in this age group was also reported by similar studies in Brazil[12,13] and other countries[6], showing that mainly cardiovascular diseases and diabetes mellitus constituted predictive factors for a worse prognosis, particularly related to COVID-19.

Similar results were observed in a previous study of 27,932 participants aged > 65 years assessing the risk factors for COVID-19 in Brazil. The study found that, of the analyzed cases, 42.9% were men, 55.9% were white and 67.0% had not completed primary education[12]. In another study, conducted in China, in which 52% of the sample comprised individuals aged >60 years, 67% of patients were men and 71% required invasive or non-invasive ventilatory support, the main support measure used for these patients[6].

Another study carried out in Brazil involving a sample of 67,180 confirmed cases of COVID-19 reported that 57.5% of cases occurred in men and

ICU stay was needed in 30.3% of the hospitalizations analyzed[13]. In this study, being an older male with low education was associated with an unfavorable outcome in relation to death from SARS. A meta-analysis found that male patients aged > 65 years may exhibit higher risk of becoming a critical or fatal case which, together with comorbidities, can significantly affect prognosis[14].

Typically, men are less likely to access health services to monitor chronic diseases, while low education is a factor known to affect access to health and the adoption of healthy behaviors[15]. Additionally, low education is also associated with lower income, which may also affect this outcome[16].

Evidence from different parts of the world suggests that age is the most significant factor contributing to risk of severe infection by COVID-19, along with its complications and adverse consequences, with immunosenescence or immune remodeling constituting the main reason why the older population is more vulnerable and susceptible to infections, with impaired immune responses[17].

Regarding signs and symptoms, a higher prevalence of dyspnea, respiratory distress, saturation below 95% and cough was observed in the present study. These results are similar to those found in another study, which reported fever, cough, fatigue, chest pain and dyspnea as the most common symptoms, emerging within 5 days after the incubation period, a shorter timeframe in patients over 70 years compared to the general population[7].

In another study, 85.2% of individuals presented with cough, while 79.6% reported fever and 76.6% dyspnea, symptoms characterizing SARS[13]. In a similar study carried out in the state of Ceará, Brazil, 86% of cases presented dyspnea, 85.2% had fever, 84.7% cough, and 77.1% experienced respiratory distress[18]. In a Chinese study, among the main symptoms highlighted, 98.0% of cases presented with fever, 77.0% with cough, and 63.5% with dyspnea[6]. The present findings are consistent with these results, and the characteristics corroborate the diagnosis of Severe Acute Respiratory Syndrome.

Regarding risk factors, comorbidities often coexist in older patients, and in such cases, individuals with these metabolic factors are more likely to be at risk for diseases and more unfavorable outcomes, exacerbating the severity of symptoms and consequences of COVID-19[14,19]. Multimorbidity is an important factor to be considered in older individuals, representing one of the main predictors of disability associated with inflammation. However, this involves a host of psychosocial processes that can contribute to healthy aging, provided this is associated with control of comorbidities and successful adaptation to health conditions[20].

Aging is associated with deregulation of immunity in individuals, characterized by an increase in pro-inflammatory factors, promoting a greater probability of developing chronic morbidities which are risk factors for chronic kidney disease, diabetes mellitus, cancer, among others. These inflammatory mechanisms include genetic factors, changes in the body's microbiota, obesity, senescence, cell dysregulation and chronic infections[21].

In a nationwide Brazilian study, hypertension was the main comorbidity found among the older population, having a prevalence of 43.8%, while more than 58.0% had a chronic non-communicable disease (NCD) considered a risk factor for COVID-19, worsening the severity of SARS cases, with men having more associated comorbidities than women[2].

In another Brazilian study, involving individuals aged >50 years, half of the population, or approximately 52.0%, had some form of multimorbidity placing them at risk for severe COVID-19, with this group comprising59.4% women and 43.5% men. The most prevalent morbidities were heart disease (56.0%), obesity (39%), arthritis (21.0%) and depression (18.5%)[22]. According to a Chinese retrospective study, the comorbidities most associated with older patients with COVID-19 were hypertension (30%), diabetes (19%) and coronary heart disease (8%)[23]. In another study, the main comorbidities found were heart diseases(66.5%) and diabetes mellitus (58.3%)[18].

The estimated lethality of COVID-19 for individuals with heart disease is 10.5%, diabetes

mellitus 7.3%, chronic respiratory disease 6.3%, hypertension 6%, and with cancer is 5.6%[24]. In addition to higher risks for older patients and those with comorbidities, Chronic Obstructive Pulmonary Disease (COPD) and cardiovascular diseases are important predictors for complications in respiratory infections, in addition to clinical signs and biological markers, indicating inflammation or organ damage, aggravating COVID-19 cases or leading to death[25].

In this study, the presence of heart disease had an inverse relationship with the occurrence of death in individuals with SARS, a finding that contrasts with the results of other studies. Although prevalent in individuals infected by COVID-19, it is unclear whether cardiovascular disease is an independent risk factor or is mediated by other factors, such as age and presence of other comorbidities[26]. Another study found that death in patients with heart disease was around 10.5%, given the virus can damage myocardial cells as a result of systemic inflammatory responses[27].

Strengths of the present study include the analysis of the sociodemographic characteristics of the older patients infected by SARS in Passo Fundo, a city recognized as a regional health hub, as well as the prevalence of signs and symptoms, comorbidities and factors associated with a worse prognosis in this population. To the best of our knowledge, this is one of the first studies addressing the issue in the older population from southern Brazil and can serve to help plan and discuss health care policies for the older population.

Given this study entailed an analysis of secondary data, limitations include the possibility of underreporting and poor quality of mandatory reporting forms, with potential incomplete data regarding clinical information, errors in transcription, double-entry or validation, inherent to studies of this kind. Additionally, the data pertains to SARS notifications, therefore, only cases in which hospitalization was required or that led to death from SARS were included in the investigation. Thus, the study only reports severe cases with influenza symptoms, and does not encompass asymptomatic or mild cases.

CONCLUSION

In the cases notified in Passo Fundo, Rio Grande do Sul, lethality was higher in individuals aged > 80 years, with sociodemographic characteristics being determinants for the trajectory of SARS, where men and low-educated individuals were the most affected by the death outcome. The lethality observed was high, with the presence of risk factors (particularly chronic kidney disease), along with sociodemographic conditions, determining this outcome.

Regarding the symptoms experienced by the older patients, these were consistent with those recommended by the Ministry of Health for the classification of SARS cases, and the comorbidities associated with the cases reflected the most prevalent conditions in the older population in general, and in individuals infected by COVID-19, the main factor causing SARS in 2020.

It should be noted that the campaign for COVID-19 vaccination in 2021, including older adults as a priority group, changed the course of SARS in this specific population by lowering the number of hospitalizations. However, it is important to mention that older people remain the group most affected by the more severe forms of the disease, leading the morbidity and mortality statistics in 2021 and 2022.

The associations found in this study can help in the planning, management and assessment of health policies and actions by elucidating the priority groups for targeting strategic actions that promote greater self-care and easier access to health services, especially for the older male population.

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Self-perception of oral health and associated factors in quilombola older people: a population-based study

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Abstract

Objective: to investigate self-perception of oral conditions and associated factors in rural quilombola older people in northern Minas Gerais, Brazil. *Method*: This is an analytical and cross-sectional population-based study, in which cluster sampling with probability proportional to size (n=406) was used. Data collection involved conducting interviews and clinical dental examinations. Self-perception of oral conditions was assessed using the GOHAI (Geriatric Oral Health Determination Index). *Results:* Most older people self-perceived oral health as excellent (46.3%) or regular (30.2%). Those surveyed also revealed precarious oral health and restricted access to dental services. In the multiple analysis, significant associations (p<0.05) were found between regular GOHAI and variables related to the location of the last consultation and use of prosthesis, as well as between poor GOHAI and variables related to marital status, religion, reason for last consultation, CPO-D index and use of prosthesis. *Conclusion:* A significant portion of the quilombola older people showed a more positive self-assessment of oral health, which differs from the professionally verified dental condition. It was also found that the report of poor perception of oral conditions was strongly associated with poorer oral health among those investigated.

Keywords: Self-perception. Oral health. Older people. Quilombolas. Vulnerable communities.

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INTRODUCTION

In the field of public health, there is a clear situation of exclusion and marginality experienced by black and brown people[1-5]. In this context, the remnants of quilombola communities[1,3,4] are included, defined as ethnic-racial groups, holders of black ancestry associated with resistance resulting from historical oppression6. These peoples generally manifest a rural geographic distribution[3,4,7], totaling 3212 quilombola communities certified by the Palmares Foundation throughout the Brazilian territory[8].

It is useful to emphasize that oral health directly impacts people's quality of life[9]. Specifically in older people, certain oral alterations are prevalent and become objectively relevant, such as edentulism, dental caries, periodontal disease, need for prostheses and lesions of the oral mucosa[3,10,11]. In the case of older people residing in rural environments, such as the Quilombolas, the epidemiological scenario is accentuated due to limited access to dental services, thus showing people with a high prevalence of edentulism and oral pathologies[3,5].

In view of the above and considering the implications of the subjective aspect on people's health, it is emphasized that self-perception measures, in a relevant way, the individual's state of health, since it incorporates cognitive and emotional aspects, as well as physical[12]. Complementarily, it is highlighted that it is essential to understand how people perceive their oral condition, since their behavior is modulated according to the relevance attributed to their own oral health[13].

In older people, the perception of the oral condition can be influenced by personal values, such as the conviction that painful and disabling events are inevitable at this age, thus leading to an overestimation of their condition[11,14,15]. In addition, it is observed, among these individuals, that the lack of perception of their real dental situation results in non-demand for professional assistance[14,16].

Studies indicate that self-perception of oral health is associated with clinical dental factors[9,11,17], subjective factors[11], in addition to being influenced by socioeconomic factors such as age and income[18].

However, it appears that there is an intense shortage of studies in the literature that discuss the self-perception of oral conditions in quilombolas, primarily covering older people. The sparse data available reveal individuals with poor oral health and negative self-perception of oral conditions[4,19]. Thus, it is inferred that the epidemiological data expressed by this investigation can encourage the proficient elaboration of public dental policies aimed at the local public.

Thus, the objective of this research was to investigate the self-perception of oral conditions and associated factors in rural quilombola older people in the north of the state of Minas Gerais, Brazil.

METHODOLOGY

The detailed methodological description of this study regarding its design, setting[20], population universe[8,21,22], sampling plan, inclusion[8] and exclusion[23] criteria, data collection and ethical aspects, is fully included in a previous related publication[3].

It should be noted that this is a cross-sectional population-based study, which was carried out in the extension of the northern health macro-region, located in northern Minas Gerais, Brazil. The region had 79 quilombola communities, encompassing about 19,000 inhabitants and an older population estimated at 2,660 people (N)[8,21,22], which totaled a minimum sample calculated for the study of 406 older people (n). For sample calculation purposes, a prevalence of 50% for oral diseases was estimated in a finite population, a confidence level of 90%, margin of error of 5%, design effect (*deff*) equal to 1.5 and estimated 10% losses.

Regarding sample selection, cluster sampling with probability proportional to size (PPS) was adopted, thus selecting 30 local communities. The selection process of residences in each community started from a previous definition of the central community region, with subsequent displacement of the researchers in loco in a spiral direction (considering the prevalent geographical distribution spaced between residences in these rural communities), going through households and carrying out examinations and interviews, until

reaching the sample defined for each community. All older people (≥ 60 years old) in the households were invited to participate in the survey.

Inclusion criteria were established to be at least 60 years old, self-declare as a remnant of quilombo and reside in a quilombola community certified by the Palmares Cultural Foundation[8]. People who showed cognitive deficits were excluded from the research, a condition that could make it difficult or impossible to transmit information regarding the researched variables. Cognitive deficit screening was performed using the Portuguese version of the Mini-Mental State Examination (MMSE), translated and modified[23].

The *dependent variable* in this study was self-perception of oral health and the *independent variables* related to sociodemographic characteristics, access to dental services and oral condition. The dependent variable was evaluated through an interview, using the Geriatric Oral Health Determination Index – *GOHAI*, composed of 12 questions. Each question had three possible answers: "always", "sometimes" and "never". They received scores 1, 2 and 3, respectively, according to each answer, and to determine the global index, the score of each question was added. Each individual's score could range from 12 to 36[13]. Thus, the individual's self-perception was classified as "excellent" (34 to 36 points), "regular" (30 to 33 points) and "poor" (< 30 points)[24,25]. The prevalence of dental caries was investigated using the DMFT Index, considering the number of decayed (D), missing (M) and filled (F) teeth, and the periodontal condition was assessed using the Community Periodontal Index (CPI) and Clinical Attachment Loss (CAL) [26].

Data tabulation and analysis were performed using statistical software. Initially, a descriptive analysis of the data was performed. Subsequently, a bivariate analysis was conducted to verify the association between self-perception and variables concerning sociodemographic characteristics, access to dental services and oral conditions, using *Pearson's* chi-square test - X^2. Finally, a multiple analysis was performed, adopting the Multinomial Logistic Regression Model and using the variables that presented a value of $p \leq 0.25$ in the bivariate analysis. The category adopted as a reference for the dependent variable was GOHAI excellent. In the multiple analysis, the hierarchical method[1,27] was adopted, as shown in Figure 1, for entering the variables in the model, using the following sequence: distal level (sociodemographic variables), intermediate level (access to oral health services) and proximal level (oral health conditions). Within each hierarchical level, for selection of variables, the *backward* selection method based on the *Wald* test was adopted, thus all independent variables were added to the model and the removal of these variables was made based on the significance of the *Wald* test. The adequacy of the model adopted in the multiple analysis was verified using the Likelihood Ratio test and the quality of the model's fit was tested using the *Deviance* test. Furthermore, the Pseudo-$R^2_{Nagelkerke}$ was used in order to obtain the explanatory power of the final model. After regression, in the final adjusted model, the magnitude of association between variables was estimated using the *odds ratio* (OR) and the *a* significance level considered was 5%.

This study followed the precepts enshrined in Resolution No. 466/2012 of the National Health Council of the Ministry of Health and those dictated by Resolution CFO 179/91 of the Code of Professional Dental Ethics. Approval of this research was carried out by the research ethics committee of the State University of Montes Claros (COEP-Unimontes), through consolidated opinion nº 2,821,454. Participants were informed about the research, as well as instructed to sign the free and informed consent form for participatory permission and data analysis.

RESULTS

Figure 2 shows the relative frequency of categories related to self-perception of oral health in the investigated quilombola older people (n=406). There was a predominance of self-perception classified as excellent (n=189; 46.3%; 95% CI 40.5 - 52.2), followed by regular self-assessment (n=123; 30.2%; 95% CI 25.3 - 35.6) and poor (n=94; 23.5%; 95% CI 18.2 - 29.8). It is pointed out that the expressed confidence interval (CI) was corrected by the effect of the study design and that the descriptive data of the sample are largely based on a previous related publication[3].

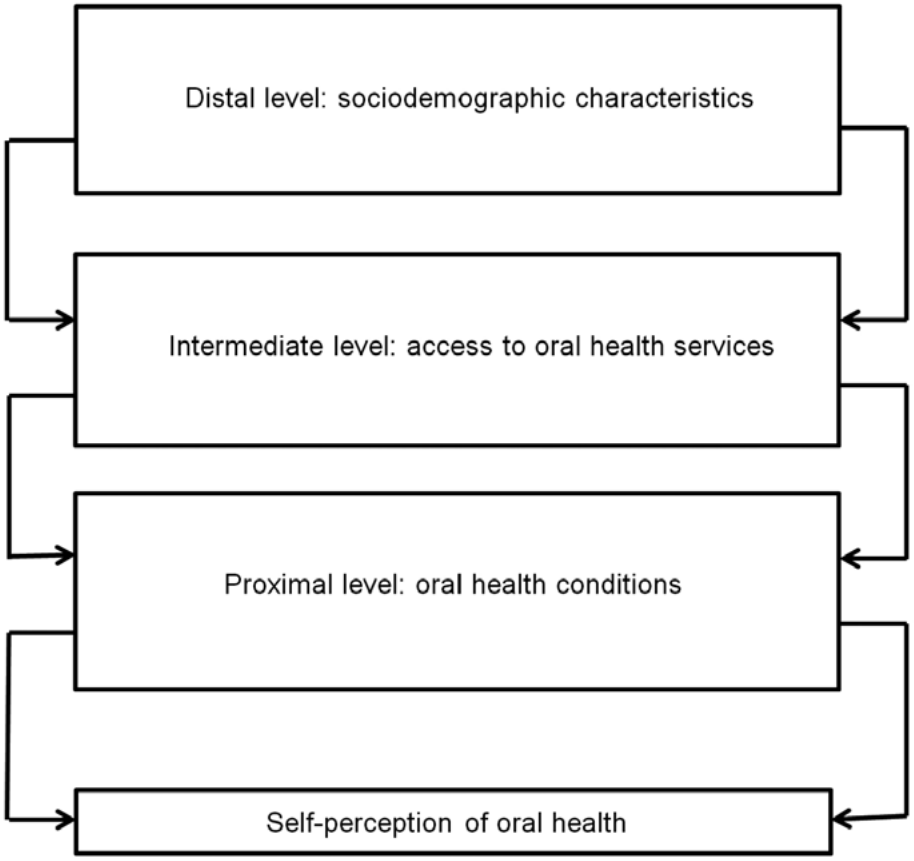

Figure 1. Hierarchical conceptual model, structured in variable input levels, used in the multiple analysis (dependent variable: self-perception of oral health).

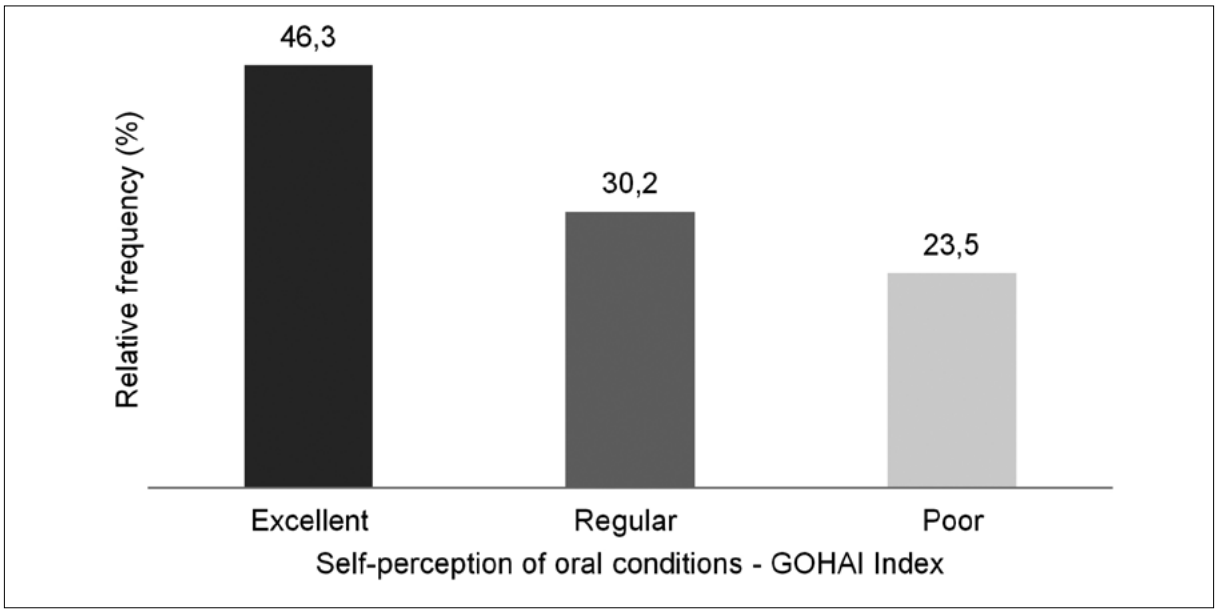

Figure 2. Distribution of self-perception of oral health in rural quilombola older people in northern Minas Gerais (n=406), Brazil, 2019.

Table 1 expresses the bivariate analysis of the data, revealing the statistical association between the dependent variable (GOHAI) and the independent variables. In this phase, the variables marital status, skin color, reason for last consultation, evaluation of care, use of prosthesis, need for prosthesis, DMFT, CPI, CAL and soft tissue alteration were associated with GOHAI, at a significance level of 25%. It should be noted that the variable "Where was the last consultation" originally manifested the category "never been to the dentist" containing only nine respondents, thus making the multiple analysis unfeasible and requiring, therefore, an adequacy of the referred variable with the removal from the aforementioned category. Thus, after adjustment, the variable "Where was the last consultation" presented, in the bivariate analysis, a value of p=0.065, revealing an association with the dependent variable and, therefore, was included in the multiple analysis.

Table 2 demonstrates the Mutinomial Multiple Logistic Regression Model, showing the existing statistical associations between the dependent variable (GOHAI) and independent variables that were included in the final model. At this stage, there was a statistically significant association (p<0.05) between regular GOHAI and the variables related to the place of the last appointment and use of prosthesis, as well as between poor GOHAI and variables concerning marital status, religion, reason for last appointment, DMFT and use of prosthesis.

Regarding the adequacy of the model used in the multiple analysis, a significance test of the adjusted model was carried out, using the Likelihood Ratio test (χ^2 (16) = 60.97; p<0.0001), indicating that the general model had at least one independent variable associated with the outcome. The model's goodness of fit test was performed using the Deviance test (χ^2 (148) =150.25; p=0.433), indicating that the model fitted the data observed in the sample. Finally, the explanatory power of the final model was obtained through Pseudo-$R^2_{Nagelkerke}$ = 0.166 (16.6%), representing the proportion of information gain estimated by the full model compared to the null model (the closer to 1, the better). It is added that the partial explanatory power of the model with the variables of the distal level was Pseudo-$R^2_{Nagelkerke}$ = 0.04 (4%); with the variables of the distal and intermediate levels, the partial explanatory power was Pseudo-$R^2_{Nagelkerke}$ = 0.104 (10.4%).

Table 1. Bivariate analysis of data relating to rural quilombola older people in northern Minas Gerais (n=406), Brazil, 2019.

Variable	GOHAI			*p*-value**
	Excellent	Regular	Poor	
	n(%)*	n(%)*	n(%)*	
Sociodemographic characteristics	n(%)			
Sex				0.349
Male	175(41.1)	88(45.8)	47(35.7)	40(38.9)
Female	231(58.9)	101(54.2)	76(64.3)	54(61.1)
Age group				0.784
≥ 80 years	53(11.9)	26(13.5)	15(9.5)	12(12.0)
70 a 79 years	103(23.6)	50(21.9)	28(21.9)	25(29.3)
60 a 69 years	250(64.4)	113(64.6)	80(68.7)	57(58.7)
Marital status				0.204
No partner	179(41.7)	93(47.8)	54(40.4)	32(31.3)
With partner	227(58.3)	94(52.2)	69(59.6)	61(68.7)
Skin color				0.012
Non-black	190(41.9)	91(45.6)	51(31.4)	48(48.2)
Black	216(58.1)	96(54.4)	72(68.6)	46(51.8)
Education				0.904
Illiterate	170(38.6)	80(37.7)	48(38.3)	42(40.9)
Literate	236(61.4)	108(62.3)	75(61.7)	51(59.1)
Work				0.305
Does not work	45(8.0)	21(6.9)	14(9.4)	10(8.0)
Retiree	286(77.1)	131(73.9)	91(82.1)	64(76.9)
Works	75(15.0)	37(19.2)	18(8.5)	20(15.1)
Family income				0.278
≤ 1 m.w.	82(21.4)	39(22.4)	25(20.6)	18(20.4)
Between 1 and 2 m.w.	234(53.4)	110(54.3)	64(52.7)	50(52.3)
>2 m.w.	90(25.2)	37(23.2)	30(26.7)	23(27.2)
Religion				0.024
Catholic	352(87.6)	169 (90.4)	110 (89.4)	73 (79.30)
Evangelical	54(12.4)	18 (9.6)	13 (10.6)	19 (20.7)
Access to dental services				
Has been to the dentist				0.842
Yes	397(97.5)	185(98.2)	119(96.8)	93(97.1)
No	9(2.5)	4(1.8)	4(3.2)	1(2.9)
Time since last appointment				0.495
Never been to the dentist	9(2.5)	4(1.8)	4(3.2)	1(2.9)
3 years or more	270(60.4)	135(67.5)	76(56.0)	59(52.2)
2 years or less	127(37.1)	50(30.7)	43(40.8)	34(44.9)

to be continued

Continuation of Table 1

Variable		GOHAI			*p*-value**
		Excellent	Regular	Poor	
		n(%)*	n(%)*	n(%)*	
Reason for last appointment					0.032
Never been to the dentist	9(2.5)	4(1.8)	4(3.2)	1(2.9)	
Pain	26(9.0)	10(8.3)	3(1.3)	13(20.3)	
Extraction	170(38.1)	70(33.3)	52(40.6)	48(44.0)	
Treatment/others	201(50.4)	105(56.5)	64(54.8)	32(32.8)	
Where was the last appointment					0.280
Never been to the dentist	9(2.5)	4(1.8)	4(3.2)	1(2.9)	
Public	181(45.3)	73(38.7)	61(47.7)	47(55.0)	
Private	216(52.2)	111(59.5)	57(49.1)	45(42.1)	
Service evaluation					0.134
Never been to the dentist	9(2.5)	4(1.8)	4(3.2)	1(2.9)	
Regular/poor/terrible	28(8.1)	9(4.4)	7(6.4)	11(17.4)	
Good/great	369(89.4)	176(93.8)	112(90.4)	81(79.7)	
Oral health condition					
Edentulism					0.399
No	192(48.0)	84(49.1)	62(59.3)	46(48.2)	
Yes	214(52.0)	105(50.9)	61(40.7)	48(51.8)	
Use of prosthesis					0.001
No	202(46.5)	72(40.4)	67(61.5)	63(69.1)	
Yes	204(53.5)	117(59.6)	56(38.5)	31(30.9)	
Need for prosthesis					0.019
No	63(12.0)	41(15.5)	21(15.6)	1(0.3)	
Yes	343(88.0)	148(84.5)	102(84.4)	93(99.7)	
DMFT					0.173
32	235(50.7)	112(53)	72(45)	51(53.5)	
21 to 31	90(25.2)	35(21.5)	26(26.5)	29(30.8)	
≤20	81(24.1)	42(25.4)	25(28.5)	14(15.7)	
Periodontal alteration (CPI)					0.138
All sextants excluded	230(49.5)	108(50.3)	70(44.1)	52(54.6)	
Present	152(45.3)	75(47.6)	40(45.0)	37(41.3)	
Absent	24(5.2)	6(2.1)	13(10.9)	5(4)	
CAL					0.152
All sextants excluded	230(49.5)	108(50.3)	71(44.4)	52(54.6)	
Present	147(42.6)	72(46.3)	40(42.8)	35(35.3)	
Absent	29(7.8)	10(3.4)	12(12.8)	7(10.1)	
Soft tissue alteration					0.002
Yes	48(10.9)	25(11.9)	19(16.7)	4(1.7)	
No	358(89.1)	164(88.1)	104(83.3)	90(98.3)	
Need for immediate care					0.934
Yes	76(17.2)	30(18.1)	27(16.7)	19(15.9)	
No	330(82.8)	159(81.9)	96(83.3)	75(84.1)	

* Values corrected by the design effect; ** *Pearson's* chi-square test.

Table 2. Multiple Multinomial Logistic Regression model for rural quilombola older people in northern Minas Gerais (n=406), Brazil, 2019.

GOHAI*	Independent variables	OR	$CI_{95\%}$	*p*-value
Regular	Marital status			
	No partner	0.79	0.50 – 1.25	0.318
	With partner	1.00	-	
	Religion			
	Catholic	0.92	0.43 – 1.95	0.821
	Evangelical	1.00	-	
	Place of last appointment			
	Public	1.65	1.02 – 2.68	0.041
	Private	1.00	-	
	Reason for last appointment			
	Pain	0.45	0.12 – 1.71	0.239
	Extraction	1.15	0.70 – 1.89	0.580
	Treatment/revision	1.00	-	
	DMFT			
	DMFT=32	1.44	0.75 – 2.75	0.269
	DMFT from 21 to 31	1.42	0.65 – 3.06	0.378
	DMFT ≤20	1.00	-	
	Use of prosthesis			
	No	2.51	1.38 – 4.56	0.003
	Yes	1.00	-	
GOHAI*	Independent variables	OR	$CI_{95\%}$	*p*-value
Poor	Marital status			
	No partner	0.50	0.30 – 0.85	0.020
	With partner	1.00	-	
	Religion			
	Catholic	0.42	0.20 – 0.84	0.015
	Evangelical	1.00	-	
	Place of last appointment			
	Public	1.27	0.74 – 2.19	0.390
	Private	1.00	-	
	Reason for last appointment			
	Pain	4.43	1.66 – 11.78	0.003
	Extraction	2.36	1.33 – 4.20	0.004
	Treatment/revision	1.00	-	
	DMFT			
	DMFT=32	2.30	1.03 – 5.16	0.042
	DMFT from 21 to 31	3.60	1.49 – 8.65	0.004
	DMFT ≤20	1.00	-	
	Use of prosthesis			
	No	3.38	1.70 – 6.70	0.001
	Yes	1.00		

* The reference category of the dependent variable was GOHAI Excellent.

OR: *odds ratio*; CI: confidence interval;

DISCUSSION

The data from this study revealed that a significant portion of the surveyed quilombola older people (46.3%) self-perceived their oral health as excellent and that only 23.5% of those investigated reported a poor self-perception. Thus, there was an evident divergence between the clinical dental condition objectively measured and the self-reported oral health by the respondents. Similar results were found in older quilombola people in southern Brazil and Minas Gerais[4,7,19]. It is inferred, therefore, that diverse cultural aspects, combined with the social inequalities experienced by quilombola older people, including the severe deficit in access to public oral health services, can lead them to a state of longitudinal resignation, culminating in acceptance of their adverse dental condition and consequent manifestation of self-assessment correlated with a more positive trend.

An indictable dissonance was also found among Brazilian older people, through national surveys[11,28], and would be linked, according to the authors, to personal and cultural issues[11,14,15]. It is clear, therefore, that there is a tendency for people in this age group to overestimate their oral condition, even in the face of a compromised dental situation[11,14,15]. Complementarily, it is emphasized that the professional evaluates the dental clinical condition according to the presence or absence of diseases, while for the patient, the symptoms and functional and social consequences resulting from oral diseases become relevant[13].

Following the opposite trend, a study conducted with urban and rural northeastern older people indicated that residents in the rural area had worse oral conditions and a higher prevalence of negative self-perception of oral health, when compared to those who lived in the urban area[29]. Research involving rural and urban older people, from a significant Chinese province, showed that 35.1% of the participants self-perceived oral health as poor, coinciding with the precarious oral condition clinically observed by the researchers[30]. Punctuated convergence between the dental clinical picture and self-perception of oral health can signal and ratify the relevance and impact that socioeconomic, personal and cultural issues can assume in diverse rural populations, greatly interfering in the self-report of oral conditions.

With regard to the multiple analysis carried out in this study, it was found that poor self-perception of oral conditions was associated with having a partner, being evangelical, having a high DMFT index, not using a prosthesis and reporting dental pain as reason to seek professional assistance. Consequently, individuals who had a partner were more likely to have a poor self-perception of oral health. Corroborating this finding, Miranda *et al.*[17] demonstrated, in a multiple analysis, that older people who did not have a partner were more likely to have a more positive self-assessment of oral health. In both studies, the authors did not show a plausible explanation for the aforementioned association, and the same thing happened with the religious issue observed in this research.

Dental pain as a motivating factor for seeking care proved to be an important variable related to poor self-perception of oral health, with a significant odds ratio. Martins *et al.*[16] found a lower prevalence of positive self-perception of oral health among older people who sought dental services when faced with the perception of an oral problem. Still in this scope, dental pain was also associated with negative self-assessment of oral health among rural adults in the Brazilian Northeast[31], corroborating the strict correlation between these variables. Similarly, a recent longitudinal study demonstrated that the worsening of self-rated health in older people is strongly associated with the presence of chronic diseases and the manifestation of frailty, confirming the impact of illness on the decline in self-rated health in individuals in this age group[32].

In the present study, older quilombola people who had DMFT between 21 and 32 showed a greater probability of self-perceiving their oral health as poor, which is therefore consistent with the professional assessment, emphasizing that most of those surveyed were edentulous. Similarly, a Chinese study, including rural and urban older people, demonstrated that individuals with DMFT ≥ 20 had worse self-perception[30]. Discordant results were found in a national study involving individuals in the express age range, demonstrating that the smaller the number

of teeth present in the investigated oral cavity, the greater their positive perception of oral health[11]. Other studies showed that edentulous older people were more likely to self-report their oral health as positive[16,18]. As argued by the researchers, this trend could be related to possible negative experiences experienced by people with natural teeth throughout their lives, such as pain or discomfort, thus boosting a better self-perception of oral health in the face of missing teeth[16].

Quilombola older people who did not use dental prostheses were more likely to have regular and poor self-assessment of oral health, thus showing a strong association between the variables and confirming the impact of missing prostheses on oral self-perception, leading to a more negative self-report[33]. Such data reiterate the need to expand access to oral rehabilitation aimed at quilombola older people, who ordinarily manifest a high prevalence of caries and edentulism[34].

Focusing on the hierarchical model adopted in this investigation, it was found that the explanatory power of the final model was 16.6% in relation to the variability of the dependent variable (self-perception of oral health), and the independent variables that most contributed to the outcome were those concerning access to dental services (6.4%). Thus, it became evident, among the quilombola individuals surveyed, the primary influence that the restricted access to dental services had on the relative variation in the self-assessment of oral conditions, thus confirming the pressing local need to expand public services of dental nature.

Silva and Castellanos-Fernandes[13], when researching older people from São Paulo, showed that the independent variables used explained 30% of the variation related to self-assessment in oral health, with a greater contribution from clinical dental variables related to DMFT (recommended extraction) and CPI (community periodontal index), which accounted for approximately 1/3 of the variability. Among Brazilian older people, the model used in the study was able to explain 50% of the variability in self-perception of oral health among dentate individuals and 43% among edentulous individuals, with a greater contribution from subjective conditions related to oral health, such as the appearance of teeth, gums and mastication[11]. It appears, therefore, that there is a relative variation in the contribution exerted by different independent variables on the variability of self-perception in oral health, a volubility that may be associated with specific social and cultural aspects, therefore requiring further investigations aimed at a fruitful scientific clarification.

It should be added that the data obtained in this investigation have external validity, being, therefore, fully extendable to the quilombola older people residing in the northern health macro-region of the state of Minas Gerais. It is noteworthy that geographic access to local quilombola communities proved to be a prominent obstacle in the course of this study. It is also reinforced that this research does not allow inferences regarding causality or temporality, since it is a cross-sectional study. Furthermore, it is pointed out that the self-declared information emanating from this study is sensitive to possible memory biases coming from the participants, which can interfere with the accuracy of the data collected. Thus, in view of the patent scarcity of research involving topics concerning the self-perception of oral conditions in older quilombola people, it is suggested that new national investigations be carried out, with a proficient purpose directed to diagnosis and planning in oral health, to scientific parameterization and to the improvement of the quality of life of this population. Finally, the deleterious impact that oral pathologies can have on quilombola older people is highlighted, as observed, which may result in a self-perception of oral conditions with a more negative tendency. Express scientific evidence signals and encourages the effective implementation of public policies at the local level, with a view to strengthening community dental care, thus contributing to the well-being of these people.

CONCLUSION

It was verified that the majority of older quilombola people expressed an excellent or regular self-perception of oral health, different from the objective diagnosis verified professionally. In the final statistical model adopted, the self-assessment of oral health was associated with the independent

variables related to the place and reason for the last dental visit, use of dental prosthesis, marital status, religion and DMFT index. Furthermore, the findings of this study demonstrate an evident local deficit of accessibility and completeness of care of public oral health services, which, according to national guidelines, must prioritize the family focus and community orientation, with the aim of guaranteeing equity in health. Additionally, it is emphasized that this study provides scientific subsidies so that local communities can, through social control of the health sector, claim improvements in dental care and a longitudinal planning of public policies that is oriented to the urgent needs identified.

AUTHORSHIP

The study on screen had valuable contributions from the researchers involved. The author Leonardo de Paula Miranda worked on project design, data collection and analysis, article writing and approval of the version to be published. The authors Thatiane Lopes Oliveira, Luciana Santos Fagundes, Patrícia de Souza Fernandes Queiroz, Falyne Pinheiro de Oliveira and João Felício Rodrigues Neto worked on project design, data collection and analysis, and review of the article.

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Alzheimer's disease: a case study involving the most prevalent neurocognitive disorder in older people

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Abstract

Objective: To analyze the clinical evolution of a patient affected by Alzheimer's disease and discuss the repercussions of an early diagnosis. Method: Instrumental case study of qualitative and descriptive type that was developed in three stages: 1) selection and delimitation of the case; 2) collection of data in the field; and 3) organization and writing of the report. This study is based on the analysis of the clinical evolution described in the medical records of a patient diagnosed with Alzheimer's disease, treated and followed-up by the Center for Psychosocial Care (CAPS), for a period of 10 years, in the Alto Vale do Rio do Peixe region. Results: This study was conducted with the patient M.R., female, 71 years old, married, housewife, with incomplete elementary education, carrier of AD and hypothyroidism, who started her follow-up at CAPS II on September 10, 2012. Patient submitted to the Mini Mental State Examination (MMSE), with a result of 14 points in the first test, below the cut-off point for the patient's level of education. Later, in 2018, she scored 10 points on the MMSE, and in 2020 she scored 11, already under medication treatment for AD: memantine 10mg 2x/day and donepezilla 5mg 1x/day. Conclusion: Early diagnosis of AD is extremely important for appropriate treatment to slow the progression of the disease. However, mental disorders such as depression are barriers in the initial clinical analysis of patients and in some cases presents itself as a prodrome for AD.

Keywords: Alzheimer Dementia. Early diagnosis. Drug therapy. Case Reports.

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INTRODUCTION

Alzheimer´s Disease (AD) is characterized as a neurocognitive disorder with a progressive course. The condition first affects the hippocampus, the region of the brain responsible for memory, and later involves other areas of the brain. The disease represents the leading cause of dementia in older adults and directly impacts the autonomy and quality of life of this group[1,2,3].

In the mild stage, the disease is characterized by symptoms such as memory loss and impaired learning, which may be accompanied by motor difficulties. More advanced stages may be marked by declines in cognitive, executive and language abilities. In relation to the disease, Câmara[5] noted that 60-80% of dementia cases are due to AD, making it the most common chronic incurable neurodegenerative disorder in the population worldwide[4,5].

Alzheimer´s disease is a multifactorial idiopathic disease. Disease progression is influenced by both environmental factors (e.g. advanced age, *diabetes mellitus*, stroke, obesity, smoking, sedentarism, inadequate diet, and depression) and genetic factors (apolipoprotein E ε4 allele)[5,6].

Diagnosis of the disorder is complex and patients often face underdiagnosis because of the difficulty identifying initial symptoms, with diagnosis typically being late, when cognitive impairment has become severe. Currently, AD is recognized by a group of clinical symptoms perceived by the patient and/or family members, together with neuropsychological screening tests such as the Mini-Mental state Exam (MMSE), and complementary imaging scans such as MRI[3,7].

Physiopathologically, AD is characterized by the aggregation of beta-amyloid (Aβ) proteins associated with the pathological alteration in the *tau* protein, where elevated levels in cerebrospinal fluid (CSF) are explained by axonal loss. In addition, the acetylcholine neurotransmitter (ACh) undergoes changes in its function and is low in the brain of AD patients, an event associated with cognitive damage[5,7,8].

With regard to treatment, a multidisciplinary care plan, in conjunction with drugs treatment, should be established, based mainly on classes of acetylcholinesterase inhibitors (AChE) and the N-methyl-D-aspartate (NMDA) receptor antagonist[2,5]. Regarding non-pharmacological approaches, Costa et al.[9] notes that most studies involve older adults with mild-to-moderate AD, where non-pharmacological methods are typically used, e.g. physical activity or aerobic activity, followed by cognitive intervention or rehabilitation, music therapy and MAKS therapy (motor stimulation, activity of daily living, cognitive stimulation and social element).

Against this backdrop, the importance of identifying the aspects involved in the process of AD progression and disease screening is clear, given the current underdiagnosis of the condition, precluding early treatment of AD patients. Therefore, the objective of the present study was to analyze the clinical course of a patient with Alzheimer´s Disease and to discuss the repercussion of early diagnosis.

METHOD

A descriptive qualitative instrumental case study was conducted in 3 stages: 1) selection and defining of the case; 2) data collection in the field; and 3) organization and write-up of the case report. This study was centered on a patient with AD, selected irrespective of gender, who had a clinically-confirmed (by psychiatrist) diagnosis of the condition, and continued follow-up at the health service. Data were drawn from the patient´s medical chart and electronic records, containing medical notes containing information on: a) mental health status at presentation to the health service (Psychosocial Care Center II); b) medication dosages prescribed for treatment; c) signs exhibited by patient at onset of neurodegeneration; and d) results of mental evaluations using the MMSE.

In accordance with legal precepts, participation of the patient entailed a visit scheduled with both patient and spouse (legal guardian) during which the aims of the case study were explained, together with the rights of participants, and anonymity and confidentiality of clinical data.

Data analysis entailed 3 stages: 1) pre-analytical, consisting of reading and exhaustive examination of the literature selected by authors; 2) exploring the material to determine the theoretical and empirical categories guiding the specification of the topics; 3) interpretation of the results in light of the study objectives outlined.

Data analysis was initially focused on the patient´s sociodemographic data, including age, place of birth and employment background. Subsequently, the analysis centered on clinical anamnesis of the patient, with an emphasis not only on the patient history upon presenting at the health service, but also on the AD diagnosis, medications prescribed during follow-up, as well as improvement or worsening of prognosis based on MMSE performance. To this end, the case was elucidated by performing an in-depth analysis of the patient´s medical records, followed by extraction of the pertinent information to build the case study.

After signing the Free and Informed Consent Form, data were compiled for the case study between July and August 2022, following approval of the documentation by the Municipal Health Secretariat and by the local Research Ethics Committee (permit no. 5.616.881).

RESULTS

The study involved M.R., a 71-year-old female patient, married, housewife, with incomplete primary education, diagnosed with AD and hypothyroidism, followed at the CAPS II since presenting at the service on 10 September 2012. Screening anamnesis by professionals at the center revealed the patient had previously been admitted to the psychiatric ward of the Hospital e Maternidade de Santa Cecília, in the city of Santa Cecília, Santa Catarina state after numerous suicide attempts. During the stay at the clinic, the patient was placed on a treatment regimen consisting of risperidone 1 mg 3x/day, chlorpromazine 100 mg 1x/day, diazepam 10 mg 1x/day and Puran® T4 100 mg/day, progressing well until discharge. Subsequently, on 4 October 2012, the patient returned to the CAPS II for a consultation with a neuropsychiatric professional, who prescribed the same medication doses and, in their report, suggested a possible diagnosis of schizophrenia or AD in view of the symptoms exhibited by the patient. On 17 of October 2012, the patient returned to the service with anxious symptoms, for which the drug Amplictil (chlorpromazine) 100mg 2x/day was prescribed.

The patient ceased follow-up due to problems getting to the health service, returning in February 2013 for a consultation with a neuropsychiatrist, who prescribed risperidone 1 mg 3x/day, diazepam 10 mg 2x/day, Amplictil 100 mg 2x/day and biperiden 2 mg 2x/day. On 13 March 2013, the first MMSE test was applied, on which the participant scored 14 points, below the cut-off for the patient´s educational level.

In September 2013, the patient was seen by another psychiatrist and given a new prescription of memantine 20mg 1x/day, risperidone 1mg 1x/day, Amplictil 100mg 1x/day. On 11 June 2014, the definitive diagnosis of AD was established. In the medical records, the multidisciplinary team noted that., during dance therapy sessions, the patient was participative despite coordination problems. The patient continued receiving psychiatric treatment, with the disease remaining stable in 2015, and also engaged in alternative therapies (art therapy). In the medical records, the team reported that the patient´s daughter had collected the medications for treatment continuation.

In 2018, the patient (accompanied by daughter) was seen by a different physician who conducted an anamnesis. Based on results, the psychiatrist documented the onset of cognitive decline 6 years prior, with the family reporting symptoms that included selling of personal items and furniture, irritability, visual hallucinations, hetero-aggressiveness, failure to recognize close individuals (except for son-in-law), decline in self-care activities, and compromised discourse. The patient was in a stable condition but exhibited impaired recent memory. The prescribed therapy of memantine 10mg 1x/day, Amplictil 100mg 1x/day and risperidone 1mg 2x/day was maintained.

At a return visit on 10 October 2018, the doctor noted stabilization of neurocognitive deficits after use of memantine in the medical record, altering the prescription to memantine 10mg 1x/day, risperidone 1mg 2x/day and chlorpromazine 100mg 1x/day. On

3 December 2018, the patient underwent another cognitive assessment, scoring 10 points on the MMSE. The Clinical Dementia Rating (CDR) was also applied, yielding a score of 3 on the standard version and 2 points on the adapted scale. On 10 February 2020, another assessment of mental state was performed, where the patient scored 11 points on the MMSE and 2 on the CDR. The prescribed medication was also changed (memantine 10mg 2x/day and donepezil 5mg 1x/day).

The patient suspended face-to-face follow-up at the CAPS II due to the COVID-19 pandemic, but continued taking the prescribed medications. The patient returned in the middle of 2022 to renew the medical prescription and again in June 2022, scoring 11 on the MMSE.

DISCUSSION

The diagnosis of Alzheimer´s Disease (AD) is reached based on clinical analysis. Among the risk factors, depression is most notable because it develops with cognitive decline, as does AD, and thus may help or hinder early diagnosis of dementia[6]. In the first case, worsening depressive symptoms may prompt seeking of mental health services, leading to a differential early diagnosis for AD, as occurred in the present case. In some cases, however, depression may present as a prodrome of AD, given that the neurodegeneration associated with dementia can trigger depressive symptoms which, in turn, may mimic dementia[10].

Regarding AD diagnosis, 3 clinical stages are defined: 1) mild, corresponding to the onset of amnesia and cognitive decline; 2) moderate, worsening of cognitive and neuropsychiatric symptoms, such as *delirium*, agitation and hallucinations; and 3) severe, patient totally dependent and overall reduction in neurocognitive domains. Recent studies show that the pathogenicity of AD commences long before the onset of first symptoms. During this asymptomatic stage, mild behavioral/cognitive alterations may occur, although these do not characterize mild cognitive impairment, being amenable to intervention for slowing or preventing disease progression[11].

With respect to the clinical assessment of the disease, clinicians rely on tests to measure the status of neurocognitive domains and determine dementia progression. The MMSE is the most widely used cognitive screening instrument owing to its accessibility, where other health professionals can also use this tool, and to its rapid application[12].

In the case reported, the patient underwent cognitive assessment using the MMSE, one of the most applied tests for assessing cognitive function in older people. The tool encompasses the 5 domains of orientation, calculation/working memory, delayed recall, immediate and episodic memory, language and visuospatial ability[13]. In the case described, the patient had 4 MMSE assessments between 2013 and 2022, yielding scores of 14, 10, 11 and 11 points.

In Brazil, Brucki et al.[14] adjusted MMSE score according to educational level, with the original scored on a scale of 30 points. In the case study, the patient had studied to incomplete primary level, corresponding to 1-4 years of education on Brucki´s classification, giving a score of 25 points. Thus, the performance of the patient outlined earlier indicates a deficit in cognitive function.

Pharmacological therapy is based on two pillars: disease-modifying drugs, i.e. acetylcholinesterase inhibitors (AChE) and N-methyl-d-aspartate receptor (NMDA) antagonists, and anti-psychotics/neuroleptics[15]. Early in the investigation, the patient was administered risperidone and chlorpromazine for suspected schizophrenia. At a later juncture, after the MMSE evidenced cognitive decline, the drugs prescription included memantine – representing the main NMDA receptor antagonist – risperidone and Amplictil, employed as an anti-psychotic/neuroleptic. The patient also had difficulty recognizing close people, exhibited compromised discourse and impaired recent memory, suggesting cognitive decline and justifying the use of donepezil, an acetylcholinesterase inhibitor (AChE). This class of drugs is recommended for patients at mild-to-moderate stages of the disease, with the aim of delaying cognitive dysfunction. These medications act by inhibiting the catabolic enzyme AChE, slowing the reduction in acetylcholine levels, thereby improving its availability[16,17].

This case study has some limitations. First, there were difficulties finding eligible patients diagnosed with AD. Second, the patient´s medical records were lacking some information on disease course, hindering the follow-up of AD progression. Lastly, despite these limitations, the findings of the present case report remain valid, with sufficient information collected for a satisfactory investigation of the disease.

CONCLUSION

The symptoms of the patient in this case study suggest the presence of mild-to-moderate dementia. After use of the disease-modifying drugs, stabilization of the condition was evident on the MMSE test. This outcome underscores the importance of early diagnosis and timely treatment of Alzheimer´s Disease to stabilize the condition and promote quality of life. However, there are barriers hampering initial clinical analysis, particularly depression which manifests as a prodrome for AD in some cases.

AUTHOR CONTRIBUTIONS

- Luciane F. Zanotto – Administration of the Project, Formal Analysis, Conceptualization, Data Curation, Writing – First Draft, Writing – Review and Editing, Investigation, Methodology, Securing of Funding, Resources.
- Vanessa A. Pivatto – Administration of the Project, Formal Analysis, Conceptualization, Data Curation, Writing – First Draft, Writing – Review and Editing, Investigation, Methodology, Securing of Funding, Resources.
- Eliana R. Adami - Supervision, Validation and Visualization.
- Ana Paula G. Pinculini - Supervision, Validation and Visualization.

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Challenges for the operation of councils for the rights of older people and their social consequences

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Abstract

Objective: to understand the perceptions of councilors about the functioning of councils for the rights of older people in the state of Rio Grande do Norte. *Method*: This is an analytical cross-sectional study with a quantitative approach carried out with municipal councilors for the rights of older people in the state of Rio Grande do Norte. 109 councilors participated, with a predominance of full members, female, from government representation and with a higher education level. *Results*: Several challenges were identified for the performance and operation of the councils, among which stand out: isolated actions, low participation of government members and representation of civil society, little time for discussion in meetings and the need for valid instruments to monitor the actions of the councils. Low technical knowledge of the councilors and aversion to divergences and political positions were also evidenced. *Conclusion*: it is essential to ensure intersectoral policies, greater independence from the executive and, above all, greater training of councilors and democratic political strengthening so that they can not only promote, but exercise a socio-political protagonism based on a collective construction and social representation.

Keywords: Aging. Public policy. Rights of Older People. Social Participation. Right to health.

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INTRODUCTION

There is a growing demand for new forms of social organizations due to global aging. It is essential to rethink aging as an essentially social phenomenon and not reduce it to merely chronological and biomedical aspects. In order to meet the demands for representativeness and social participation of older people in Brazil, Law 8842, of January 4, 1994[1], created the National Council for the Rights of the Older Person (CNDI), which consists of a joint body, with an advisory and deliberative character.

The CNDI represents the maximum sphere of participation and social control in the promotion, protection and defense of the rights of older people. The council is committed to formulating, monitoring, inspecting and evaluating social protection policies for this population group. However, the councils for the rights of older people are still fragile, timid and hostage to the actions of managers of the executive branch, since they depend on them for their establishment, from creation to administrative and financial functioning[2].

However, in 2019, decree nº. 9.893[3] was sanctioned, which aimed to demobilize and centralize the actions of the CNDI. Articulation between government entities and civil society was restricted, the number of councilors, meetings was reduced and its members were submitted to the federal government, solely to the Ministry of Women, Family and Human Rights, hindering the execution of intersectoral policies. Although partially revoked by Decree nº. 10,643 of 2021[4], it made clear the purposes of neoliberalism in the face of institutions that seek to strengthen participation and social control.

This neoliberal rationality operates through subjectivation processes guided by discourses saturated with individualist and mercantilist messages whose normativity underlies a specific rationale for governing the life of the population[5]. Neoliberal capitalist society distances itself from older people, judging them as impotent and unproductive beings and, on the other hand, establishes standards of being and living associated with the moralization of physical attributes. A moral filter refractory to old age itself is encouraged based on the exaltation of the signs of youth, characterized by expressive physical valences, readiness to work and productivity. On the contrary, the older one appears, the less social capital one has[5-8]. Still in the flourishing of the 21st century, while society enhances longevity, it denies older people their value and social importance[9].

In view of the exposed challenges and the need for greater visibility and strengthening of social control of public policies for dignified aging, this study aimed to understand the perceptions of councilors about the functioning of councils for the rights of older people in the state of Rio Grande do Norte.

METHOD

This is a cross-sectional study of an analytical nature with a quantitative approach. The study was carried out in the state of Rio Grande do Norte (RN), which has a little over 3.5 million inhabitants[10] of which approximately 500,000 are older people, according to IBGE projections for the year 2022[11] and accompanying demographic characteristics. the global trend regarding the significant increase in the older population. It is associated with a substantial increase in life expectancy of almost 140% in the last 40 years, from 55.5 years in 1980 to 76.4 years in 2019[11], being considered the second largest magnitude among the Brazilian states in this period.-

Data collection was carried out between the months of September and November 2019 with the municipal councilors present in the training on the Social Control of the Rights of the Older Person, offered in five pole municipalities of the state by the State Council for the Rights of the Older Person of Rio Grande do Norte (CEDEPI/RN). CEDEPI/RN was created by State Law nº. 6,254, of January 10, 1992[12] and became deliberative, and not just advisory, through the approval of Decree nº. 29,737, of June 1, 2020[13].

According to CEDEPI records, there were a total of 75 municipalities with Municipal Councils for Older People (CMPIs) implemented (44.9% of the state), with only 33 of them active[14]. Among the 172 participants in the training events, it was observed that some were not councilors (36.5%) and there was a greater participation of those from the

municipalities of the metropolitan region (36.0%), with a lower participation of the municipalities from regions farther from the capital. The sample was given by convenience, with a size defined by the number of responding participants, considering as inclusion factors: being a municipal councilor and being present in the regional trainings that took place in five municipalities of RN: Natal, Mossoró, Pau dos Ferros, Santa Cruz and Caicó and was considered an exclusion factor: the presence of psychomotor and/or visual disorders that hinder the ability to write and/or read.

A structured questionnaire based on research carried out by the Applied Economic Research Study[15] (IPEA) was used for data collection, in addition to other research that discussed the main challenges for constituting councils on the rights of older people[16,17]. The questionnaire was developed by authors with expertise in aging during a meeting to discuss and define, by consensus, the indicators related to the construct of interest. This questionnaire was structured by 18 closed questions and one open question, divided into three axes: a) characterization of the councilors; b) performance of councilors and c) operation of councils for the rights of older people in the municipalities of RN. The purpose of the open question was to collect information about some peculiarity of the council to which the respondent belongs, considering one of the three axes mentioned or even a consideration about the questionnaire itself.

The questionnaires for situational analysis of the RN councils were given to the councilors at the beginning of the training and a report was made on their application and on the research objectives, as well as clarified that the data will not be personified and, therefore, the link was not discriminated from the councilors to their respective. The collection took place at the end of the meeting. For analysis, we performed the simple sum of the marked items, but in question 3.3 we added the inverse score, that is, for priority "1" (highest priority) we attributed 3 points and for priority "3" (lowest priority among those scored) we attributed 1 point.

We consider the challenges for the functioning of the CMPIs as a dependent variable in view of the following independent variables: a) characterization of the councilors of the municipalities; b) performance and c) operation of CMPIs. We also used, as a method of analysis, the Foucauldian precepts of Biopower, which consist of an immaterial power anchored in bodies and their acts and which aspires to ensure discipline through the regulation of life and normalization of customs[18].

The study was approved by the Ethics Committee of the University Hospital Onofre Lopes (CEP/HUOL) of the UFRN under opinion number 5.224.483.

RESULTS AND DISCUSSION

109 municipal councilors from RN were interviewed. In Table 1, the results referring to the axis of the interviewees' characterization questionnaire are compiled.

There was a predominance of women regarding the occupation of councilors for the rights of older people. Similar characteristics were found in the study by IPEA[15] (2012), in which 12 full councilors and six alternates of the CNDI participated, of which 75% were female.

The predominance of women can be explained by their historical role in the field of social care policies and their low socio-political protagonism. They are ahead in a context of low social capital, as in Brazil there is still a tradition of improvising equipment structures regarding the care of older people, in addition to the low investment in the qualification of teams and representatives[19]. However, in the National Congress, where power relations have a wide magnitude, women occupy approximately 15% of the vacancies. Brazil remains one of the countries with the worst female political empowerment index, occupying the 156th position in a list of 190 countries[20].

Table 1. Characterization of the interviewees. Natal, RN, 2022.

Variable	n (%)
Sex	
Male	20 (18,3
Female	87 (79,8)
Color/race	
White	46 (42,2)
Black	7 (6,4)
Yellow	1 (1)
Brown	52 (47,7)
Did not answer	3 (2,8)
Education	
Elementary School	6 (5,5)
High school	21 (19,3)
Incomplete higher	14 (12,8)
Higher education	28 (25,7)
Specialization	34 (31,2)
Incomplete master's degree	1 (0,9)
Complete master's degree	4 (3,7)
Complete doctorate	1 (0,9)
Political stance	
Left	21 (19,3)
Center	8 (7,3)
Right	13 (11,9)
Does not know	11 (10,1)
Did not answer	56 (51,4)
Age Group	
Up to 19	1 (0,9)
20 to 29	19 (17,4)
30 to 39	29 (11)
40 to 59	39 (35,8)
60 or more	18 (16,5)
Did not answer	3 (2,8)
Council status	
Holder	55 (50,5)
Deputy	26 (23,9)
Others	17 (15,6)
Does not know	2 (1,8)
Did not answer	9 (8,3)
Social representation	
Public Power	65 (59,6)
Civil society	36 (33)
Did not answer	8 (7,3)

The results regarding the characterization of the interviewees show that the level of education, 62.4% have at least completed higher education, of the councilors is well above the national proportion, which is only 17.4% of the population with higher education[21], while the racial issues reproduce the Brazilian social distribution, which in 2018 consisted of 43.1% whites, 9.3% blacks and 46.5% browns[22]. Most of the councilors represented the public authorities, were holders and were between 31 and 60 years old. This representation was also verified in a study carried out by IPEA[15], in which 69% of the CNDI councilors were aged between 41 and 60 years.

Souza and Machado[23] (2018), consider important the participation of older people in instances of promoting the rights of older people. This is because a greater representation of the main stakeholders in the councils would make it possible to single out and give life to local demands, aiming at the development of their own political guidelines. The lack of this authentic diagnosis of the local reality, in turn, can limit participatory management and the socio-political role of the older person, making municipalities mere executors of federal policies. Other authors, however, defend the technical capacity and educational level as the main assumptions of the board of councilors representing civil society for the greater possibility of exercising an active role in decision-making[24].

One cannot accept the idea of incommensurability, focusing only on one variable, in this case, age classification or technical capacity to occupy an essentially political position. It is believed that the ideal would be for councilors, in addition to having a high level of education, to be primarily older people. There is a caveat, as the composition of the councils by older people does not guarantee the legitimacy of local demands, as they may not represent and have not experienced the reality of communities with low social capital, which are the ones that most need public social assistance. For example, in the study carried out by IPEA[15], 94% of the councilors participating in the survey had a monthly income at least 44.7% higher than the national average and almost 50% had an income at least 189.5% higher than the national average.

To corroborate this context, the concept of habitus is brought up, which consists of a tendency to homogenize the forms of behavior and thoughts referring to people who occupy the same social spaces, being elitist, making it difficult to understand in relation to material needs and interests of less favored social groups[25]. Therefore, the CMPIs must materialize other strategies to represent the values and needs of the older people in the different performance scenarios beyond technical capacity, highlighting the development of valid instruments to evaluate and monitor decision-making by different social strata, including older people, this being an attribution of the CNDI according to Decree nº. 4,227 of 2002[26].

It should also be noted that eight councilors did not know their social representation on the councils and worse, a large part was averse to political stances, with a denial of response by more than 50%. It is reiterated that approximately 10% did not even know their political stances. This fact confronts the function of the councils, which inaugurate a pattern of political activity and consolidation of democracy and social representation of older people, with the purpose of allowing society to participate in defining priorities for the political agenda, as well as in formulating, in monitoring and controlling public policies[26]. Indeed, political positioning itself is a democratic exercise.

In this way, the councilors seem to be unaware of the scope of their role, which is essentially political. Without a proper understanding of their role, councilors will hardly be able to become subjects of politics, instead of objects manipulated by neoliberal hegemonic powers, which naturalize and blame the health conditions of older people linked to the interests of capital[7,16,27]. Only in this way will it be possible to act to transform, as such a conquest can never exist if the concrete reality is hidden. This lack of preparation was also reflected in the completion of the questionnaire according to the paragraph referring to the limitations of the study. The need for training councilors was also highlighted in a study carried out by the National Front for Strengthening Councils for the Rights of the Older Person (FFC)[28].

The absence of political positioning and the strangeness of the truths that constitute us sustain a social order disguised as technical objectivity in order to legitimize the hegemonic neoliberal biomedical model, which subsidizes the State's lack of

responsibility[29]. Population aging becomes a burden to be carried from the perspective of neoliberal policies. The State is more concerned with managing older people in order to ensure a reduction in health costs than, in fact, with caring for them. The burden of the State, subverted to the care of an unproductive body marked by old age, conditions changes towards a "reprivatization" of old age, which values individual responsibility and blames negligent older people on their bodies, making them solely responsible for diseases or other conditions that may affect them[17]. Generalizing to old age what can be experienced by only a minority of old people and, even more, blaming them for the inability to follow a broad prescription of aging "without old age", is one of the cruelest paradoxes of productivism.

The neoliberal capitalist imperative distances itself from older people, judging them as impotent and unproductive beings. The social dimensions and natural singularities of the older people are ignored as a perverse counterface of productivity and, moreover, as a pathological state to be treated and, if possible, prevented[30]. The market, oblivious to social issues, is still a benchmark for all spheres of life. The principle of depoliticization and isolation is consolidated, tending to individualize what should be the object of collective analyzes and political struggles[7]. This approach seeks to deactivate any initiative that has a political or demanding character[30].

However, political polarization has been experienced, further weakening debates that promote participation and social control as instruments of political empowerment[31]. Otherwise, we are increasingly subjected to a neoliberal ideological institution and, therefore, responsible for everything that happens to us, ignoring the social determinants of health. It is necessary, in fact, to deepen democracy. "But in reality, we really need to rescue it from the caricature it has become"[27] in order to give voice to the divergences, and not only meet the hegemonic neoliberal precepts that are far from the real values, needs and socio-political protagonism of the older person.

In the axis of the questionnaire referring to the performance of the councilors, an attempt was made to evaluate the composition of the council in terms of the number and forms of choices of the civil or public sectors represented, as well as the degree of articulation of the councils with the public power and civil society (details in Table 2).

In general, there is satisfaction on the part of the councilors with regard to the action taken in the face of the issues raised, but there is less satisfaction with the way of choosing the councilors within the social entities, with a margin of non-satisfaction of 27% of the respondents, very similar to the IPEA study[15], which had 25% of non-satisfaction of the respondents.

In the axis referring to the functioning of the CMPIs, we list some aspects related to the satisfaction of the councilors, as well as the biggest obstacles, as shown in Tables 3 and 4, in general, we list the main initiatives to promote the effectiveness of the councils.

Table 2. Performance of Municipal Councilors for the Rights of Older People. Natal, RN, 2022.

2.1 How do you consider the composition of the council in relation to each of the items below					
	Very satisfactory (%)	Satisfactory (%)	Not very satisfactory (%)	Unsatisfactory (%)	Did not answer (%)
Total number of councilors	27 (24,8)	62 (56,9)	15 (13,8)	1 (0,9)	4 (3,7)
Diversity of sectors represented	18 (16,5)	63 (57,8)	18 (16,5)	3 (2,8)	7 (6,4)
Form of choice of entities with seats on the council	15 (13,8)	65 (59,6)	19 (17,4)	2 (1,8)	8 (7,3)
Form of choosing councilors within the entities	17 (15,6)	57 (52,3)	26 (23,9)	2 (1,8)	7 (6,4)
2.2 Evaluate your degree of articulation with the other sectors of the council, according to the table below (mark with an "X" the column corresponding to each sector)					
	Very satisfactory (%)	Satisfactory (%)	Not very satisfactory (%)	Unsatisfactory (%)	Did not answer (%)
Public Power	28 (25,7)	61 (56)	9 (8,3)	2 (1,8)	9 (8,3)
Civil society	20 (18,3)	49 (45)	28 (25,7)	2 (1,8)	10 (9,2)

Table 3. Functioning of Municipal Councils for Older People. Natal, RN, 2022.

3.1 Evaluate the influence of the Council's performance in relation to the:					
	Very satisfactory (%)	Satisfactory (%)	Not very satisfactory (%)	Unsatisfactory (%)	Did not answer (%)
Public policies to protect older people	15 (13,8)	54 (49,5)	26 (23,9)	3 (2,8)	11 (10,1)
Civil society initiatives	6 (5,5)	43 (39,4)	41 (37,6)	5 (4,6)	14 (12,8)
Productive sector initiatives	2 (1,8)	38 (34,9)	43 (39,4)	8 (7,3)	18 (16,5)
Government initiatives	9 (8,3)	53 (48,6)	26 (23,9)	5 (4,6)	16 (14,7)
Perception of public opinion on the topic	6 (5,5)	40 (36,7)	37 (33,9)	10 (9,2)	16 (14,7)
3.2 Is the language used in meetings easily understood and appropriated by all councilors?					
No					4 (3,7)*
Yes, partially					40 (36,7)
Yes, fully					55 (50,5)
Did not answer					10 (9,2)
3.3. In your opinion, what are the main difficulties and obstacles faced by the council? (mark a maximum of 3 alternatives, listing from 1 to 3 in order of priority. Where 1 equals the main difficulty and 3 equals an important difficulty, but less priority in relation to the others).					
Low representation of the older population, when represented, they do not reach those who actually use public services					97 (13,0) †
Low participation of government members in meetings or deliberations					89 (11,9)
Lack of structure					88 (11,7)
Low qualification of civil councilors					70 (9,3)
Little time for discussion in meetings					65 (8,7)
Low political priority by the executive					50 (6,7)
Excessive bureaucracy					39 (5,2)
Unpaid tenure					38 (5,1)
Little divergence in the opinions of the councilors					36 (4,8)
Very sparse meetings					34 (4,5)
Political matters outside the council					31 (4,1)
Guidelines and subsidies for discussion made available at short notice					24 (3,2)
Maintenance of clientelist standards in the relationship with the executive					24 (3,2)
Coexistence of very different narratives about the problems of old age and their solutions					23 (3,1)
Too many meetings					17 (2,3)
*others					9 (1,2)
Did not answer					15 (2)

* Percentage referring to the number of respondents to items 3.2; †Percentage referring to the total score of the respondents of items 3.3, where we scored 3 points for the item with priority one, 2 points for what had intermediate priority and 2 points for the item that had the lowest priority of the three listed (priority 3).

Differently from the performance axis, in the functioning of municipal councils there were some indicators in which satisfaction was not very predominant. In question 3.1 "Evaluate the influence of the Council's performance in relation to:" the results point to the maintenance of sectoral fragmentation in the structures of the councils' organizations, with a low satisfaction of the councilors in face of intersectoral policies, highlighting the productive, governmental and social sectors.

Intersectoriality is conceptualized as a fundamental strategy to face health problems related to social determinants. The proximity of isolated knowledge, without generating new articulations or prosperity of dialogues, is not able to promote synergistic and lasting solutions[23]. The councils end up reaffirming the fragility of intersectoral policies based on the low participation of civil society and government representatives in the meetings. The study carried out by the FFC also observed the need for a more aligned action between the councils themselves in the different governmental, federal, state and municipal levels[28].

Other aspects were pointed out as obstacles to the functioning of the councils with regard to indicator 3.3, as shown below: "In your opinion, what are the main difficulties and obstacles faced by the council (check a maximum of 3 alternatives, listing from 1 to 3 in order of priority. Where 1 equals the main difficulty and 3 equals an important difficulty, but less priority in relation to the others)", of which we highlight: little time for discussion in meetings; lack of structure; low political priority by the executive; low qualification of civil councilors; low participation of government members in meetings or deliberations and the low representation of the older population. The last two indicators reaffirm the fragility of intersectoral policies while the indicator "low qualification of civil councilors", endorses the previous discussion related to the characterization of the interviewees.

The short time for discussion may be related to the low divergence of opinions among the councilors. These issues bring to light a culture that tries to hide disagreements and seeks recognition through consensus. Other authors point out that the lack of plurality of ideas in decision-making is related to the low technical capacity of the body of civil society councilors, particularly with regard to knowledge of legislation and the functioning of the state machine[24]. Disagreements rarely appear and when they do, they tend to be seen as consequences of vested interests and even the annoyance of certain councilors[17].

As for the aspects associated with the main initiatives to promote greater legitimacy and effectiveness of action in the councils, we highlight the need to develop an evaluation and monitoring through valid instruments, intersectoral actions and the construction of specific policies, which arise from the community reality (details in Table 4).

Table 4. Main initiatives to promote the effectiveness of the Councils on the Rights of Older People. Natal, RN, 2022.

4.1 Are council goals and actions based on valid indicator systems?	
Yes	74 (67,9)*
No	22 (20,2)
Did not answer	13 (11,9)
4.2 Are there mechanisms to monitor older people care activities?	
Yes	45 (41,3)*
No	46 (42,2)
Did not answer	18 (16,5)
*If yes, which	

to be continued

Continuation of Table 4

4.3 Which of the initiatives would be the most important to ensure the performance of the councils?	
Valid instrument to identify problems, evaluate and monitor the actions of the councils	40 (21,3)†
Seek incentive mechanisms for participation by certain segments.	39 (20,7)
Tax incentives, such as tax deductions, for cash donations made to institutions providing services aimed at the older population	36 (19,1)
Improve the means of communication and dissemination of the council's work	36 (19,1)
Expand articulation with other councils at different levels of the federation	28 (14,9)
Debureaucratization of councils	4 (2,1)
Did not answer	5 (2,7)
4.4 In the exercise of your mandate as a councilor, is there a support base?	
Yes	80 (73,4)*
No	11 (10,1)
Not applicable/Did not answer	18 (16,5)
4.4.1 If yes, which entity represents the support base	
Executive	59 (72)*
Legislative	4 (4,9)
Judiciary	3 (3,7)
Other social representation	16 (19,5)
4.5 In your opinion, what would be the most important practice to guarantee the social protection of the older person?	
Legitimate existing laws	48 (44)*
Re-signify them to adapt to local reality	57 (52,3)
Did not answer	4 (3,7)
4.6 Do you think that the set of Brazilian laws and norms regarding older people are efficient?	
Yes	28 (25,7)*
No	76 (69,7)
Did not answer	5 (4,6)
4.7 Are the councils in which you operate characterized, in fact, as a deliberative body?	
Yes	82 (75,2)*
No	9 (8,3)
Did not answer	18 (16,5)

* Percentage referring to the total score of the respondents; † Percentage referring to the total score obtained from respondents in items 4.3, where we add 1 point for each mark.

Questions 4.1 "Are the goals and actions of the councils based on valid indicator systems?" and 4.2 "Are there mechanisms to monitor older people care activities?" are complementary, but they show a certain contradiction of the respondents regarding the understanding of a system of valid indicators, since in question 4.1, 77% of respondents associated the actions of the councils with systems of valid indicators and in item "4.2", the respondents cited routine monitoring activities, such as: visits, communication, civil whistleblowing, labor gymnastics, home care program, among others, which do not characterize valid evaluation/monitoring instruments. This fact is ratified in sequence by question "4.3", in which the use of valid instruments is pointed out as one of the most important initiatives to ensure the performance of the councils.

Also in question 4.3, the importance of improving the means of communication and mechanisms to encourage plural participation to promote intersectoriality was also highlighted. Another point

highlighted in an intermediate way in question 3.3, but more evident in question 4.3 was the need for tax incentives and financial resources. Questions 4.5 "In your opinion, what would be the most important practice to guarantee the social protection of the older person?" and 4.6 "Do you think that the set of Brazilian laws and norms regarding older people are efficient?" bring a uneasiness of councilors regarding the inefficiency of laws to protect olde people. Public policies must be evaluated and readjusted periodically, since they need to follow the changes that occur in society over time, so that their guidelines become effective[2]. Moreover, in order to meet the health needs and expectations of each community and support its own political agendas, it is necessary to link the informational activity to the autonomy of the places in an ascending way, doing justice to the function of formulating public policies of the councilors so that they are not only mere executors of national policies.

Of the 109 participants, 19 (17.4%) answered the open questions, but there were no innovative facts to what had already been commented. Much praise, nine of which are objectives and related to the research initiative (47.4% of respondents), in addition to specific criticisms to make the questionnaire more succinct, to cover councils in the implementation phase, in addition to questions about what would be a valid indicator although we have been available for any queries. It was also commented on the importance of financial resources for the functioning of the councils and a criticism for having a question about the political position of the councilors, as there seems to be a paradox, since the councilors occupy a political position, but are afraid or uncomfortable to express their positions confidentially.

The study had limitations due to the mistaken understanding of the councilors for completing two questions: in question 3.3, where they were asked to list only three alternatives, listing from 1 to 3 in descending order of priority, from highest to lowest, 13 respondents did not respect the maximum amount and 30, instead of scoring, marked an "x". Thus, in item 3.3 we scored 2 points for each marking of "x", the forecast was 3 points for marking 1 (highest priority); 2 points for marking 2 (intermediate priority) and 1 point for marking 3 (lowest priority), however, all markings were considered, even if there were more than three as stated. In item 4.3, mistakes were also noticed in filling out the questionnaire, where 39 people marked more than one item despite the statement requesting only one initiative. Thus, all markings were taken into account, adding 1 point for each marking.

The way of allocating the sample by convenience in a training meeting is also a limitation for the representativeness of the data, however, the final size of the sample is considered relevant in view of the existence of just over 30 active councils. It was also not possible to analyze the participation of different municipalities, as this data was not collected to avoid a possible identification of respondents. Furthermore, it was not possible to establish parameters regarding the characterization, performance and functioning of the councils due to the lack of studies in this context.

FINAL REMARKS

Despite the reported support from the executive branch, it was observed that the structural weakness and the need for qualification and active participation of council members, especially people aged 60 or over and civil society, who had a lower proportion of participation, reflect in a perception that the effectiveness of the set of laws and legal bases is still far from the real needs and expectations of the older person. Thus, the need for efforts towards participatory management and a centrality that involves older people participant in the communities is evident. These mechanisms reposition the relationship between the State and society in the construction of public policies closer to people's reality.

To this end, it is necessary to strengthen the main representative entity of the older person based on some aspects, among which we highlight: a) mandatory executive powers for their creation and guarantee of independence, with the aim of ensuring greater legitimacy and autonomy in their functions; b) training of councilors to carry out their activities; c) development of valid instruments so that they can evaluate, monitor and identify priority indicators for improving the quality of services provided to the older person, considering the different areas of social action and d) consolidation of the transversal

principle of intersectoriality in view of the complexity and association of several variables that permeate the sociopolitical protagonism of the older person.

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Experiences of older adult with chronic pulmonary disease using long-term home oxygen therapy in romantic and sexual relationships

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Abstract

Objective: To understand the meanings attributed by older adult with Chronic Obstructive Pulmonary Disease (COPD) using the Long-Term Home Oxygen Therapy (LTOT) regarding romantic relationships and sexual practice. Method: Qualitative study in which seven semi-structured interviews were carried out with patients with a confirmed diagnosis of COPD and using LTOT, treated in an outpatient service. The content analysis technique was applied with the support of the WebQDA2.0 software license. COREQ criteria were used to report method and outcome. Results: Two categories emerged: 1- Destabilization in the romantic relationship and in the sexual life of the LTOT user: : revealed that therapy causes relationship breakup, change of partner after prescription of the LTOT or even the idea of looking for an extramarital person; 2- Experience and meanings of COPD and oxygen therapy during sexual intercourse: suffering with physiological problems, how much the patient feels short of breath to have sexual intercourse and the impact of this on performance and frequency, reducing these moments with the partner. Conclusion: The perception of elderly people with COPD using LTOT indicates that oxygen therapy had an impact on sexual practice and romantic relationships. Having good quality in relationships and sexual practice is a fundamental condition for health promotion.

Keywords: Qualitative Research. Oxygen Inhalation Therapy. Aged. COPD. Sexuality.

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INTRODUCTION

Aging, in the biological condition, is associated with molecular and cellular damage[1]. These losses can increase the risk of contracting various diseases and, frequently, Chronic Noncommunicable Diseases (NCDs)[2] occur. One of the common NCDs that affects the older population is Chronic Obstructive Pulmonary Disease (COPD), which has its highest prevalence in people over 40 years of age[3] and worsens over time.

COPD is an inflammatory disease of the lungs, resulting from pathological changes in the peripheral airways and lung parenchyma, represented by airflow limitation[3]. When the patient is diagnosed in a severe stage of COPD, Long-term Home Oxygen Therapy (LTOT) is prescribed[3].

LTOT results in clinical improvement and increased survival of the user, but also entails physical and psychosocial limitations[2], highlighting changes in love relationships and sexual practice. Having a good sexual quality is a fundamental condition to promote health and quality of life[4], because aging does not mean becoming asexual.

In today's society, sexual intercourse in older people is still seen with prejudice, taboo and myths, both by the older people and by the population of other age groups[5]. Even if older people have a decrease in sexual practice or even if they have negative stereotypes of their sexuality, the theme should be addressed in health services and guidelines, building new concepts about the sexual practice of the older population[6].

It is necessary not only to treat the patient's chronic disease, but to have a holistic view of them. Knowledge of these changes is essential to offer humanized care to the patient and improve patients' adherence to treatment, without having to choose between LTOT and a romantic relationship, providing them with quality of life.

This study is justified by the search for knowledge about the perception of strengths and challenges in the use of oxygen therapy associated with a loving relationship and sexual practice. This understanding is important, as it can help health professionals to better manage the difficulties of adherence to treatment, improve the assistance provided, so that they can assist users in the management of this treatment, creating strategies in which health guidelines do not reach. This issue should be addressed in health services and guidelines, as there is a lack of material in the literature on the subject to support professionals.

The objective of this study is to understand the meanings attributed by the older person with COPD using the LTOT regarding the love relationship and sexual practice.

METHOD

This is a qualitative study, approved by the Research Ethics Committee of the Faculty of Medical Sciences/ UNICAMP, under opinion number 2658702.

Study participants are patients treated at the Pulmonology outpatient clinic of the Hospital das Clínicas da UNICAMP (HC/UNICAMP), with a diagnosis of COPD, according to the *Global Initiative for Chronic Obstructive Lung Disease* (GOLD) guidelines[3]. The inclusion criteria in the research were: being on long-term home oxygen therapy for ≥ one year; being aged ≥ 60 years and be able to communicate verbally, oriented and aware.

The sample closure happened by theoretical saturation. This means that the inclusion of new participants was suspended because the data obtained showed repetition and redundancy, failing to contribute significantly to the research[7]. The study included 7 patients, from P1 to P7.

Before starting data collection, the researcher and student observed and interacted with the local health team and patients during the 1st half of 2019. The purpose of this interaction would be the setting, a technique used to avoid bias in data collection, in addition to understanding how the service works and being able to adapt before collection.

Data collection took place in the 2nd half of 2019 and the beginning of the 1st half of 2020. Due to COVID-19, the interviews were suspended in certain periods, but this did not interfere with the study findings.

The participants were informed that the interviews would be recorded and subsequently analyzed and, upon agreeing, they signed the Free and Informed Consent Form.

Semi-structured interviews were carried out before the appointment at the outpatient clinic, in a reserved environment and alone with the researcher, with the following guiding questions: "What feelings or impressions do you have about your body image?", "How are you in relation to affection?", "How do you feel pleasure?", "What does it mean for you to use oxygen during sexual activity?", "Talk about the quality of your sexual relationship after you started using LTOT?"

To characterize the population, a questionnaire originated by the study was carried out, with sociodemographic data (age, gender, occupation, religion, education, marital status), and history of LTOT use (number of hours/day and how long it has been in use of O_2, flow, number of hospitalizations and attendance at emergency services due to lung problems in the last 12 months) and sexual behavior (active sex life, steady partner, stopped having intercourse after LTOT, frequency of sex in the week before and after LTOT).

A WebQDA2.0® Software license was used, which served as a support tool for data organization and analysis[8]. A word cloud was also built, which is a tool that shows the most used words during the participants' speeches.

The methodological technique used for data analysis was Content Analysis by Lawrence Bardin[9], which is divided into three stages, pre-analysis, material exploration and treatment of the obtained results and interpretation9. Data validation was carried out by peers and judges, specialists in this methodology.

For the analysis of the results, two theoretical references were used, Medical Psychology[10], which approaches the patient in a holistic way, having biopsychosocial relationships and with the inserted environment and Psychosomatic Medicine[11,12], study of mind and body relationships. The *Consolidated criteria for reporting qualitative research* (COREQ) were used to report the method and results[13].

RESULTS

The sociodemographic data can be found in Table 1. The variables related to the use of oxygen (O_2) are the time of use of O_2, which was between 1 and 13 years (mean of 3.5 years), and the daily hours of use, which were between 18h and 24h (mean of 23 hours). As for the number of hospitalizations and attendance at the emergency room in the 12 months prior to the interview, three patients were hospitalized and five sought the emergency room due to lung problems[2].

As for the elements related to sexual behavior: four individuals have an active sex life and have steady partners, two patients stopped having sexual intercourse with their partner after the LTOT was prescribed and four patients changed the frequency of sexual intercourse, before oxygen therapy they had more moments of intimacy with the partner.

Table 1. Biosociodemographic characteristics of the studied sample, Campinas, São Paulo,2020[2]

SOCIODEMOGRAPHIC DATA						
Patient	Sex	Age (Years)	Schooling	Former occupation	Religion	Marital status
P1	F	60	Illiterate	Home maker	Catholic	Has lived with the partner
P2	F	63	High school	Bath and groom pet shop	Catholic	Has lived with the partner
P3	M	73	Primary	Worked with cellulose	Atheist	Lives with the partner
P4	M	63	Primary	Construction	Catholic	Lives with the partner
P5	M	76	Primary	Truck driver	Catholic	Lives with the partner
P6	F	60	Technical	Administration at city hall	Catholic	Has lived with the partner
P7	M	73	Basic	Mechanic	Catholic	Lives with the partner

In the qualitative analysis, two categories emerged from the interviews: 1- Destabilization in the love relationship and in the sexual life of the LTOT user revealed that the therapy causes disturbance in relationships; 2- Experience and meanings of COPD and oxygen therapy during sexual intercourse.

In the first category, patients reported changing partners after the LTOT was prescribed or even the idea of looking for an extramarital person, as in the cases of P1 and P6.

> "I even told him, go and look for someone on the street for you. He said "why if I have you?" (P1).

> "When I started using oxygen, I was with my partner. After a year, I saw that things had changed too much, I asked and he said he had found another partner, that he would live with her and left. After 35 years of being married to him. I was already feeling very bad, I got worse. I think that when he saw me with oxygen, he saw that our relationship was over, he didn't wait to see how I adapted. He already got another woman. Oxygen was the end of our relationship." (P6).

It also highlights the concern of family members with the therapy, preventing P2 from being alone with his partner.

> "I stopped having sex because of myself. My son started to spend more time with me, I decided to pay more attention to my son" (P2).

In the second category, suffering with physiological issues is reported, how much the patient feels short of breath to have sexual intercourse and the impact of this on performance and frequency, reducing these moments with the partner, as in the case of these patients:

> "I don't have sex with my partner because of the shortness of breath. I felt very bad, I felt like I was going to die. It's once a month, and far off, once in a while." (P1).

> "I felt a lot of shortness of breath in the relationship. So, in order not to look bad, I preferred to go out with my head held high and dedicate myself to my health" (P2).

> "Because by the time I finish having sex, I think I'm going to die of shortness of breath. I have much less sex, before putting on oxygen it was every week, now with oxygen every 3 to 4 weeks to have sex. I even keep thinking, in the past I had nothing, right? No problem, I could. Now I can't, I'm so tired. Before, I was much better than with oxygen" (P3).

> "This is difficult, I can't have sex anymore, no. I have sex very little, once a week, in the past it was 2 to 3 times a week, that burdens our bodies too, right?" (P5).

> "After the oxygen we had no more. He didn't look for me anymore" (P6).

P1 and P5 also refer to the sensations and feelings that arise in this circumstance, such as fear of having intercourse and feeling sick, shame in using oxygen during the act and respect for the partner, because of his moment and the disease.

> "I don't have sex with my partner because of the shortness of breath, and also because I feel ashamed, right? Ah, this thing on me, right? It's ugly. I feel ashamed. I have sex with him, but he doesn't force me, it's when I want to" (P1).

> "She says she doesn't look for me anymore to have sex because she's afraid I'll feel sick, run out of air" (P5).

This category also presents the users' attitudes towards the therapy, P4 using the LTOT during sex and P3 and P7 not using it or using it differently from what was prescribed by the doctor.

> "I don't use oxygen to have sex, I don't think you need it, right? But then you have a lot of shortness of breath, it hits you! I feel very bad afterwards, I'm too tired. Because by the time I finish, I think I'm going to die. I seem to be looking for air, it's a dang problem. Then I put on the oxygen, after about 2 to 3 minutes I get better. I don't put it on because that hose gets in the way of having sex" (P3).

> "Having sex makes me feel short of breath. I didn't use it to have sex, I felt sick and had to be hospitalized. I stayed 10, 15 days there. To have

sex, it's with him, because any effort, it goes down and I feel short of breath. But it recovers soon, because I'm using oxygen" (P4).

"I sometimes feel that shortness of breath when I'm having sex, but I think it's normal, right? Everyone feels that shortness of breath, it seems that the air is going to run out, we take a deep breath. I don't use oxygen, I can have sex without it. This is not effort, I can do it. You can have sex without (P7).

The study also originated the Word Cloud, presenting the most frequent terms used by the participants during the interview (Figure 1).

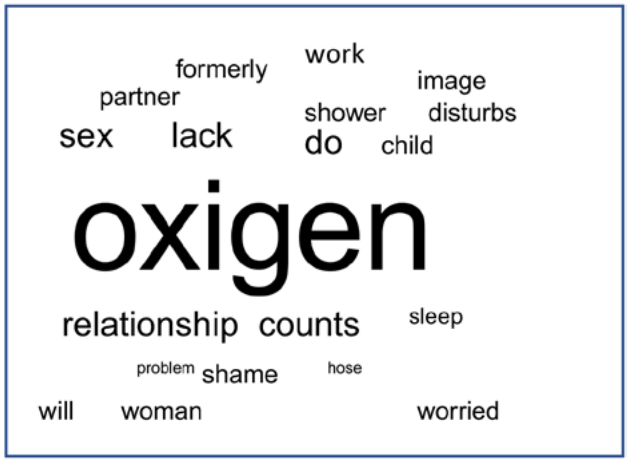

Figure 1. 20 most referenced words in the speeches of the studied sample, Campinas, São Paulo, 2020[2].

DISCUSSION

This study clearly indicated that oxygen is at the center of these participants' lives. It demonstrates alterations in love and sexual relationships, in routine activities, and in the representation of the body in the mind. Participants use the word formerly, as if the use of LTOT was the mark of a new life. The word lack is also used a lot and shows how much they see LTOT as deprivation.

Given these results, it is essential to involve the spouse in the treatment, as the partner maintains intimate relationships with the patient, which involve feelings and physiological needs[14]. It is necessary to have holistic care for this patient, to prevent the feeling of intimacy and friendship with the partner from diminishing or even disappearing, as well as the identity of marital union.

Living with an older patient with COPD using LTOT is not easy, and as the degree of dependence increases, the greater the dedication, negatively impacting several dimensions of the spouse's life[15], feeling forced to live a life different from the one planned, with the possibility of breaking up the marriage[15], as was the case with P6, who was unable to sustain all the changes and all the feelings.

The user going through situations of choosing between therapy and romantic involvement may not adhere to the treatment as prescribed by the doctor. The resistance to using the LTOT often triggers marital tensions, the lack of patient and caregiver communication, isolating the patient from the spouse[16,17], also suffering changes in the couple's intimate moments, leading to changes in the individual's libido and sexuality.

The sexual function of the older people with COPD is more affected than in healthy older people[18]. There is a greater loss of libido and erectile dysfunction is more pronounced, due to debilitating systemic inflammation in terms of functional limitations,

hormonal imbalance, chronic hypoxia, intolerance to efforts and the use of medications[19–21]. The relationship between erectile dysfunction and COPD is recent, since the first data published on the subject were in 1982 and, since then, there have been few studies[19,21,22].

Some patients in this study reported how much the disease had repercussions on sexual intercourse, both due to shortness of breath and fear of feeling sick during intimate moments. There are changes in sexual relations or total abstinence due to patients' physiological and emotional symptoms[15,23].

The individual needs to feel desired, take pleasure in their own body, to have their well-being[24]. Changes in the image are not formed only by neurological information, but also by psychic and libidinal issues[25]. In the case of P6, she suffers from the change in her body figure, decreasing libido, feeling unwanted, losing her sexuality. With all this process, the patient represents with signs of mourning, which can trigger melancholy and various feelings of suffering[24].

It is necessary to understand this patient in psychological distress to provide comprehensive care, as we cannot rule out sexual issues and treat only COPD. The idea that there is no sex life in old age and that problems are only linked to age is unacceptable. It is necessary to consider the whole scenario in which the person is inserted. Interventions are necessary to support spouses and are essential to promote a better adjustment to the disease and prevent couples from drifting apart[15]. Including the family in the treatment is essential and benefits everyone[17].

Studies show that the health team feels embarrassed and ashamed to address this issue with patients[26,27], but it is necessary to improve adherence to treatment and not impact the quality of life of these older people, as sexual activity is possible and beneficial for health. This subject is little discussed between the health team and the patient, and professionals need to be aware that these patients need sexual assessment[19]. COPD guidelines need to delve deeper into correlating the disease with sexual activity and include a sex counseling document for these patients and their spouses[19].

The limitation of the study was the difficulty of accessing the participants, as most of them used public transport to go to the consultations, having a time to arrive and leave.

CONCLUSION

In light of the study's findings, the perception of older people with COPD using LTOT indicates that oxygen therapy had an impact on sexual practice and romantic relationships. Patients had their lives changed, with changes in habits, physiological changes and family reorganization.

Faced with such results, the health team needs to help the family and the patients to reorganize themselves in the new routine, meeting the demands and encouraging them to continue taking care of themselves, without depriving the patient and the spouse. Only then can they be partners in the treatment, avoiding turmoil, minimizing the suffering caused by the process of becoming ill in the whole family, bringing benefits to all.

Having good quality relationships and sexual practice is a fundamental condition for promoting health. Aging does not mean becoming asexual. The issue should be addressed in health services and guidelines, using health education, building new concepts about the sexual practice of the older population and love relationships.

AUTHOR CONTRIBUTIONS

- Giovanna Hass Bueno - Administration of Project, Writing – First draft, Writing – Review and Editing
- Claudinei José Gomes Campos - Formal Analysis, Methodology and Conceptualization
- Egberto Ribeiro Turato – Methodology and Validation
- Ilma Aparecida Paschoal - Formal Analysis
- Luiz Cláudio Martins - Formal Analysis, Data Curation, Securing of Funding, Resources and Supervision

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What it is like to be an older person with memory complaints: the perception of women seen at a Physical Rehabilitation Center

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Abstract

Objective: To understand what it is like to be an older person with memory complaints from the perspective of women seen at a Physical Rehabilitation Center. *Method:* A qualitative exploratory descriptive study was conducted involving a population of older women aged >60 years who had impaired cognitive function, as measured by the Mini-Mental State Examination (MMSE), and subjective memory complaints was carried out. A questionnaire was applied to characterize the participants and an audio-recorded semi-structured interview based on a guiding question was conducted. The transcribed interviews were analyzed using Bardin's Content Analysis. *Results:* The age of the 19 participants ranged from 62 to 84 years, with mean of 72.37 (±6.72) years. Reading and analysis of the discourse produced in response to the guiding question revealed two categories: (1) feelings the older women experienced due to memory complaints; (2) daily life situations affected by memory complaints. *Conclusion:* Being an older woman with memory complaints was reported as challenging, promoting changes in daily life, impacting situations that used to be routine, and requiring readjustments both for the older individual with memory impairment and those around them.

Keywords: Memory loss. Elderly. Cognitive Dysfunction.

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INTRODUCTION

Memory can be defined as the ability to acquire, store and retrieve information and experiences. This is a complex cognitive process which is fundamental for learning, adaptation and survival as humans, allowing Information to be held in the mind for long periods and retrieved when needed[1]. At all times, this cognitive resource is used to perform daily activities and is a factor influencing Independence in everyday life[2].

Memory is one of the most impacted cognitive functions during aging. Aging is accompanied by decline in processing speed, attention span, episodic recall ability and execution of different tasks[3-5]. Memory complaints in older individuals are more prevalent among women[6,7].

Subjective memory loss or complaints in older people may be associated with objective dysfunction of memory loss and cognitive deficit, problems which can be revealed using specific tests[8].

The Mini-Mental State Exam (MMSE) is the most widely-used tool for screening cognitive status in adults and older people in Brazil and worldwide. Studies involving memory training apply the MMSE to assess and check change among individuals presenting this impairment, despite the fact this tool evaluates more than memory impairment[2] .

Aging can negatively impact quality of life of older people, especially when associated with memory complaints and cognitive decline. These factors directly affect autonomy, self-care, social interaction and functioning. Older people with these impairments and experiences may present depression, anxiety, irritability, aggressiveness, apathy, hopelessness, anguish and fear[2].

In the context of the COVID-19 pandemic, neurological symptoms were observed, including cognitive and mental impairment, during acute episodes of the disease and over the long-term. Of the different cognitive symptoms displayed, memory complaints are the most common[9].

Older age, low educational level, presence of comorbidities, severe COVID-19 infection, need for Intensive Care Unit (ICU) admission, and presence of *delirium* constitute risk factors for developing cognitive impairment over the long term[9].

Lockdown measures adopted to curb the COVID-19 pandemic promoted changes in everyday life, family and social relationships, as well as in the number of activities performed by older people. This change is associated with cognitive decline and impairment of functions such as memory and a worsening of cases of pre-existing memory problems[10].

The identification of memory complaints in older adults, and their objective assessment and monitoring of change, allows health professionals to plan and apply interventions to manage these issues, improving the independence and quality of life of individuals affected. In addition, this evaluation enables the adaptation and complementing of approaches employed for treating diseases affecting older people, toward better adherence and compliance with guidance, given these aspects are influenced by an individual´s capacity to process, retain and store information[2] .

The manner in which older people deal with experiences of loss during aging, including memory loss, is mediated by a number of different factors, such as culture, religiosity, social support, coping strategies and personal characteristics[11,12] .

Assessing the perceptions of older people regarding the impact of this impairment on their daily lives is important for professionals of heath teams. Knowledge of this perception can help inform professionals, allowing them to make their treatment strategies more individualized and humanized.

Previous studies show that gender differences exist in the way older individuals perceive their aging and the changes this process promotes[11]. Thus, the objective of the present study was to determine and understand what it is like to be an older person with memory complaints from the perspective of women seen at a Physical Rehabilitation Center.

METHOD

A descriptive qualitative exploratory study was conducted. The study population comprised older adults aged >60 years seen at a Physical Rehabilitation Center of a public university in Paraná state between February and August 2021 who had cognitive dysfunction, as confirmed by the MMSE and reports of subjective memory complaints. Exclusion criteria were: being male, history of COVID-19 infection, diagnosis of diseases whose clinical symptoms precluded verbal communication; being bedridden (dependents); and having physical disability.

Participants were contacted by telephone to schedule the first stage of data collection. At the first face-to-face meeting (held in room at rehabilitation center), a questionnaire collecting the following sociodemographic variables on participants was applied: name, age, sex, marital status, living arrangement (alone or with others), job, family income, education and religion. These variables were analyzed using simple descriptive statistics.

The MMSE was used to objectively screen older women who had subjective memory complaints. When applying the MMSE, educational level is a factor influencing the scores obtained[13]. The cut-off points established by BRUCKI et al.[14] were adopted to determine the presence of cognitive impairment: 20 points for illiterate subjects; 25 for 1-4 years of education; 26.5 for 5-8 years; 28 for 9-11 years; and 29 for >11 years of formal education. In the group of individuals whose score indicated cognitive deficit, a second telephone call was made to notify them of the results and check for the presence of subjective memory complaints or otherwise. Participants who reported this complaint were invited to return for a second face-to-face meeting to undergo a sound-recorded semi-structured interview based around the following guiding question: "For you, what is it like to be an older person with memory complaints?".

Interviews were sound recorded, transcribed in full and labeled with an identifier beginning with the letter E followed by numbers (denoting randomly assigned order in which interviews were conducted) for Content Analysis[15].

During both the first and second interviews with participants, the sanitary health measures implemented by the rehabilitation center were observed in order to prevent contact with and spread of the coronavirus. These measures were necessary because data collection took place in 2021, a period in which the provision of health services was resuming amid the pandemic.

The researchers tasked with data collection, as well as study participants, underwent screening checks for signs and symptoms of COVID-19 prior to admission to the center. Also, while on the premises, the use of alcohol cleansing gel (70%) to sterilize hands was compulsory, and of alcohol fluid (70%) for cleaning desks and chairs, in additional to wearing of face masks and respiratory precautionary measures.

Distancing of 2 meters between researchers and study participants was maintained in the data collection room, and windows and doors kept open to ensure ventilation of the space, while assuring privacy when collecting the necessary information.

The present study was approved by the Ethics Committee for Research involving Humans at the University Teaching Institution of which the center was part, under permit no. 3.990.370, in accordance with Resolution nos. 466/2012 and 510/2016. All participants had read and signed the Free and Informed Consent Form prior to application of the questionnaire.

RESULTS

A total of 79 older adults were treated at the center between February and August, 2021. This patient group comprised 58 (73.42%) women and 21 (26.58%) men. All 58 female patients were included in the study, of which 20 (34.48%) had cognitive dysfunction, as determined by the MMSE.

These 20 individuals reported memory complaints, however, 1 patient refused to take part in the semi-structured interview for personal reasons. Thus, for the remaining 19 women interviewed, age range was 62-84 years and mean age was 72.37 (±6.72) years. With regard to performance on the MMSE, mean score was 9.58 (±4.02) points. Participant characteristics are presented in Table 1.

Table 1. Characteristics of study participants (N=19), Cascavel, Parana, 2021.

Variables	n (%)
Marital status	
Married	9 (47.37)
Widow	7 (36.84)
Single	3 (15.79)
Employment status	
Retired	17 (89.47)
Housewife	2 (10.53)
Monthly family income (minimum wages)	
≤1	8 (42.11)
1-2	3 (15.78)
3-5	8 (42.11)
Education	
Illiterate	3 (15.79)
Primary incomplete	3 (15.79)
Primary complete	6 (31.58)
Secondary incomplete	1 (5.26)
Secondary complete	2 (10.53)
Higher incomplete	2 (10.53)
Higher complete	1 (5.26)
Post-graduate complete	1 (5.26)
Religion	
Catholic	14 (73.68)
Evangelical/Protestant	5 (26.32)

Source: Created by authors, 2021.

Reading and analysis of answers given verbally in response to the guiding questions revealed the following categories: a) feelings experienced by participants due to memory complaints; b) everyday situations impacted by memory complaints.

Feelings experienced by participants due to memory complaints

The participants presenting memory complaints described this situation using negative adjectives such as "hard", "bad", "awful", and "sad".

> "It´s the worst thing ever, because I always was, I always had a sharp memory [...]" (E14).

> "[...] it´s sad, I think there is nothing worse than someone whose "lost" their memory" (E18).

The results showed that the participants associated negative feelings with their memory problems. The individuals reported feelings of anger, distress, shame, discomfort and hopelessness. Positive feelings, such as joy, were reported when managing to remember something.

> "It maddens me you know, when I want to remember things but I´m unable to [..] after some hours I remember, which makes me really happy because I have managed to remember" (E8)

> "[...] it´s an issue we have sometimes, feelings of shame [....]" (E11).

> "It´s distressing, depressing" (E18).

> "[…] sometimes I mislay something, leave things in the wrong place in the kitchen [...], it´s annoying" (E3).

As a result of the memory complaints, participants felt dependent on others to do things they used to do alone, such as visiting the doctor or going out to run errands.

> "I think it's really terrible because you need, I think someone else, to accompany you the whole time, especially to go to the doctor, because they prescribe medications and the right time to take them, and we need to know this precisely" (E8).

> "Relying on others to walk together, I can´t walk alone" (E11).

Fear featured in the everyday lives of the women with memory complaints. The participants reported being fearful over their clinical memory problem worsening, fear of facing the future alone with declining memory, fear of early onset of more severe memory issues and also of becoming dependent on others.

> "I´m fearful that one day I, as they say, totally lose it [...]. [...] I´m afraid of not remembering anything [...]" (E5).

> "[...] at the moment, we, despite being a bit forgetful, we are lucid enough to go out, deal with things, but its tough girl, imagine later on in the future how it´s going to be, a few years from now" (E8)

> "My only worry is that I think maybe mine is coming a bit earlier, because I am 66 years old" (E4).

Some of the participants appeared to have accepted their memory issue, believing this is a normal part of aging.

> "[...] I know this is natural, I understand it´s normal for my age" (E10).

> "I accept it, I kind of accept it, because it's physiological this, there´s no getting away from it, it's physiological and I know this is coming, you see" (E4).

Everyday situations impacted by memory complaints

During the interviews, the participants spoke about the severity and frequency with which memory problems arise in their daily lives.

> "Actually, I forget everything" (E2).

> "I forget a lot of stuff" (E1)

> "It´s not very common, sometimes I have whole days without problems, remembering everything" (E19).

Forgetting where they had "put" something was a recurrent theme in the narrative of the study participants.

> "[...] I put things somewhere else and then forget I´ve done it you know, [...]" (E14).

> "Sometimes I already have the thing I´m looking for but no, I go hunting for it, then come back and there it was" (E11).

> "I´m forgetful, sometimes I want to fetch something, go to get it and start wondering, what is it I´m getting, then I return, walk around a bit, and then I remember" (E17).

> "Sometimes I grab my handbag [...] put it away and then forget where I put it" (E19).

Interviewees reported not being able to recall whether they had done what they had to do. They reported often "mixing" multiple tasks, while doing one, they start another, forgetting what they were doing in the first place.

> "Sometimes we go out thinking we have done that, and have not done it, so we get back and shortly afterwards we remember, maybe [...]" (E3).

> "There are times when I get a pressure device and check my pressure, finish that and then start cleaning the house, then I mix it, I want to do everything at once and lose track of what I´m doing" (E7).

In some cases, the participants forgot things while cooking, preparing a meal and forgetting what they were doing, needing to maintain full concentration in order to complete the task,

> "I put the rice on, if I leave it for a moment, turn to the sink, I forget the rice, because my stove is behind me, and turn to the sink to do something, and don't remember the rice any more" (E2).

> "If I move away, I forget it and it burns, I can´t move away, I need to pay attention to it you know, like that" (E7).

The relationship of the women with others was affected by the memory difficulty, not recalling what was said, saying things they never used to verbalize, forgetting people´s names and details conveyed to them. This problem had led some people to stop talking to them.

> "[...] say something, arrange something with somebody and then no longer remember [...], nobody talks to me anymore because they know I'm losing it [...]. [...] I no longer know anyone´s name, I need to read the name or write it down, really bad [...]" (E14).

> "Sometimes I even forget names of family members you know, my mind goes blank, it vanishes [...]" (E8).

> "Saying things which, sometimes shouldn't be said" (E11)

The interviewees stated that they had experienced situations in which they encountered difficulties to locating/recognizing where they were, even in familiar places; and situations where, having gone out, they forgot why they had left home.

> "Memory loss is like that, there are times when we don´t know where we are" (E7).

> "You go someplace, reach the street, get there and don´t know why you went, go back home" (E2).

> "You go into town to a place and don´t go in, visiting another store instead, you wanted to go in this one and not that one" (E11).

> "There were occasions when I got the bus, I had to think where I was supposed to get off, I didn´t remember, it´s awful" (E7).

The participants reported missing appointments, such as visits to the doctor, and not recalling whether they had taken their medication or not, or taken them at the right time.

> "I forgot my appointment on the 1st that I had scheduled in order to update my prescription, I forgot, nobody reminded me and I ended up forgetting" (E7).

> "Yes, the medications sometimes as well, I also miss the time, not by a lot, but it happens [...]. [...] On occasions I take it and then I´m left wondering, did I take that one, at that time?" (E3).

DISCUSSION

This analysis of the narrative content of the study participants revealed that being an older woman with memory complaints was associated with negative feelings and impacts on situations of daily life due to this deficit. Having memory complaints was reported as being "bad", "sad", "hard", "unpleasant" and "unwanted", which in turn promoted feelings of anger, distress, shame, embarrassment, hopelessness and fear.

Activities of daily living, ranging from more basic (everyday tasks) to more complex (planning a trip, driving, engaging in sports, taking part in community groups, etc.), can be impacted by memory complaints. This can give rise to depressive symptoms due to loss of the ability to perform tasks that were hitherto possible[16].

Overall performance of the individual on these activities is closely linked to the integrity of their intellectual functioning. When older people exhibit poor cognitive performance, symptoms such as distress, rage, blame and embarrassment can emerge[17].

Older individuals presenting subjective memory complaints are more prone to having low self-esteem, stress and depressive symptoms than their counterparts without these problems[18]. During

the first two years of onset of memory problems, depressive symptoms tend to be worse and more evident. In other cases, cognitive memory decline causes reduced functioning and self-care, resulting in depressive signs and symptoms[19].

With advancing age, loss of autonomy becomes a key factor contributing to reductions in well-being and quality of life. When this loss is associated with functional and cognitive decline, the impact on quality of life is compounded[20].

Fear over cognitive decline and its consequences may stem from previous experiences of memory issues seen in other people[21]. Exposure to this situation triggers apprehension regarding the future, since many individuals in this age group experience rapid decline, limitations in activities of daily living and end up becoming dependent on others[22]. Older people with impaired memory tend to hold a pessimistic view of the future, because of the possibility of developing dementia[23].

In older age, women tend to spend the vast majority of their time within the home, engaging in household tasks such as cooking, cleaning and tidying up[24]. Family caregivers of older people with memory problems report that the elders put themselves in danger involving situations such as lighting the gas stove and forgetting to turn it off and handling saucepans on the hotplate.

Symptoms of cognitive decline can include problems remembering names, word-finding difficulties when trying to describe something, and mislaying objects[6].

Older people often have chronic diseases which require pharmacological treatment. When this population has memory issues, they may forget whether they have already taken their medications or have difficulty adhering to the prescribed timing[27].

Strategies adopted to counter these problems include associating the time of administering drugs with a meal for example, or by using reminder notes in the event of episodes of forgetfulness. This scenario may pose a health risk in promoting poor treatment adherence and quality, as well as complications secondary to lack of self-care[28].

Many older individuals with memory complaints do not seek treatment, holding the misconception that memory problems are part of the "normal" aging process. Other individuals see a stigma attached to memory impairment, construing this as a problem which must be concealed from family and the people around them[29].

Having a more active brain can help prevent, slow or attenuate the factors associated with cognitive aging, such as memory decline. Interventions with beneficial outcomes have been recommended, proving positive for health of older people by improving performance on activities of daily living[30].

Cognitive training entails interventions applied to stimulate thinking and cognition with different degrees of difficulty and intensity. The objectives of training include maintaining or improving cognitive and functional capacity for activities of daily living. These typically involve standardized structured tasks for training abilities such as attention, memory, information processing speed and problem-solving[30]. These programs can be applied alone by a health professional or in a multi-disciplinary fashion including professionals from different areas[31].

Cognitive training using an abacus, an apparatus which stimulates attention and reasoning, is a fun strategy for optimizing cognitive reserve of older individuals, boosting memory[30]. Other strategies can be used, such as memory games, memorizing drawings, differentiating colors, explaining meanings of common expressions, writing shopping lists or spotting the maximum items in a room, logic and language exercises, such as reading a text with numbers simulating letters, texts containing shuffled letters, reading a word backwards, writing own name or drawing with the non-dominant hand[32].

Formal and informal support groups are forums of social interaction that potentialize the competences of older people, helping them to play their role in society, overcome difficulties and change attitudes amid health-disease[33].

With regard to intellectual and psychological aspects, informal and formal groups prove important in promoting reflection on changes which occur during this stage of life. The fact that older people

can vent their feelings, feel embraced and heard, awakens dormant potential and fosters self-esteem, warding off isolation and loneliness, improving self-care, as well as relationship with family members[16,33].

Regularly screening the cognitive ability of older people for early detection and diagnosis of memory decline is an important measure toward prevention and early treatment of memory complaints[2].

In the present study, the data collection was performed in 2021, limiting the number of women included. During this period, the number of individuals undergoing treatment at the study venue was lower relative to the pre-pandemic period. Many subjects, when invited to visit the health service where the study was run, turned down the assessment and treatment for fear of leaving home and getting infected by the coronavirus.

In addition, lack of contact with people, change in routine and reduced level of daily functional activities during the lockdown amid the COVID-19 pandemic have been associated with poorer concentration and memory loss[10], possibly influencing the responses given.

Moreover, lockdowns may have had a negative impact on participants´ mental health, consequently influencing their experiences regarding memory complaints. People facing social restriction and deprivation can experience negative feelings and may exhibit stress-related symptoms, anxiety and depression, and also exacerbation of previous mental disorders[10,34]. The older population is a group deemed more susceptible to these phenomena when faced with this type of situation[35].

CONCLUSION

Being an older woman with memory complaints proved a challenge, impacting the daily life of participants, promoting changes in previously normal situations, requiring re-adaptation by both the patient and those around them.

Decline in memory was associated with experiencing negative feelings, dependence for tasks previously performed alone, and with attitudes of acceptance on the misconception that impairments were inherent to the natural physiological process of aging. The women reported starting tasks and not finishing them, encountering difficulties orienting themselves in familiar places, and noted deterioration in their interpersonal relationships. Participants also reported problems forgetting where they had put things, important dates, managing medications and health-related appointments.

Future studies should investigate what it is like to be an older man with memory complaints. Lastly, studies on the objective perception and evaluation of these complaints in older people, before and after applying cognitive training, and exploring their impact on memory deficits should be conducted.

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- Thais Schemberger Favarin: Methodology, Investigation, Formal Analysis, Writing - First Draft
- Camila Costanaro: Writing - Review and Editing
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Association between functional capacity, sleep disorder and physical activity level in individuals with Parkinson's disease during the covid-19 pandemic period: a cross-sectional study

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Abstract

Objective: To assess the level of exercise of older people with Parkinson's disease (PD), taking into account sociodemographic, clinical, and functional characteristics. *Method*: A cross-sectional study was carried out based on the following data: level of physical activity (International Physical Activity Questionnaire short version - short IPAQ), sleep disorders, cognitive complaints, duration of illness, degree of dependence to perform basic daily activities through Schwab & England (S&E) scale of older individuals with PD treated at a tertiary health service during the covid-19 pandemic. Poisson regression, Mann-Whitney U test and Student's t test were used for statistical analysis. *Results*: The prevalence ratio of being active increased by 1.04 (95% CI 1.01 - 1.08) for every 10 points of elevation on the S&E scale, whereas those who did not report sleep difficulties had a prevalence ratio of 1.17 (95% CI 1.02-1.34) times greater to be active. Inactive individuals with PD were older and had longer disease duration. *Conclusion*: Emphasis should be given to the functional capacity and sleep of individuals with PD for the adequate management of the PA level in periods of social restriction.

Keywords: Parkinsons's disease. Covid-19 pandemic. Physical Inactivity. Sleep disorders.

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INTRODUCTION

Parkinson's disease (PD) is the second most prevalent neurodegenerative disease in the world and its incidence increases with aging [1]. In Brazil, a percentage of 100% growth in the number of people affected by PD between 2005 and 2030 is estimated [2].

PD is characterized by the presence of motor and non-motor symptoms, which cause physical, cognitive and emotional damage and consequent physical inactivity [3]. The greater severity of the disease, limitations in walking and activities of daily living are associated with lower levels of physical activity (PA) [3]. PA levels usually decrease with aging and this occurs more significantly in people with PD [4]. Individuals with mild to moderate PD have a lower level of PA when compared to healthy controls.

Physical impairments from PD results especially from the cardinal symptoms of the disease, such as rigidity, bradykinesia and postural instability; while cognitive and emotional symptoms result from non-motor symptoms such as depression, anxiety, attention deficit, apathy, executive dysfunction, dementia and memory impairment, among others [1].

Among the non-motor symptoms, sleep disturbances are frequent symptoms in individuals with PD due to nocturnal motor disorders (such as dystonias and akinesias), nocturia (due to detrusor hyperreactivity), side effects of parkinsonian therapy, of depression and REM sleep behavior disorder (RBD), which compromise the quality of life of these individuals [5].

During the covid-19 pandemic period, the lifestyle of the population as a whole underwent substantial changes, such as: a greater risk of assuming sedentary behaviors and changing sleeping habits [6]. The increase in physical inactivity during the pandemic can be associated with various damages, such as loss of aerobic capacity, loss of physical conditioning, cognitive and musculoskeletal decline [7]. Individuals with neuromuscular diseases and older people, in particular, demonstrated more significant muscle losses resulting from physical inactivity during the covid-19 [8] pandemic. In PD, losses in PA level, mental health and quality of life were also observed during the pandemic [9]. Sleep disorders, also present during the pandemic, were associated with declines in physical and mental health, since adequate sleep duration and quality facilitate the construction of coping mechanisms to adverse situations and good immune function [10].

As the practice of PA can be suggested as a protective factor in PD due to multiple mechanisms (mediation of inflammation and oxidative stress, promoting nerve regeneration and mitochondrial function and reducing the deposition of α-synuclein protein)[11], knowing the factors associated with PA in PD may be the basis for future therapeutic interventions that may delay the progression of PD and the functional decline associated with this condition [3].

Addressing the issue of physical inactivity, considered one of the main causes of death in the world and a pre-pandemic public health problem [12], during the pandemic is of strategic importance. In PD, this assumes even greater relevance, since, as a result of their underlying pathology, these individuals seem to be more prone to physical inactivity and sleep impairments in periods of social restriction. Therefore, the objective of this study was to evaluate the level of physical activity, considering the sociodemographic, clinical and functional conditions, of older people with Parkinson's Disease (PD).

METHOD

The data used in this descriptive and cross-sectional study came from a cohort study conducted in the city of Fortaleza (Ceará) based on teleconsultations instituted during the covid-19 pandemic period. All teleconsultations were carried out once a week during the afternoon shift, following the routine procedure of face-to-face consultations as a strategy for maintaining the clinical follow-up of almost 350 individuals with PD followed up at the Movement Disorders Outpatient Clinic of a tertiary health service. Data were collected in teleconsultations, between the months of May and December 2020. The study was approved by the Research Ethics Committee (CEP) of the Hospital (Approval number: 31232720.2.0000.5045) and carried out in accordance with Resolutions nº 466/2012 and

510/2016 of the National Health Council, and carried out in accordance with the principles described in the Declaration of Helsinki. To ensure the quality of the study, STROBE *(Strengthening the reporting of observational studies in epidemiology)* was used.

The study included individuals with idiopathic PD, diagnosed by neurologists specialized in movement disorders, according to the criteria of the Brain Bank of the Parkinson's Disease Society of the United Kingdom[13], who underwent face-to-face follow-up at the outpatient clinic in the 12 months preceding the start of the project; (2) stages one through five on the Hoehn and Yahr (HY) stage of disability scale[14]. Subjects were excluded from the study if (1) they did not feel comfortable with virtual medical consultations, regardless of the reason, (2) if they had other types of parkinsonism, (3) if they did not have the necessary communication technology available, or (4) previous diagnosis of dementia according to the Diagnostic and Statistical Manual of Mental Disorders - V recorded in the medical record, and their caregiver was not available to attend the remote consultation with the participant.

Data collection

The teleconsultations took place according to the service's usual appointment scheduling list, constituting a consecutive convenience sample. Individuals who met the inclusion criteria were included in the study according to the Service's scheduling list. The teleconsultations were carried out using the *WhatsApp*© application for video calls, whose tool was familiar to the studied population. Initially, all participants were informed about the research objectives and received an informed consent form and a code was assigned to each one of them.

After eligibility and consent, individuals answered the physical activity level questionnaires applied by physical education and physiotherapy students and the sleep questionnaires were self-completed because they were sent on WhatsApp© as a link to Research Electronic Data Capture (REDCap). We used Research Electronic Data Capture (REDCap) software for data collection and management. REDCap is a secure, web-based application designed to support data capture for research studies. Data entry takes place online, either by participants carrying out surveys, or by logged-in project team members. Integrated tools help manage data collection, which helps ensure the quality of their data. The researchers were part of a multidisciplinary team of the "Living with Parkinson's Disease Research and Extension Project" at the Federal University of Ceará. All researchers were trained and supervised by a geriatrician trained in movement disorders. After two months of training, the geriatrician collected the questionnaires with each student to standardize the procedures in the first two months of collection. Parkinsonian patients were evaluated during the "on" phase of the medication, within three hours of the last dose of the antiparkinsonian medication.

Clinical data were collected by a geriatrician with training in movement disorders, together with three neurology residents and one geriatrics resident. In the first two months, the geriatrician evaluated the clinical and demographic data together with each resident in order to calibrate data collection and recording.

Before the consultation, the patient's medical record was reviewed in order to assess comorbidities and the use of medications in order to reduce record bias. The remote consultations in which the collections were carried out took place in the afternoon shift and at a frequency of once a week, in accordance with the previous functioning of the outpatient clinic that attended to the participants. In an attempt to reduce interviewer bias, standardized questionnaires already validated in Brazil were used for PA level, daytime sleepiness and sleep quality.

Clinical and demographic data were collected, such as gender, age, levodopa equivalent dose, use of a walking aid, physical therapy, time since diagnosis of PD, activities of daily living *Schwab and England* (S & E), occurrence of falls in the last six months, sleep data (presence of disorders, including the clinical diagnosis of REM sleep behavior disorder (RBD) and application of the *Epworth and Pittsburg* scales), subjective cognitive complaint, presence of visual hallucinations , diagnosis of depressive disorder and use of medication (amount and use of specific classes such as benzodiazepines and antipsychotics). Sleep disorders were defined by the individual's anamnesis,

and the complaint of maintenance disorder, sleep onset or early awakening was considered as insomnia. The patient's or family member's report of exacerbated vocalizations and movements during sleep was characterized as the presence of RBD. Daytime sleepiness was recorded according to the presence of this complaint by the individual when questioned. Finally, the respiratory disorder obstructive sleep apnea syndrome (OSAS) was suggested when there was a report by the individual or his family member of an abrupt, repeated and temporary interruption of breathing during sleep, with or without the presence of snoring. The levodopa-equivalent dose of an antiparkinsonian drug was calculated from the Tomlinson scale, defined as the dose that produces the same level of symptomatic control as 100mg of immediate-release levodopa[15]. Polypharmacy was defined as the use of 5 or more drugs[16].

The International Physical Activity Questionnaire short version (short IPAQ) was used to assess self-reported PA levels. Because it is a quick and easy administration instrument, it allows population studies and international comparisons. The short IPAQ measures the weekly frequency, duration and intensity of PA, allowing the classification of individuals as sedentary, irregularly active A, irregularly active B, active and very active. Even in its short form, it presents coefficients of validity and reproducibility similar to other more expensive application instruments[17]. The short IPAQ consists of seven items, covering all domains of activity (addresses leisure, domestic, work-related and transportation activities)[18]. During its validation in Brazil, it was analyzed under different forms of application (self-assessment, telephone interviews) [17]. In the present study, due to the sample size, participants were organized into two groups: active individuals (categories: active and very active from the short IPAQ) and inactive individuals (categories: irregularly active and sedentary from the short IPAQ).

The Pittsburg Sleep Quality Index (PSQI) is a self-administered instrument that assesses the quality and presence of sleep disturbances over the past month. This questionnaire is validated in Brazil [19] and has its items grouped into seven components scored on a scale from zero to three, whose total score varies from zero to 21, showing adequate internal consistency and validity [19]. The seven components of the PSQI are: subjective sleep quality; sleep latency; sleep duration; habitual sleep efficiency; sleep disorders; use of sleep medications and daytime sleep disturbance. This questionnaire is also composed of five additional questions (usually used only for clinical purposes) that must be answered by a roommate. The higher the total score, the worse the sleep quality. A global score of 5 or more indicates poor sleep quality[20]. These properties of the PSQI mean that this questionnaire is used in clinical research in general 20 and in PD for subjective assessment of sleep quality[21].

The Epworth Sleepiness Scale (ESS) is a simple and self-administered questionnaire [22] that assesses sleepiness. Consisting of eight situations in which the probability of a person sleeping is evaluated on a scale from 0 to 24, in which a score greater than 10 indicates excessive sleepiness, which is a valid and reliable instrument for assessing daytime sleepiness in clinical practice and in research with the Brazilian population and in PD[22].

The Schwab & England Basic Activities of Daily Living Scale (S & E) was used to stratify the degree of independence to perform activities of daily living and is commonly used to monitor the functional capacity of individuals with PD. The scale was first presented in 1968 at the *Third Symposium on Parkinson's Disease, Royal College of Surgeons in Edinburgh*[23]. In this scale, individuals are distributed in percentages that vary from 0 to 100%, where higher percentage values indicate better functional capacity [24]. The S&E scale has become a standardized assessment tool in PD and has been used in hundreds of studies. The clinometry properties of this scale, however, have never been established. Available data from studies primarily aimed at investigating the characteristics of other rating scales suggest moderate to substantial validity and good reliability[24].

Descriptive statistics was performed for all variables. Clinical and demographic characteristics of participants were described using measures of central tendency and dispersion. In the analysis of the comparison between the groups, the *Mann-*

Whitney U test and *Student's* t test were used, according to adherence or not to the Gaussian distribution. Pearson's chi-square test and Fisher's exact test were used to investigate the association between categorical variables. For the construction of the Poisson regression model, the association between the dependent variable level of physical activity (short IPAQ) (1= active individuals and 0= inactive individuals) with the independent variables: absence of sleep disorder, cognitive complaint, disease duration, S&E score. For goodness of fit, the "golden rule" of a maximum of one independent variable for every five individuals with a positive outcome was respected.

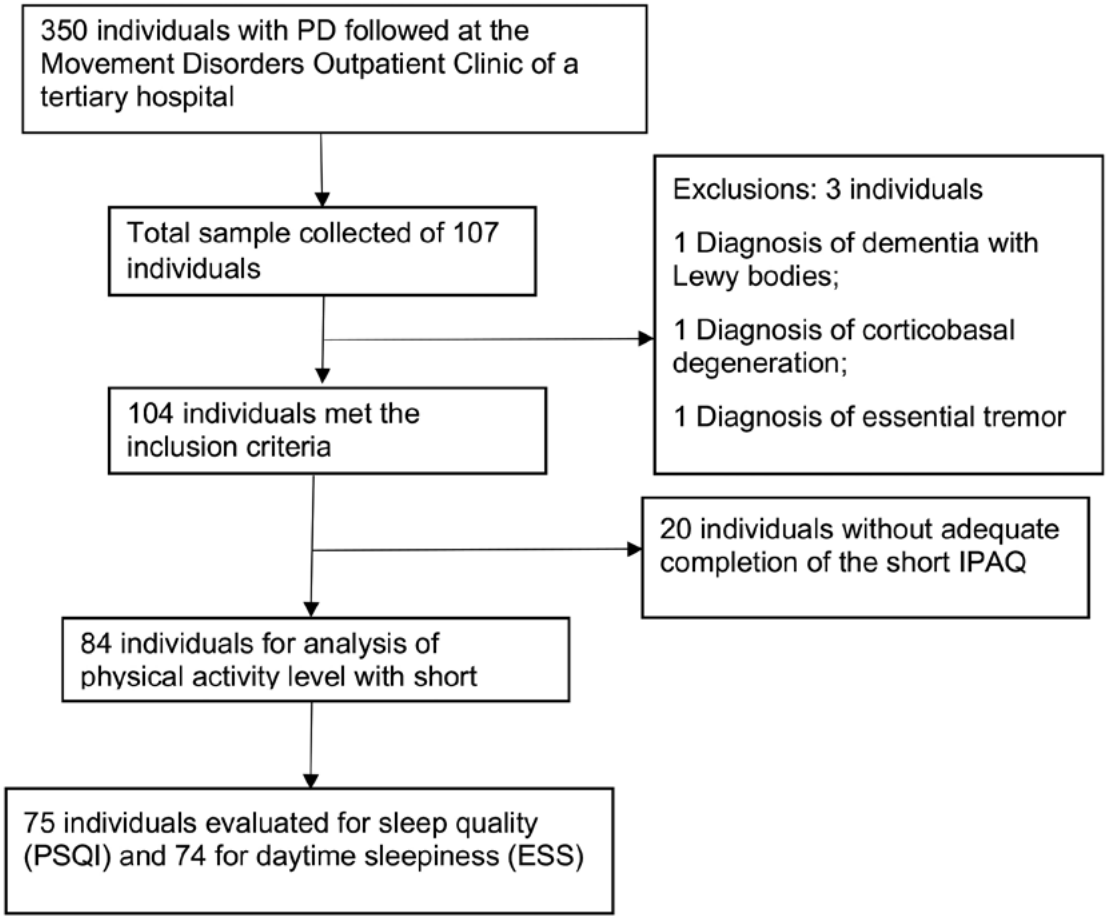
The Power of the sample of 84 patients was calculated a posteriori, using the G*Power 3.1.9.2 program, based on the comparison between the level of physical activity and the variable related to the severity of PD by S & E, obtaining the value of 93.6%.

RESULTS

Of the 350 individuals monitored by the clinic, a total of 107 participants were initially evaluated for this study (30.6%). Of these, 84 individuals (Figure 1) adequately filled out the short IPAQ, constituting the sample used for analysis in this study. Of these, 52 (61.9%) were classified as non-active and 32 (38.1%) as active. Mean age was 68.1 (±12.9) years, mean disease duration was 10.1 (± 6.3) years, mean levodopa equivalent dose was 1,032mg (± 510.1) and the mean S&E score was 69.7(±24.5). The most prevalent health condition, excluding sleep disorders, was systemic arterial hypertension, which was present in 35 individuals (41.6%), followed by depressive disorder in 27 individuals (32.1%). Only six participants (7.1%) reported regular physical therapy practice. The clinical-epidemiological characteristics of the participants and their association with the level of PA according to the short IPAQ are shown in Table 1. Data regarding the presence of sleep disorders in their clinical anamnesis were also obtained due to the relevance of sleep for the health of these individuals (Table 2).

For the evaluation of sleep quality, 75 participants answered the *Pittsburgh*, of which only one individual (1.3%) had good sleep quality (score 0-4), with a mean score of 12.1(± 3.7). As for the assessment of daytime sleepiness, 74 individuals responded to the ESS and 45 (60.8%) of these classified themselves as having excessive daytime sleepiness, with a mean score of 11.5 (± 5.9). As the sleep scales were answered by the patients through a link from Redcap to Whatsapp, unfortunately there were greater losses because some patients did not respond.

Due to the sample size and because it is a cross-sectional study, Poisson regression was performed (Table 3) for which variables were selected that presented, according to the literature, greater association with the level of physical activity. Elevation in the S&E scale (variation of ten points) was associated with the outcomes: active and very active categories of the short IPAQ, with a prevalence ratio of 4.5%. It was also found that individuals who did not report sleep disorders had a 17.2% higher prevalence of being physically active.



PD: Parkinson's disease; Short IPAQ: International Physical Activity Questionnaire; PSQI: Pittsburg Sleep Quality Index; ESS: Epworth Sleepiness Scale

Figure 1. Sample recruitment flowchart. Fortaleza, CE, 2020

Table 1. Clinical and demographic characteristics of non-active and active individuals with Parkinson's disease (N=84). Fortaleza, CE, 2020.

		IPAQ		
	Total	Non-active	Active	p
Sex				0,06[c]
Male	51 (60,7%)	31 (59,6%)	20 (62,5%)	
Female	33 (39,3%)	21 (40,4%)	12 (37,5%)	
Education				0,63[d]
Illiterate	8 (9,5%)	4 (7,7%)	4 (12,5%)	
Incomplete Elementary	39 (46,4%)	28 (53,8%)	11 (34,4%)	
Complete Elementary	6 (7,1%)	4 (7,7%)	2 (6,3%)	
Incomplete High School	3 (3,6%)	2 (3,8%)	1 (3,1%)	
Complete High School	12 (14,3%)	7 (13,5%)	5 (15,6%)	
Incomplete Higher Education	6 (7,1%)	2 (3,8%)	4 (12,5%)	
Complete Higher Education	6 (7,1%)	3 (5,8%)	3 (9,4%)	
Postgraduate	4 (4,8%)	2 (3,8%)	2 (6,3%)	

to be continued

Continuation of Table 1

	IPAQ			
	Total	Non-active	Active	p
Education in years	7,3 ± 5,3 5 (0 - 20)	6,8 ± 4,9 5 (0 - 17)	8,1 ± 5,9 6,5 (0 - 20)	0,43[b]
Age (years)	68,1 ± 12,9 71 (0 - 94)	70,5 ± 10,2 72,5 (47 - 94)	64,2 ± 15,8 68,5 (0 - 89)	**0,03**[b]
Time since diagnosis of PD (years)	10,1 ± 6,3 9,5 (0 - 28)	11,1 ± 6,3 11 (1 - 28)	8,4 ± 6,1 7 (0 - 27)	**0,03**[b]
S & E	69,8 ± 24,5 80 (10 - 100)	62,9 ± 25,4 70 (10 - 100)	80,9 ± 18,4 85 (20 - 100)	**<0,01**[b]
Number of falls in 6 months	4,1 ± 9,9 0 (0 - 60)	4,4 ± 11,5 0 (0 - 60)	3,6 ± 6,5 1 (0 - 26)	0,29[b]
Equivalent dose of levodopa†	1032 ± 510 1078 (25 - 2600)	1030 ± 433 1200 (50 - 1648)	1035 ± 622 1000 (25 - 2600)	0,75[b]
Use of walking aid	30 (36,1%)	24 (46,2%)	6 (19,4%)	**0,01**[c]
Report sleep disorder	58 (69%)	41 (78,8%)	17 (53,1%)	**0,01**[c]
ESS Score*	11,4 ± 5,9 11 (0 - 24)	11,4 ± 6,3 11 (0 - 24)	11,4 ± 5,2 11 (0 - 21)	0,65[c]
ESS*				0,75[c]
Daytime sleepiness	45 (60,8%)	28 (37,8%)	17 (22,9%)	
No daytime sleepiness	29 (39,1%)	17 (22,9%)	12 (16,2%)	
Pittsburg Score**	12,1 ± 3,8 12 (4 - 20)	12,9 ± 3,5 13 (6 - 20)	10,9 ± 3,7 11 (4 - 17)	**0,02**[b]
*Pittsburg***				0,20[c]
Poor sleep quality	74 (98,7%)	46(61,3%)	28 (37,3%)	
Good sleep quality	1 (1,3%)	0 (0%)	1 (1,3%)	
Presence of cognitive complaint	34 (40,5%)	26 (51%)	8 (25%)	**0,01**[c]
Presence of visual hallucinations	26 (31%)	22 (42,3%)	4 (12,5%)	**<0,01**[c]
Use of benzodiazepine	20 (23,8%)	16 (30,8%)	4 (12,5%)	0,05[c]
Use of atypical antipsychotics	10 (11,9%)	9 (17,3%)	1 (3,1%)	0,05[c]
Use of typical antipsychotics	0 (0%)	0 (0%)	0 (0%)	
Depression	27 (32,1%)	19 (36,5%)	8 (25%)	0,27[c]
Number of medications in use	5,8 ± 3.1 5 (1 - 15)	6,1 ± 3.2 5,5 (1 - 15)	5,4 ± 2,9 5 (1 - 13)	0,27[b]
Polypharmacy	53 (63,1%)	34 (65,4%)	19 (59,4%)	0,30[c]

Data displayed in n (%) and Mean ± Standard Deviation, Median (Minimum-Maximum). b: Mann-Whitney test c: Pearson's chi-square test; d: Fisher's Exact Test. PD: Parkinson's disease; S&E: "Schwab and England" clinical assessment scale; ESS: Epworth sleepiness scale; *: number of 74 individuals; **: number of 75 individuals. † levodopa equivalent dose = (levodopa dose) + (amantadine dose x 1) + (pramipexole dose x 100) + (rasagiline dose x 100) + (levodopa dose plus entacapone x 0.33) + (extended-release levodopa dose x 0.75)

Table 2. Frequency of sleep disorder (N= 58). Fortaleza, CE, 2020

Sleep disorder	N (%)
Insomnia	36 (62)
REM sleep behavior disorder	37 (63.7)
Daytime sleepiness	26 (44.8)
OSAS suggestion	17 (29.3)
Others	5 (8.6)

Table 3. Poisson regression for the physical activity level outcome (short IPAQ). Fortaleza, CE, 2020

Variables	PR	95%CI	p-Value
Absence of sleep disorder	1.17	1.02-1.34	**0.02**
cognitive complaint	0.91	0.79-1.05	0.20
Duration of disease	0.99	0.98-1.01	0.60
S&E Score (10)*	1.04	1.01 – 1.08	**0.01**

*variations every 10 points; S&E: "Schwab and England" clinical assessment scale; PR: prevalence ratio

DISCUSSION

In this study, absence of sleep disorders and better functional capacity, assessed by S&E, were associated with a higher level of PA. The worsening of motor capacity (strength, balance and flexibility) that occurs with disease progression is directly related to physical inactivity in PD[6]. PA improves functional capacity in PD, delaying or reversing physical decline[25]. The association between better functional capacity and higher levels of PA corroborates the importance of non-pharmacological management of this chronic health condition.

Another factor associated with a higher level of PA was the absence of sleep disorders. As well as physical inactivity, our population showed a high prevalence of sleep disorders as well as other studies previously carried out in PD [6]. Sleep disturbances are among the first symptoms experienced in PD and it is believed that this dysfunction can operate as a trigger exacerbating neurodegeneration from the early stages of the disease[26]. Insomnia and poor sleep quality were prevalent complaints during the pandemic period, not only due to the changes suffered in work routines, but also due to the stress generated by the fear of illness and irregular exposure to daylight, the main factor for timing the circadian cycle[10]. In this study, the presence of sleep disorders was associated with a greater chance of the studied individuals being more inactive. For the management of chronic diseases, maintaining a sufficient amount of physical activity and a good quality and quantity of sleep are beneficial habits, with a bidirectional relationship between both these behaviors, which directly influence each other[27]. In view of the findings, it is suggested that the sleep disorders seen in this study during the pandemic period may contribute to physical inactivity. However, other study designs are needed to prove this association. Evaluating the presence of daytime sleepiness and sleep quality during the period of the covid-19 pandemic is necessary, since increases of 40% in the prevalence of sleep disorders were recorded during this period[27].

Because it is a progressive neurodegenerative disease, PD involves motor and non-motor impairments that can lead to a more inactive lifestyle [28], which corroborates the result of the present study, in which older individuals and those with a longer duration of disease presented predominantly distributed in the non-active group. A fact that also occurred for participants who had worse functional capacity, as assessed by S&E. This result is in agreement with a pre-pandemic longitudinal study, in which PA was assessed by self-report, where a higher level of PA, obtained by self-report, was associated with a better score on the S&E[29]. In the same direction, studies carried out during the pandemic with individuals with PD described worsening of motor symptoms in these individuals associated with a reduction in PA[30].

The mean ESS and PSQI scores were greater than 11 and 12, respectively, which denotes a high prevalence of daytime sleepiness and poor sleep quality. In this study, higher PSQI scores were seen in the non-active group. Furthermore, previous records have shown that physical inactivity can worsen non-motor symptoms in PD, such as insomnia, for example[3].

The prevalence of sedentary and irregularly active individuals in the studied population of individuals with PD was high in the period (61.9%). This result is corroborated by other studies in individuals with PD [3]. As a result of home confinement being adopted as one of the main measures to control covid-19, a

reduction in physical activity levels was expected in that period. A similar result was observed in studies with diabetic individuals [31] in which both sexes showed an increase in inactive time during the pandemic period. Interestingly, Italian individuals aged over 12 years during the covid-19 pandemic with no previous habit of playing sports did not use this period to do so, however, those who had the habit now had more time to do so and increased the frequency of physical activity[6].

The average number of falls in 6 months was higher in the non-active group, with no relevant statistical significance. However, due to the impairment in functional capacity that these events cause and because they are related to the cardinal symptoms of PD, this information should be highlighted. Fear of falling and greater disease severity were previously associated with more physical inactivity[3]. Memory bias may have made data on the occurrence of falls in the last 6 months less reliable.

Present in more than 40% of the individuals in this study, the cognitive complaint was significantly related to physical inactivity. Previous studies have shown that physical activity can improve motor function (strength, balance and flexibility) and non-motor symptoms, alleviating cognitive impairment, depression and improving executive function in PD [12]. In Brazil, family members are often the main care providers for dependent individuals with PD due to physical, cognitive and social damage, a situation that can generate family and financial stress [32]. Studies have found a relationship between cognitive impairment and the PD phenotype in which postural instability and gait difficulty predominate[33], and there may be greater physical dependence between these. The dependence presented by individuals with cognitive impairment may be a factor related to their lower level of physical activity, which requires further investigation.

A limitation of this study was the fact that it was carried out without the physical examination of the patients due to the use of teleconsultations given the peculiarities of the period of social restriction, not being possible to evaluate them in terms of the HY scales (the most widely used and accepted staging system for PD severity) [34] and *Unified Parkinson Disease Rating Scale* (UPDRS). UPDRS is valid, reliable and sensitive to change, it has been translated through a rigorous process into 14 languages. It reflects the severity of symptoms across multiple aspects of the disease [35]. Another limitation is due to the fact that teleconsultations can negatively interfere with the motivation of eligible individuals to participate in the study. Finally, having considered the diagnosis of sleep disorders clinically without the use of other complementary tests may limit the interpretation of the data. On the other hand, the strengths of this study are the evidence that suggests that a more physically active behavior was associated with the absence of sleep disorders in individuals with PD during the period of social restriction that occurred during the pandemic.

CONCLUSION

The present study showed that higher levels of functional capacity and absence of sleep disorders were associated with better levels of physical activity in individuals with PD, emphasizing the importance of optimizing the multidisciplinary approach in these areas for better health conditions, especially in periods of social restriction.

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Vaccination against covid-19 in older people: information provided by the news media

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Abstract

Objective: To evaluate the media content produced about vaccination against covid-19 aimed at the older population in Brazil. *Method*: A desk research study based on the analysis of 19 articles published by the newspapers Estadão, Folha de S. Paulo, O Globo and GAÚCHAZH between December 2020 and September 2021. The data were processed by the Iramuteq software, analyzed using Descending Hierarchical Classification (DHC) and interpreted by Content Analysis. *Results*: The corpus yielded five thematic classes. These classes revealed the dissemination of information about vaccination against covid-19 for older people as a necessary measure for the health of this population, justifying the intense reporting of news on the vaccination campaign. The articles highlighted the organization of immunization policies, as well as their benefits for the older population, especially institutionalized individuals. In addition, the vaccine emerged as a key element in the fight to contain the spread of the coronavirus, increasing the protection of older residents of long-term care facilities and, undeniably, reducing the mortality of this population. *Conclusion*: The findings highlight the importance of disseminating health promotion policies across a wide variety of communication channels, allowing access to health information by all audiences and reinforcing the urgency of collective care practices offered to older people, including those residing in institutions.

Keywords: Covid-19. Older people. News Media. Vaccine. Health promotion. Long-Term Care Facility for the Elderly.

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INTRODUCTION

Covid-19 is an infectious, highly communicable disease caused by the SARS-CoV-2 virus. Around 3 months after the first cases were reported in December 2019 in Wuhan, China, the World Health Organization (WHO) declared the situation a pandemic[1,2]. This triggered the great world health crisis in the last 100 years[3,4].

Subsequently, lockdown and personal protection measures were implemented around the world, in addition to hand cleansing protocols and respiratory etiquette. The concerted efforts of authorities to implement public and health policies preventing further outbreaks sought to curb soaring mortality rates[5].

In 2020, older individuals represented approximately 53% of the deaths attributed to the disease in Brazil, emerging as one of the most vulnerable groups to the infection[6,7]. Given that aging is a natural process accompanied by numerous biopsychosocial changes, older individuals are more prone to developing chronic diseases and/or functional decline. These factors, in the context of the coronavirus, constitute a potential risk in this population[7,8].

With regard to residents of long-term care facilities (LTCFs), the situation caused by the coronavirus proved even more critical. The majority of such residents have chronic comorbidities, increasing their level of frailty and, hence, the chances of developing more severe forms of the disease[8,9].

In this setting, the search for treatment and a vaccine against covid-19 were viable actions to tackle the pandemic[10]. Although developing immunobiological agents takes time, efforts were made to ensure the efficacy and effectiveness of new vaccines in the shortest possible timeframe[11].

Following approval by international agencies, vaccination against covid-19 took center stage, where vaccination was made available free of charge to Brazilian citizens[5]. Vaccination proved the main strategy in controlling the novel coronavirus, with the potential to change the dynamics of the outbreak by reducing the number of severe cases and hospitalizations, and providing effective protection[6,10].

Initially, the priority groups were health professionals, indigenous peoples and institutionalized individuals aged 60 years or older[12]. Over time, the logistics of the vaccine rollout were adapted according to the specific needs of each area, allowing intensifying of vaccine measures[13]. Supporting biosafety actions in LTCFs, immunization took place in a manner which minimized transit of residents and exposure to risks by applying vaccines onsite within care facilities[14,15].

The body of evidence on the impact of the vaccine at a population level is growing. Media channels highlighted shifts in the dynamic of the pandemic, as reported by government organs globally, which included a decline in the number of cases and hospitalizations among older people and other population groups. However, the need for adherence to the recommended schedule of vaccine doses against covid-19 should be reiterated to the public, aiding mass immunity[16].

In this context, the information conveyed by the media on immunization of older adults is of great importance. Although major strides with regard to vaccination have been documented, a strong correlation between the number of deaths attributed to covid-19 in older individuals living in the community and residents of nursing homes is evident, highlighting the importance of community transmission, despite the raft of measures to protect residents of these institutions[17].

Since the start of the pandemic, countless reports have been published in news media channels on the subject. Against this backdrop, the present study sought to elucidate the type of content disseminated on covid-19 vaccination in national newspapers. Mass vaccination campaigns, incentivized by the media, brought about a shift in the Brazilian scenario, and likewise globally, with a decline in morbimortality associated with the coronavirus. This phenomenon confirms the influence of news reporting on the mindset of the public, prompting greater adherence to the vaccines available. In this context, the objective of the present study was to assess the media content

produced on vaccination against covid-19 targeting older people in Brazil.

METHOD

A descriptive, exploratory desk research study was carried out involving compiling the news items available on the internet. As the data source, the study drew on news reports published by the national newspapers the *Estadão, Folha de S. Paulo, O Globo* and *GAÚCHAZH*.

According to information from the Circulation Verifier (IVC Brasil) for 2020/2021, these Brazilian newspapers had the highest general readership in terms of circulation and daily print runs and were therefore elected as the search sources for the present study. The IVC Brasil is a national entity responsible for multi-platform media auditing. The entity provides data on communication, circulation, events and others, interconnecting figures for a range of audiences to agencies in the sector[18].

As a research instrument, the search tool offered by the website portals of each of these newspapers was employed, in the capacity of service subscriber of each title, given that non-subscribers had only limited access to the database of past articles. The search descriptors selected were the search strings "vaccination in older people" and "covid-19", and the search period spanned from December 2020 to September 2021. This sample time window was necessary due to the vast number of news texts on adolescents and younger people who later became a priority focus of vaccine campaigns. Column-based reports or news items covering the topic and available online in full were included. Content addressing the topic with other audiences or purpose, or not involving news texts, such as adverts and publicity pieces, were excluded.

News items were selected according to headline/title, read and then stored in a digital spreadsheet along with the following parameters: newspaper, publication date, headline, type of item, content link, and topic. For data processing, an analysis *corpus* was constructed based on the content selected, in the form of a single text file encompassing all of the items chosen.

The database was processed using the free software tool IRAMUTEQ (*Interface de R pour analyses Multidimensionelles de Textes et de Questionnaires*), allowing statistical analyses to be performed on text corpuses and individual tables/words, organizing and identifying the elements with the highest representativeness[19].

In the present study, the Descending Hierarchical Classification (DHC) was used, by which text segments are classified according to their respective vocabulary. Use of matrices cross-referencing text segments and words yields a stable definitive classification, deriving the classes and organizing the data into a dendogram[19]. Content analysis was then performed, enabling inference and interpretation of the results.

The report generated by the IRAMUTEQ tool classified 73.41% of the material as relevant. Classification of at least 70% of the text units assures robust reliable results[19]. Based on the analysis of the data compiled, word groups were produced and presented in the form of a dendogram.

RESULTS

The search led the retrieval of 190 news items. Of this total, 19 met the inclusion criteria and were included in the study. Most of the items selected were published in the Estadão newspaper (42%). Regarding type of news content, there were more news reports than column type publications. These findings are presented in Table 1.

Analysis of the text *corpus* revealed 13,262 instances of words, comprising 3061 distinct forms. Thus, the *corpus* was divided into 361 elemental context units (ECUs), of which 265 (73.41% of total words) were matched using DHC of text segments, indicating the degree of semantic affinity of the resultant classes.

The *corpus* was divided into two main different themes: *Organization of covid-19 vaccination policies*, accounting for 54% of the total ECUs analyzed; and *Benefits of vaccination for LTCF residents*, representing 46% of the content analyzed. The 5 classes derived from the partitions of the corpus are depicted in Figure 1.

Table 1. Proportion of news items on covid-19 vaccination for older people, by newspaper and type. João Pessoa/ Paraíba state, 2022.

News items selected by newspaper		Type and no. of news items	
O Globo	6 (32%)	Column	2
		Report	4
Estadão	8 (42%)	Column	3
		Report	5
Folha de São Paulo	1 (5%)	Column	0
		Report	5
GaúchaZH	4 (21%)	Column	0
		Report	4

Source: produced by authors

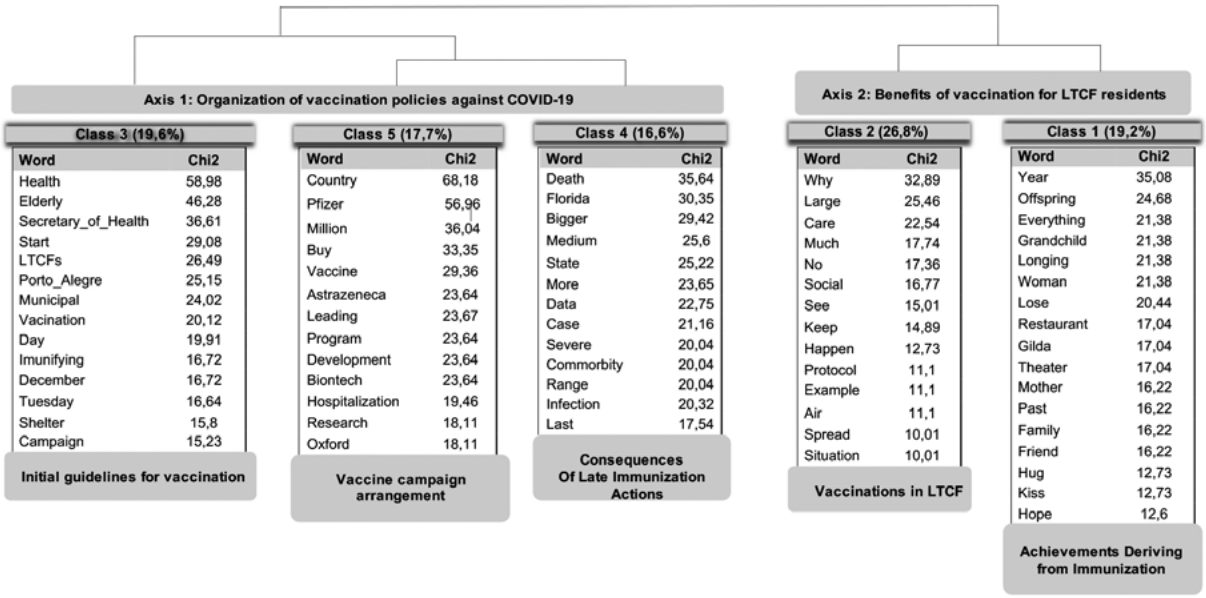

Figure 1. Dendogram of main themes on vaccination for older adults reported in news media channels. João Pessoa, Paraíba state, 2022.

Source: produced by authors using Iramuteq software.

Class 3: Initial guidelines for vaccination

In this class, the news items emphasized the commencement of vaccination in Brazil and worldwide, expounding on the distribution of vaccines to the population, and also the logistics for determining priority groups to receive immunization against covid-19, as illustrated in the passages below:

> "The United Kingdom began vaccination on 8th December, following approval of the *Pfizer* vaccine. Roughly 400,000 older adults and health professionals are covered by the initial campaign; older residents of nursing homes and staff are priority" (Estadão, 14/12/2020).

> "Each state has devised a vaccination plan. According to rules for Rio de Janeiro, only health professionals and older residents of some nursing homes can receive the little over 480,000 vaccine doses in this first stage" (Folha de São Paulo, 22/01/2021).

The news items also report how the cities, states and Brazilian Federal government, as well as the experience of European countries, have systematized the start of the campaign for the vaccine. Moreover, they reveal that the oldest old residing in institutions, a group highly vulnerable to covid-19, were prioritized at the outset in different locations.

Health professionals, including those practicing in LTCFs, were also prioritized due to the need for care and protection of residents in these facilities.

Class 5: Organization of vaccine campaign

Results showed that the global panorama of the vaccination campaigns against covid-19 was a focus of news media reports. Thus, class 5 shows the planning and legislative procedures behind the acquisition of vaccines and their availability to society. In Brazil´s case, the national health system (SUS) provided free immunization at a nationwide level.

> "Brazil is a world reference in large-scale immunization programs and has a public health system (SUS) which reaches remote regions of this country of continental proportions" (Estadão, 14/12/2020).

> "Over this period, the vaccine may have saved the lives of up to 58,000 people aged 60 or older, according to figures projected by the epidemiologist Marcelo Gomes" (O Globo, 18/07/2021).

The media also reported on the need to invest in large-scale immunization, given that studies around the world had shown that the start of vaccination promoted an improvement in the situation for the population, particularly older people, with a lowering of hospitalizations and severe cases. The organization of campaigns in Brazil and other countries required huge financial investment. However, deaths were avoided and costs of lengthy hospital stays reduced.

Class 4: Consequences of delayed immunization actions

The news items selected in this class report on the consequences arising from delays in commencement of vaccination in different countries. These delays resulted in a worsening of the pandemic crisis with an increase in number of hospitalizations and high mortality rate.

> "The data on the pandemic in Florida, sparser since the state lifted the emergency for covid-19, reveal only limited information on who is dying. Hospitals stated that over 90% of their patients were unvaccinated" (Estadão, 30/08/2020).

> "If vaccination had not commenced, Rio de Janeiro would now be seeing peaks of over 350 deaths per day, whereas the 7-day rolling average is below the 120 notifications mark" (O Globo, 18/07/2021).

The passages reveal that adopting a preventive approach through vaccination can avoid negative consequences for older individuals and other population groups. The media also highlights that delayed actions represent a major obstacle for health promotion, holding back the running of interventions to ensure well-being, in stark contrast with the positive outcomes seen in areas where early vaccination was carried out.

Class 2: Vaccination at LTCFs

Class 2 is the largest of the classes, being part of the second theme of analysis and having a direct focus on vaccines against covid-19 for residents of LTCFs. The content shows that initial vaccination in LTCFs was prioritized worldwide given their residents were cause for major concern owing to the high rates of infection, transmission and severe cases.

> "Immunization will be carried out in 5 stages: in the first, 650,000 older residents of LTCFs will be vaccinated; in the second, individuals aged older than 75 and older than 65 years with comorbidities" (Estadão, 14/12/2020).

> "There are 90 older residents and 120 staff of the LTCF. This is literally lifesaving because they are not just high-risk, but extremely high-risk. They have been under lockdown for 10 months" (GaúchaZH, 19/01/2021).

The frailty of older residents of LTCFs is multifactorial, making them a top priority. The aging process, comorbidities, immunosenescence and close contact with other older residents, negatively impact their health, calling for extra care measures amid such a major pandemic.

Class 1: Benefits derived from immunization

Class 1 expounds on the benefits provided by covid-19 vaccination for LTCF residents. Although the population as a whole has been hit by the pandemic, albeit economically, physically, mentally or socially, older individuals develop more severe symptoms of the disease, particularly those who are institutionalized.

> "After almost a year without hugs or kisses from the family and friends, this group of over 60s and 70s can get their first dose" (O Globo, 16/01/2021).

> "We are delighted to be out after 1 year and 10 days, it was high time! It's an injection of vitality, dreams and great optimism" (Estadão, 25/02/2021b).

The reports show that, after vaccination, family visits and interaction among the older residents, which had been banned to prevent contamination and local outbreaks, could now be resumed, allowing a change in the prevailing scenario of insecurity, loneliness and fear. This content reflects the situation experienced by older people who were shielded from their families and not allowed to mix or interact with the other residents of the nursing homes.

According to the Descending Hierarchical Classification, the relationship between the classes (Figure 1) shows that the news content on covid-19 vaccination demonstrates that large-scale immunization is advocated by most news media channels as a solution to the crisis created by the disease, providing a range of benefits for the population at large, especially LTCF residents, leading to an improvement in quality of life.

The media content produced on vaccination against covid-19 aimed at older people in Brazil is constructed and conveyed through an information network, conferring a positive influence on vaccination take-up. Although older people may be aware of the importance of vaccination, influence from third-parties can often be necessary to prompt them into actually getting vaccinated, further corroborating the importance of the role of media in fully covering the matter.

DISCUSSION

The meaning derived from the materials analyzed on vaccination against covid-19 brings to the fore the content covering the organization of policies for implementing the vaccine in Brazil and the main benefits for the older population. With regard to the action of the vaccine, this was administered with the goal of reducing the risk of severe cases of infection and proved a focus of reports in all newspapers searched.

The results of the present study suggest that the content of the news items portray the vaccine as an effective measure against the coronavirus disease. The logistics for distribution of the vaccine featured as a key factor, ensuring that the population, including those in remote locations, had free access to the vaccine under the national health system (SUS). Thus, operational planning for commencing vaccination, as outlined in Class 3, was essential.

Vaccine programs are regarded as one of the most successful and effective health intervention strategies for the population in combating infectious diseases. This explains why its implementation, in conjunction with other measures aimed at protecting health, constituted a promising element to mitigate the spread of covid-19[20].

Hence, vaccination efforts have a positive impact in disassociating the disease from death. Given that vaccines can prevent serious outcomes and hospitalizations, changing the *status quo* from one of pandemic to endemic, it is vital for public health entities to devise strategic measures to vaccinate the whole population, with the aim of achieving maximum immunity on a global level[21,22].

With respect to these conditions, the National covid-19 Vaccination Rollout Plan faced challenges along the way, such as availability of up-to-date population-based data, where the last nationwide census took place 12 years prior[23,24]. This increases the efforts needed at state and municipal levels to manage registries of individuals who have been vaccinated and those yet to receive the vaccine.

Therefore, the most effective strategy for structuring health campaigns was based on the use of microplanning. These approaches entail a set of strategic actions and methods which pool local information, logistics analysis, monitoring tools and population databases[23-25]. This information was used to map the target population and the most effective actions to reach priority groups[26,27].

It is noteworthy that vaccination against covid-19 may require a variety of strategies contingent upon the supply of different manufacturers, age range and groups, as well as specific local conditions[27]. Nevertheless, given their potential for containing infectious diseases, it is paramount that campaigns are mounted as soon as vaccines become available[28].

Efforts are made toward structuring and organizing vaccine campaigns in a bid to optimize the vaccination process, conferring immunity to the population as rapidly as possible, curbing the spread of diseases. Over this period, Class 5 highlights the context of Brazilian planning.

Clearly, wealthier countries, particularly China and Japan, made heavy use of technology to aid the process of registration and checking of vaccination status, assuring greater safety and adherence to recommended protocols[29]. This contributed to increased compliance and faster meeting of goals.

A number of studies show that, after commencing the vaccination program, there was a considerable decline in infections, hospitalizations and mortality attributed to the virus[13,15,16]. However, besides reducing cases, vaccination reopened up socioeconomic activities[30]. Countries with larger economies had more effective vaccination campaigns, providing high coverage of the adult population, leading to lifting of restrictions and earlier resumption of activities[31].

In this respect, one of the fundamental aspects for successful large-scale vaccination is information. The population needs to be aware of the benefits in order to take up the vaccine[32]. Countries that failed to adopt effective covid-19 vaccination measures, including health education, faced negative consequences of delayed actions, as shown in Class 4.

Limited adherence of South American countries, in terms of effective measure to curb the virus, led to further spread and rising rates of transmission and mortality as the months went by[33]. This issue was recurrent in the news items, revealing that measures to combat the disease were implemented differently depending on location.

On this front in Brazil, there was a lack of standardization and integration across cities and states, leading to disparities in decision-making and consequent differences in the number of cases and death tolls throughout the country, with contamination levels remaining high[33]. Moreover, risks such as the steady rise in hospitalizations and deaths, along with difficulties countering variants of the novel coronavirus, placed an increasing cost burden on the health sector and other areas[13].

Delayed decision-making, out of step with guidance recommended by the WHO, as well as the adoption of ineffective health policies, had repercussions not only for the local population, but also for overall immunity, promoting outbreaks that were localized or affecting specific populations[33].

Amid this scenario, at the outset of the pandemic, more specifically during the first wave of covid-19, LTCFs worldwide were the hardest hit by outbreaks of the disease[33]. The absence of action plans and public policies to address the situation caused thousands of residents in these areas to develop severe infections and/or evolve to death. The news covering this aspect can be found in Class 2, showing that the main factor responsible for turning the prevailing situation around was vaccination.

After launching of the vaccine campaigns, the older population showed renewed optimism and resumed their daily routines, which was further restored with the arrival of the so-called "new normal". Thus, it is undeniable that the pandemic

heightened concerns over environments housing older people, including LTCFs, because these facilities tend to accommodate older individuals who are more frail. This calls for constant scientific updating, with actions based on the latest evidence aimed at preventing contamination by SARS-CoV-2, allowing this to be tackled, while maintaining respect for older members of society, caregivers, family and workers[14].

Studies support the positive impact of vaccination[15,16]. The first dose of the covid-19 vaccine in residents of LTCFs resulted in a 40-50% reduction in infections, rising to 80-90% protection with the full vaccine schedule. Concerning severe cases, vaccination promoted a 95% reduction in hospital admissions and 97% decrease in mortality risk[35].

The potential of protection, particularly among more frail individuals, provides fresh hopes of social interaction, as reported in the news items contained in Class 1. Given that these individuals have come through an extremely lonely pandemic, uncertainties associated with the novel coronavirus can be attenuated by vaccination.

Notwithstanding, older residents of LTCFs are, in many ways, already somewhat isolated from social interactions, having contact only with fellow residents, staff and family members who visit regularly. Amid the pandemic, the news content confirmed that lockdown and social distancing were further reinforced, with restrictions being eased only after administration of 2 doses of the vaccine, allowing resumption of safe contact with others which, for many, symbolized a return to normal life.

Thus, the influence of communication channels on which topics were discussed socially should be recognized. On the one hand, the media reported the difficulties faced by more frail older individuals, together with the health policies for organizing the vaccine campaign, which met with some push back from governments and the population, undermining planning efforts; on the other hand, the benefits gained by areas which implemented the campaign earlier were used to justify the imminent need for wider adoption of these actions, outlining the advantages of implementation.

Nevertheless, the dissemination of information in the news media contributed toward building an image of the vaccine as fundamental for maintaining health in society, broadening knowledge on vaccination and undoubtedly influencing the take up of the vaccine.

The present study has some limitations, including the use of written text only, where the stock of images employed in news items was not examined and nor was the time bias of information.

CONCLUSION

This study revealed how the news media influenced the start of vaccination against covid-19, and likewise the measures adopted and their impact on the population. The results presented show that the vaccine campaign was extensively reported, with news items that focused on the risk faced by unvaccinated older individuals, along with the benefits of applying the vaccines.

In this sense, actions targeting the older population in general and residents of LTCFs, a priority group for receiving the vaccines from the outset, show that the global pandemic phenomenon reiterated the need for quality gerontological care, while underscoring the need to confer new meaning to care actions for older people.

Similarly, the news content highlighted high morbimortality as a consequence of delayed implementation of vaccination, besides other difficulties faced by the population at large. Thus, the covid-19 vaccine emerged as a key component in the effort to curb the spread of the virus, spelling hope of better times ahead for the older population amid the unprecedented crisis experienced worldwide.

Therefore, understanding the approach to the issue during the course of vaccination against covid-19 allows reflection on the proposal of these measures for health, which impact care quality, satisfaction with services delivered, case reduction, and disease prevention.

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"Go home, old man!" Ageism in the covid-19 pandemic: netnography on the Youtube™ platform

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Abstract

Objective: To analyze the repercussions of ageism directed at older people during covid-19, through the content available on the Youtube™ platform. Method: Netnographic, exploratory and qualitative study, whose data were collected in videos on the Youtube™ platform; a thematic analysis of Bardin's content was performed and the elements were discussed in the light of the Theory of Stigma. Results: Three categories explain the repercussions of the investigated phenomenon: expressions of ageism pre-existing to the pandemic, with expressions of exclusion, disregard and disrespect; expressions of ageism during the pandemic from the risk group label that strengthens stereotypes of sick and incapable people; and feelings and attitudes of the older people towards the repercussions of ageism, which led to repercussions on social interactions, lifestyle and health of older people. Conclusions: The repercussions can cause physical, cognitive, social and psychic sequelae, and the fight against its impacts starts from the educational sphere towards a social pact that allows a respectful and empathetic coexistence between generations.

Keywords: Ageism. Older people. Pandemics. covid-19. Internet use.

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INTRODUCTION

The first victims of covid-19 were older people, which raised distinction in the way of treating them and highlighted the ageism present in societies. Ageism[1] manifests itself when one age group addresses another, based on stereotypes created to discriminate against people based on their chronological age[2], whether due to ideological aspects — based on characteristics attributed to an age group — or practical/behavioral aspects — through judgments, beliefs and attitudes.

In the context of the pandemic, this phenomenon became evident in the treatment given to older people, over 60 years old, in the association with stereotypes/negative images and deterioration of physical and cognitive/behavioral capacities[3]. Prevention procedures were used to justify attitudes of depreciation and discrimination/stigmatization of older people[4,5], it is important to emphasize that stigma is a mark/impression that is carried throughout life, established by society to categorize people and the attributes considered as common and natural for members of each of these categories[6].

The stigma that permeates old age/aging was boosted during the pandemic, when prejudiced attitudes made some people think that the pandemic was an "older people's problem" and only the older people should be in social isolation[7], since old age is associated with economic spending, social burden and symbol of unproductivity[8]. This stigma also arises as a consequence of the non-enforcement of laws that protect and guarantee the rights of Brazilian older people[9].

This problem disregarded a history of epidemic outbreaks that occurred over the centuries and showed that the best preventive measures for the advancement of highly contagious pathogens were vaccination, quarantine and lockdown[10] of the entire population, not just risk groups.

During social distancing, it was necessary to seek means that would serve as a bridge between people and the new knowledge that emerged about the disease, as well as to achieve forms of socialization during distancing. For this, it was possible to use the internet, which despite having negative aspects in its use, such as the consumption of untrue content and excessive time in front of the screen, which cause concerns, repercussions on well-being, exhaustion and sleep disturbance, is of great importance for streamlining communication and disseminating information. Social networks are the methods of choice for posting common activities, especially the Youtube™ platform, due to the ease of sharing videos capable of expressing opinions, transmitting knowledge, spreading news and being used as a source of information on health-related matters[11].

In view of this, videos on the Youtube™ platform gained national repercussion and visibility, raising relevant debates and reinforcing the importance of this study, especially by demonstrating ageism, based on narrated situations, and its repercussions for the older population. In addition, it is important to demonstrate how these narratives relate to the Theory of Stigma[6], with a view to strengthening the fight against the problem.

In this context, the objective of this article was to analyze the repercussions of ageism directed at older people during covid-19, through the content available on the Youtube™ platform.

METHOD

Exploratory study with a netnographic qualitative approach developed based on the methodological rigor criteria of the COREQ checklist, which has been frequently used for ethnographic approaches applied to the study of cultures and online communities within consumer and marketing research. Netnography is distinguished from other types of qualitative research on the Internet by presenting, in a single term, a set of guidelines for carrying out computer-mediated ethnography and its integration with other forms of cultural research[12].

The "YouTube™" video sharing site has the virtual address: *www.youtube.com.* This investigation was not submitted to the Research Ethics Committee for consideration because it was the use of publicly accessible data, as established by the ethical standards of the platform itself, as well as by Resolution 510/2016 of the Brazilian Health Council[13] and by the Federal Law 12527/2011[14].

Videos were searched based on the following inclusion criteria: having been posted from March 20, 2020 (start of the pandemic) to May 2021 (start of vaccination of older people); address content related to ageism and covid-19; be available in Portuguese, English or Spanish; having been presented by older people, whether they are narrating their own experiences and/or those of third parties.

Videos with reproduction difficulties, with duplicate content or of dubious character (checking the news channel and its content for veracity and reliability, giving preference to official channels and those of researchers that presented scientific references), as well as those that did not contain content referring to the repercussions of ageism on the covid-19 pandemic.

The selection and data collection took place in February 2022 through the keywords: ageism; ageism in the pandemic; ageism in covid-19; prejudice against older people in the pandemic; ageism in the pandemic; age discrimination; stereotype; gerontophobia; old age; ageism; old phobia; old age; stigma; prejudice; and its correspondents in Portuguese and Spanish. These keywords were combined to create the expressions: *"ageísmo pandemia"; "ageísmo covid-19"; "preconceito contra idosos na pandemia"; "preconceito de idade na pandemia"; "gerontofobia pandemia; etarismo pandemia"; "velhofobia pandemia"; "idosismo pandemia"; "violência idoso pandemia"*; "ageism pandemic"; "old age pandemic"; "gerontophobia pandemic"; "ageism covid-19"; "*edadismo pandemia*"; "*discriminación por edad pandemia* e *discriminación por edad* covid-*19*".

The content search and selection process was carried out by a researcher and is detailed in Figure 1. The information from the final corpus of the videos was organized in a table in Microsoft Excel and identified by title, access link, channel and date of posting and duration (Chart 1).

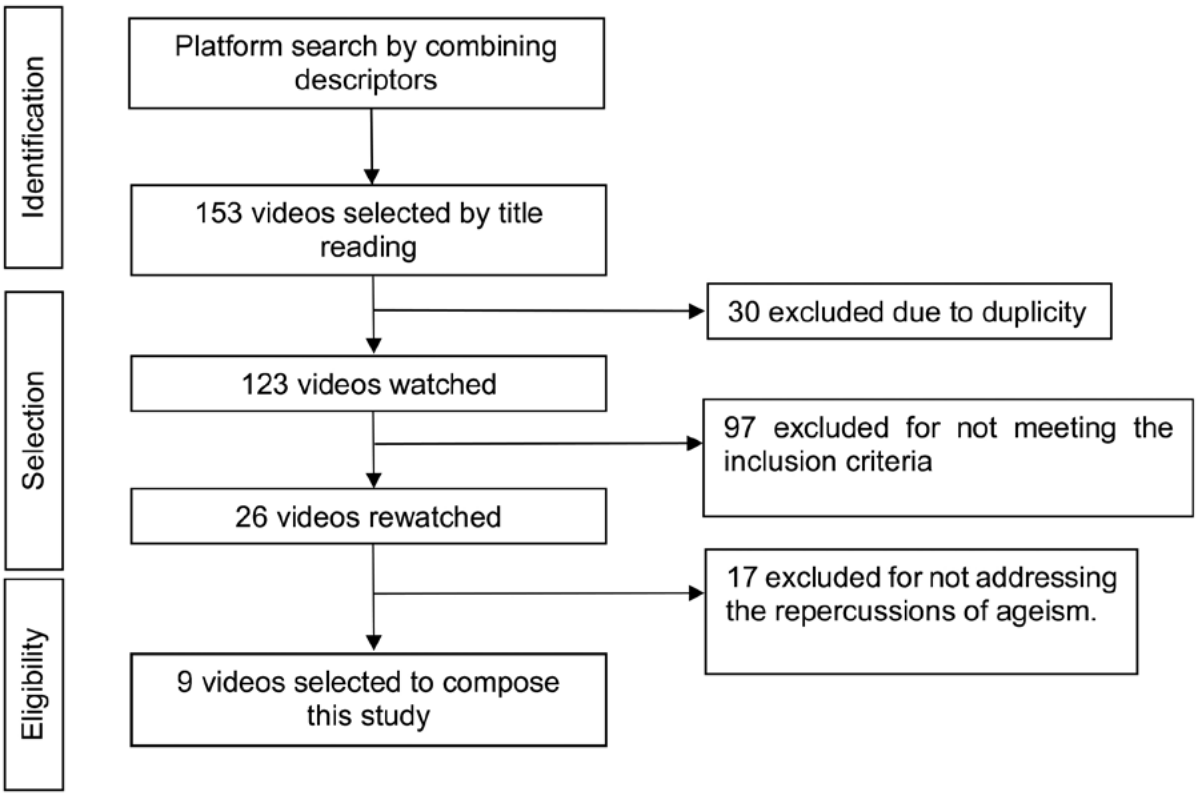

Figure 1. Flowchart of the video search and selection process. Feira de Santana, Bahia, Brazil, 2022.

Source: Own elaboration.

Data analysis was guided by an in-depth study of the videos, in which an attempt was made to understand the reports narrated individually through Bardin's[15] thematic content analysis, which focuses on qualifying the subject's experiences, as well as their perceptions about an object and its phenomena, allowing the discovery of social processes still little known about specific groups and the adoption of new approaches, in addition to the revision and creation of new concepts and categories during the investigation[15].

In the pre-analysis, the materials to be used and the keywords were chosen, the videos were searched and the material was selected. By watching all the videos, it was possible to know the content of each one of them, to obtain the first impressions and to constitute the *corpus* of the study of relevance for the research based on the inclusion and exclusion criteria.

In order to explore the material, all the content of the videos was transcribed into text format in a Word file. Then, the material was read and possible errors were corrected. Videos in English and Spanish have been translated into Portuguese. Subsequently, the typed material was read exhaustively and the contents were codified by cutting out the recording units related to the theme of the repercussions of ageism in the covid-19 pandemic. This phase was validated by two researchers, doctor and master, with expertise in the subject and in the study of the Theory of Stigma[6].

For the interpretation of the material, the recording units were grouped by similarities and differences, generating the categorization, whose interpretation was performed based on Goffman's Theory of Stigma[6], which discusses how society establishes means to categorize people and attributes considered common and natural for the members of these categories — as certain marks or characteristics that stigmatize the subjects —, and as derogatory attributes that can make the subjects react or accept the conditions that are imposed on them as "normal" or "abnormal". Such theory helps to identify central features of stigmatized people's life situations and how they affect social and personal identity.

Each video was identified with a number from one to nine, and each excerpt relevant to the research was identified with the initials of the person who expressed themselves in the video, with the expression Without Identification (WI) being used for a person whose name was not revealed.

RESULTS

The selected videos are characterized in Chart 1, based on the categories: pre-pandemic expressions of ageism; expressions of ageism during the pandemic; and feelings and attitudes of the older person towards the repercussions of ageism.

Data analysis revealed content related to ageism that was culturally accepted, albeit veiled, directed at older people even before the pandemic (Chart 2).

The content of the videos presented findings that demonstrate ageism in the pre-pandemic period and the subsequent addition of new ageist elements, strengthened from the health, political, socioeconomic and cultural crises.

The repercussions of ageism generated feelings and revealed attitudes of prejudice and discrimination experienced by the older population (Chart 4).

Chart 1. Characterization of videos related to the repercussions of ageism during covid-19 on the Youtube™ platform. Feira de Santana, Bahia, Brazil, 2022.

Nº	Título	URL	Channel	Posting date	Video duration
1	Ágora Abrasco: Painel: Idadismo e a pandemia de coronavírus - só o fez aumentar!	https://www.youtube.com/watch?v=urLIoxk43lA&t=2841s	TV ABRASCO	August 17, 2020	1h 42min 06seg
2	Casos de violência contra Idosos dispararam no Brasil durante a pandemia	https://www.youtube.com/watch?v=pEnrKu-ww_Y&t=1s	Acta Oficial	July 14, 2020	5min 56seg
3	Coronavírus e o preconceito contra idosos no brasil	https://www.youtube.com/watch?v=e1p_heSuwlg	UOL	May 21st, 2020	3min 32seg
4	Depoimento - Ageísmo	https://www.youtube.com/watch?v=4FzBxZlfC9w&t=16s	Programa USP 60 mais	April 06, 2020	2min 53seg
5	Discriminación que sufren los adultos mayores, incrementado en ésta pandemia del Coronavirus	https://www.youtube.com/watch?v=ZLCuBWFqZXw&t=1s	ASV	July 1st, 2020	2min 56seg
6	Margaret Morganroth Gullette, Instead...How Ageism Worsened in the Pandemic	https://www.youtube.com/watch?v=49b656cchEA	Lise Gottell	October 16, 2020	1h 28min 28seg
7	Pandemia de covid-19 e a evidência da "velhofobia"	https://www.youtube.com/watch?v=MMqSvKystI8&t=65s	Rádio UERJ	September 29, 2020	10min 15seg
8	Pandemia fez aumentar violência sobre idosos	https://www.youtube.com/watch?v=xRSOhi6j3WE	Euronews	February 23, 2021	2min 45seg
9	Preconceito na pandemia: idosos sofrem com piadas nas ruas	https://www.youtube.com/watch?v=PdzHlPJogNs	TV Portal Terceira Idade	April 21st, 2020	4min 13seg

Source: own authors.

Chart 2. Fragments of the repercussions of pre-pandemic ageism on the Youtube™ platform. Feira de Santana, Bahia, Brazil, 2022.

GENERAL EXCLUSION
"[...]*to get old, to survive, it's a struggle between life and death.*" (V1_LV)
"[...]*I thought it was important to emphasize the issue of inclusion, it is impossible to be including and feel included if you lead a life of exclusion, having to endure prejudices".* (V1_AK)
"[...]*Question: Have you ever suffered any kind of ageism? Answer: I go through this practically every day".* (V4_MJ)
EXCLUSION IN LEARNING SPACES/DIGITAL EXCLUSION
"[...]*and I include myself, as an older person, knowing that I can collaborate in some way in the transmission, in the use of these digital means, now that I am somehow in the process. I am included as an older person in this community that uses digital media to act against the prejudice that excludes me. It seems to be intentional, taking us back to the holds of the ship, especially when you're black. So you have to face these teachings*". (V1_LV)
" [...]*I looked on the internet for a course that I was interested in, but when I accessed the site I saw that it was only for people aged 18 to 35. I was at a loss to understand why, as I am a technologically active person. Why discriminate against age? Maybe I learn slower, in the face of artificial intelligence, but that doesn't mean I can't learn".* (V4_MJ)

to be continued

Continuation of Chart 2

DISREGARDING THE VARIOUS WAYS OF BEING AN OLDER PERSON
"[...]*most people set standards and don't give older people a chance. There are people aged 65 who have more difficulty with mobility, but not all 65-year-olds will be the same, they vary according to experience and cannot be leveled. It's rude situations that have been happening".* (V4_MJ)
"[...]*in addition to the various forms of reproducing prejudices, I experience aesthetic behavioral pressure. When a person turns 60, it's as if they were given a list of behaviors and those who don't follow them receive a series of judgments. It is as if certain practices, such as sex for example, become inappropriate just because the person has aged.".* (V7_D)
DISRESPECT OF THE RIGHT OF OLDER PEOPLE TO HAVE ACCESS TO PUBLIC TRANSPORTATION
"[...]*when I get on public transport, people discriminate against me, they don't give me a seat".* (V4_MJ)
LABEL OF SICK, WEAK, BURDEN AND UNPRODUCTIVE
"[...]*ageism has developed very quickly and is built on existing hostilities, but the new ageism of the covid-19 era, surprisingly, has increased these hostilities, especially in the US, in the face of the belief that we are old, sick, susceptible to die and we live too long, whose treatment with health would be useless and expensive, acting with indifference to our well-being. The problem has become common in Reddit posts and non-serious tweets, but also in articles published in respected magazines.".* (V6_MM - translated)
"[...]*although they seem harmless, many comments have a strong negative, unproductive and unnecessary charge towards the older person".* (V7_D)
MISTREATMENT AND VIOLENCE
"[...]*I was hungry, I had nothing to eat, I was treated badly by my family, because I was old".* (V2_SJ)

Source: own authors.

Chart 3. Fragments of the repercussions of ageism during the pandemic on the Youtube™ platform. Feira de Santana, Bahia, Brazil, 2022.

STEREOTYPE OF SICK, BURDEN AND DISPOSABLE
" [...]ageism is lethal, it meant wishing us dead, naturalizing older people to die naturally in an epidemic*".* (V6_MM - translated)
"[...]*authority figures in some popular discourses have found our supposed weakness to be a useful mortal destiny. A Vice Governor in Texas said on FOX NEWS that we should be willing to risk our survival for the sake of the economy, that we older people wouldn't matter in a revived economy. A Fascist version of fantasy coming from your own governor".* (V6_MM - translated)
"[...]*I was taking a document to the city hall when a car passed by and shouted at me 'go home, "you old man"' that's not what he said, but I'll say that was it. Older people, when they need to go to the street, eventually buy a medicine, or in a supermarket, they cannot be questioned and be embarrassed that way".* (V9_P)
OLDER PEOPLE AS A RISK SUBJECT
"[...]*it's pretty sad. At the beginning of the pandemic, I observed the spread of several prejudiced discourses: 'This disease only affects old people'. Inappropriate speeches by our president of Brazil: 'Put grandpa and grandma in the corner', when suggesting isolation only for older people. These inappropriate speeches negatively impacted health, bringing psychological distress".* (V7_D)
DISRESPECT OF THE RIGHT OF PRIORITY IN VACCINATION
"[...]when imagining that older people could be given priority to get the vaccine, I feared that the population could complain and make negative statements, with jokes". (V1_AL)

Source: own authors.

Chart 4. Fragments of the feelings and attitudes of older people towards ageism on the Youtube™ platform. Feira de Santana, Bahia, Brazil, 2022.

FEELINGS
"[...]*the biggest offense I've ever experienced is when they say to me: 'Wow, but you have a 30-year-old spirit'".* (V3_DV)
"[...]*I feel upset at being treated like someone who has problems and difficulties".* (V4_MJ)
"[...]*I have friends who have experienced issues such as threats of sexism, racism, classicism and ageism".* (V6_MM - Translated)
"[...]*An example of ageism is when we are treated in a childish way".* (V7_D)
"[...]*there are thousands of older people who are in the same situation as me, isolated, living alone, it's terrible".* (V8_WI - Without identification)
ATTITUDES
"[...]*we seniors are disciplined, we take care of ourselves, we find different ways of living, we make handicrafts or masks, we cook, we practice gardening, we read and we connect with our emotions, to face discrimination".* (V5_MT - Translated)

Source: own authors

DISCUSSION

The netnographic findings made it possible to verify the configuration of the ageist manifestation that stigmatizes older people, by excluding this population from digital learning spaces, disregarding the ways of being an older person, and disrespecting the right to have access to public transport. Thus, the labeling and stereotype of "sick", "weak", "burdensome", "unproductive", "disposable", contributed to mistreatment/violence, marking as "subject of risk", disrespect for the right of priority in vaccination and the outbreak of negative feelings and attitudes to face the problem of ageism.

The establishment of normative attributes to categorize people in what is considered common and natural imputes estrangement and deterioration of social identity[10], making it "different". The installation of these normative attributes can revert to stigma: what is negative about the moral status of a person in relation to another. Such normative determination imposes social categories of forced framing/fitting, permeated by stereotypes[11] about the older person, which implies prejudice/discrimination. The exclusion derived from stigma surprised men diagnosed with covid-19, marked by class and gender privileges, not used to being demoted in interactions when compared to other groups[16].

Exclusionary attitudes can be implemented against older people, reverting to ageism[17]. In this sense, stereotyped expressions about the perceptions one has about other people based on age are aggravated by the intersection of social markers of discrimination throughout life: when the stigmatized person starts to have the same beliefs about his identity as those who stigmatizes.

In order to avoid negative experiences and feelings related to the deterioration of the social image, many stigmatized older people can assume behaviors/attitudes/practices in advance to respond and/or create barriers and defend themselves against ageism through withdrawal, social isolation or even aggressiveness. In view of this, it is essential to carry out actions that promote the self-care of the older person in order to avoid biopsychosocial deficits[18]; inter-institutional strategies aimed at advocating and supporting the older population to know, recognize and establish effective measures to face ageism and its repercussions.

The absence of effective responses and/or coping strategies includes not only those that can be taken by those who suffer stigmatization, but those that could be carried out by the entire apparatus of public devices, which makes many older people ignore their own wills, become depersonalized and abdicate their rights, favoring the growth of ageism as an inappropriate but common practice. However, there was a loss of hope, meaning/purpose in life, the imposition of marks of asexuality, mental illness and suicide, as they judged themselves to be inappropriate to live collectively in old age[4].

The labeling of older people in the covid-19 pandemic was another significant finding in our study. It should be noted that the ageist label imputes the idea of being "incapable", favors discrimination[19], limits opportunities and reverberates in a feeling of indignation at the "impossibility" of learning to use technology, especially in the period of greater social isolation and lockdown, despite having the intellectual capacity to do so and showing a strong advance in the number of older people with internet access, especially in relation to the use of smartphones[20].

Another important finding concerns the derogatory images and attitudes of life in old age, which constitute the pillar of support of ageism[4] and are manifested through expressions of "sick" and "burdensome" to the health system, which highlights a serious social problem installed, which can put the lives of the older population at risk, as seen in countries like Spain and Italy, which have established genocidal measures against older people in nursing homes[21].

In some countries, protocols explicitly used age as a criterion for the allocation and non-allocation of treatment, with an age limit for access to intensive care and the use of ventilators[22]. The establishment of purely age criteria strengthens labels that are harmful to health, which directly compromise access to health services and interfere with the quality of health care[23]. This bad practice, through decision-making on whether or not to maintain the life that is breathing with the help of a mechanical ventilator, in the occupation of an Intensive Care Unit bed, continues to be perverse and takes many lives, as it takes into account, mainly, the age of the subject[17]. Restrictions based only on chronological age reinforce discrimination and reduce human life to arbitrary numbers, which disregard values and choices. Thus, despite ethical recommendations aiming at fairer resource allocation protocols, it is still essential to educate health professionals to recognize institutional ageism[24].

Negligence in care and the occurrence of physical/psychological violence in spaces of protection, such as Long Term Institutions (LTI), were not exempt from suffering from ageism. Both managers and professionals who work in these spaces are able to perceive the configuration of violence in some particular situations: (1) violence before institutionalization, motivating reason for sheltering; (2) institutionalization as an act of violence, when the family disregards the older person's autonomy regarding their desire to go to the institution or not (absence of any assistance/attention) or when they abandon the older person; and (3) absence/limitation of public policies, lack of State actions, little effectiveness of existing legislation[25].

In view of this, the institutionalized older population that already suffered from the effects of isolation and social negligence[26] saw itself as a victim of discrimination, through the media discourse that revealed exclusionary speeches, of social non-acceptance, provoking identity shame, self-hatred, self-deprecation and self-isolation[10].

If, on the one hand, there was a narrative that the older population was the most affected by covid-19[3], on the other hand, there was the representation of the "vulnerable subject", "dangerous" and "disposable", becoming the "other" of the pandemic. In this sense, older people would be the only ones capable of dying from the disease or transmitting it, an idea that was perpetuated for a long period of disease dissemination[4]. As a consequence, there was a lack of priority in investments in the health of these people[4], which led to the curtailment of the right and opportunity of the older population to benefit from therapeutic measures.

In this sense, it is urgent to insert the principles of geriatrics/gerontology as a strategy to face ageism: clinical-functional assessment; implementation of individualized care for older people/families; combating the stigma of old age, aging and ageism[27]; and investment in mental health literacy to recognize specific disorders and psychological distress and seek professional help[28].

Combating ageism involves directing care to older people in terms of their physical, mental and social health needs; evaluate the specificities of the subject, its context, autonomy and independence, fulfillment of rights and duties and, mainly, respect for the individualities, limitations and potentialities of each subject. It also means establishing a social education pact as a pillar of intergenerational reconnection, respect and empathy.

The contributions of this study to geriatrics/gerontology are: highlighting the need to disseminate knowledge about ageism, the repercussions and ways to combat this phenomenon, which, although old, was originally evidenced in 1969 by the psychiatrist and gerontologist Butler[29], and strengthened during the covid-19 pandemic. In addition, it encourages the development/implementation of focal public policies, capable of including older people and respecting their rights.

The limitations of the study are: search for videos on only one platform; and the time frame, since, due to the fact that the pandemic was not over by the end of this study, other videos continue to be published on the platform. In order to deepen these phenomena, future studies are needed, based on primary data, which listen to older people about the repercussions of ageism.

The implications for the geriatric-gerontological practice lie in: recognition of situations of ageism and stigma that surround social relations; adoption of self-monitoring postures to avoid deleterious consequences; remediation of traumatic situations, including post-pandemic ones.

Thus, older people actively seek well-being, to continue their lives in the best possible way, with the exchange of knowledge and experiences, various activities that help financially, relax and help in the redefinition of life, as they see themselves as capable subjects with high self-esteem and personal affection[30].

CONCLUSIONS

The repercussions of ageism directed at older people involve the social spheres generated from social isolation as a measure to contain the pandemic; feelings of worthlessness and self-deprecation; non-compliance with the rights of older people by institutions; generational conflicts between older people and the young; repercussions on lifestyle, as they fail to carry out their common activities of daily living because they feel incapable and because of the effort to use technology more and more as a means of communication; and repercussions on health, as older people are victims of negligence and recklessness within health institutions. These repercussions can cause physical, cognitive, social and psychic sequelae, whose permanence time and consequences require future investigations.

The demands brought about by this study affirm the need to deconstruct the idea that aging is a painful and survival process, the need for greater socio-professional and media inclusion of appropriate content, with a focus on health education to increase digital literacy. It is also essential to teach coping measures so that older people know how to handle prejudiced situations.

Professional gerontologists need to act through an expanded clinic, focusing on the therapy of psychosocial repercussions in the face of social stigma and discrimination, which were enhanced throughout the pandemic, through the use of compassion, empathy and solidarity.

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Survival of hospitalized older adults with prior use of potentially inappropriate medicine

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Abstract

Objectives: We aimed to evaluate the impact of potentially inappropriate medications prescribed prior to hospitalization (PIM-ph) on the mortality of hospitalized older adults. Methods: We included 318 patients, aged ≥65 who sought emergency care and were hospitalized for any clinical reasons. Information on patients' clinical and social indicators was obtained via structured interviews conducted 24 to 48 hours after hospitalization. All medications used by older adults prior to hospitalization were recorded, and PIM-ph were identified using the Brazilian PIM Consensus. The study considered the influence of the entire set of PIM-ph and specific PIM-ph used by these patients. The impact of PIM-ph use during hospitalization and after 30 days of this event was statistically determined by multivariable Cox proportional hazard regression analysis, which included sex, age, and other clinical and functional indicators as intervening variables. Results: The prevalence of PIM-ph use was 49.7% (n=158). A total of 85 (26.7%) patients died during hospitalization or within 30 days after discharge. Eighteen pharmacological classes of PIM-ph use were identified. The use of total PIM-ph, benzodiazepines (IC: 1.055-3.365, p= 0.032), digoxin(IC: 1.623-7.048, p=0.001), and loop diuretics (IC: 1.000-3.455, p=0.05) increased the relative risk of mortality independent of sex, age, clinical causes of hospitalization, frailty risk, social support, presence of confusion symptoms, polypharmacy, and in-hospital evolution of geriatric complications. Conclusion: PIM-ph use, especially benzodiazepines, digoxin, and loop diuretics, could contribute to mortality risk in hospitalized older adults. These results could be relevant in the management and therapeutic care of hospitalized patients.

Keywords: Aged. Hospitalization. Potentially Inappropriate Medication. Mortality.

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INTRODUCTION

The management of hospitalized older patients is highly complex, probably associated with heterogeneous biological aging processes and non-specific complications, including mobility impairment, fall history, cognitive impairment, and drug iatrogenic[1,2]. These complications are known as geriatric syndromes, a term broadly used by geriatricians and gerontologists to highlight the unique features of common health conditions in the elderly[3]. In addition, aging-induced physiological changes could influence the efficacy and safety of certain drugs contributing to iatrogenic in older adults. Therefore, a pharmacological prescription is considered a component that directly affects health management in older adults. Choosing the appropriate medication for each clinical condition must combine the requirement for effectiveness and low risk of adverse effects to achieve a good cost-benefit ratio[4].

As older people exhibit modifications that can alter the pharmacokinetics of many drugs, in recent years, efforts have been made to identify potentially inappropriate medicines (PIM) used by this age group. PIM refers to medications that carry a higher risk of adverse effects when given to older adults or in certain medical conditions. These medications may be considered inappropriate due to the unfavorable risk-benefit ratio or a higher risk of side effects when compared to other available medications. PIMs can cause adverse drug reactions, falls, cognitive impairment, and other complications, particularly in older adults who are already at an increased risk of drug-related problems. Several criteria have been developed to identify PIMs, such as the Beers Criteria by the American Geriatrics Society and the Screening Tool of Older Persons' potentially inappropriate Prescriptions (STOPP) criteria.[4,5] The use of these criteria can help healthcare providers to identify PIMs in older adults and adjust medication therapy accordingly. By reducing the use of PIMs, healthcare providers can improve medication safety and reduce the risk of drug-related problems in older adults.[4,5]

Bories et al.[5] estimated that the prevalence of PIM in primary care, home care, and hospital care was 19.1%, 29.7%, and 44.6%, respectively. Another review, which included information from five databases, also described that 57.9% of older adults have some PIM prescription[6]. The PIM in 458 older patients from Brazilian primary healthcare was estimated to be 44.8%[7]. PIM use has also been associated with polypharmacy and dementia in institutionalized older adults, such as benzodiazepines (BDZ) drugs[8]. A cohort ten-year follow-up study that included 418 Brazilian older adults reported a PIM incidence of 44.1 cases per 1,000 people per year with a relevant impact on mortality[9].

Furthermore, PIM prescription has been associated with the evolution of geriatric complications, delirium, seeking medical care after hospital discharge and hospital re-admission, need for surgical intervention, increased mortality of cancer patients, and higher risk of institutionalization and death of older adults [10-17].

However, studies on PIM use generally focus on their adverse effects that can lead to hospitalization, institutionalization, and death. Therefore, the aim of this study is to investigate whether the use of PIM before hospitalization could impact the hospital clinical outcome and the risk of death of patients.

METHODS

Study design and population

An observational, longitudinal, prospective, and descriptive population-based study was conducted from September 2015 to October 2016 in older adults admitted to the hospital from the emergency room at the University Hospital of the Federal University of Santa Maria (HUSM), Santa Maria, Rio Grande do Sul State, Brazil.

In developing countries, such as Brazil, older adults are 60 years of age or older, representing 14,79% of the population in 2021[18]. For this reason, the research investigation was initially designed to include individuals aged 60 years and over. However, as most experiments involving PIM use have been carried out in individuals aged 65 years and around, we decided to exclude those younger from the sample in this study. Therefore, we selected 318 subjects using a simple random sample based on sample size

calculation performed for a cohort study, taking into account the incidence of hospitalizations of the elderly in Brazil in 2015, of 2.669,949, for a confidence level of 90% and 5% margin of error. The incidence of variables associated with death and hospitalization of adults in the emergency room, based on data provided in the HUSM Statistics Section. They were 65 years or older at the time of their inclusion in the study. General exclusion criteria included insufficient information about medication use before admission or lack of consent to participate in the study. All elderly people who stayed less than 24 hours in the emergency service were also excluded, thus making it impossible to collect the information necessary to conduct the study.

The following patient approach and follow-up flow were used in the study: (i) older adult people sought emergency care at the hospital; (ii) all patients referred for hospitalization were invited to participate in the study; (iii) detailed information about the patient's clinical and social indicators, including the use of some clinical geriatric tools, were applied by trained health professionals or graduate students between 24 and 48 h after hospitalization; (iv) during hospitalization all participants were accompanied by the geriatric doctor that is an author in this study; (v) a survey was conducted about all the medications the patient ingested before hospitalization; (vi) further prescribed drugs were databank plotted and the identification of PIM-ph use was performed based in the Brazilian consensus of potentially inappropriate medication for elderly people (I, which was based in the American Geriatrics Society Beers Criteria and in the STOPP/START criteria[19,20]. The analysis considered the influence of the entire set of all PIM-hp and specific PIM-ph used by patients; (vii) after organizing the database in PIM-ph patients and patients without PIM-ph use (here identified as control individuals) were compared regarding sex, age, some pre-hospitalization social and health indicators. Detailed information about the patient's clinical evolution in the hospital was obtained from the medical records. Patient survival up to 30 days after hospital discharge was assessed by telephone contact with the older adult or caregiver; (viii) a multivariate analysis was performed to identify potential covariates that could influence the impact of PIM-ph use on the survival of hospitalized older adults.

Ethical statement

This study is part of the "Development of a line of care for the older hospitalized adults at the University Hospital of Santa Maria" research project approved by the Research Ethics Board of the Federal University of Santa Maria and registered on the Brazil Platform (Approval opinion number 3.498.206). The study also included older people with a lowered level of consciousness or with clinical conditions that affected their cognition. Therefore, all patients or their caregivers provided informed consent.

Pre-hospitalization social and health descriptive variables

The main descriptive variables of the study were age, sex, the clinical condition that led to hospital admission, and results from four tools widely used in geriatric clinics and, previously validated in Brazilian Portuguese Language: Identification of Seniors at Risk (ISAR)[21], Charlson Comorbidity Index (CCI)[22], Confusion Assessment Method (CAM)[23], Geriatric Depression Scale (GDS-4)[24]. The ISAR[21] score is a valuable screening tool for frailty and identifies elderly patients at risk of adverse outcomes after an emergency department (ED) visit. The instrument is an assessment of 6 yes/no items that cover the area of need of help (2 items), prior hospitalizations, sensory restrictions (vision), cognitive impairment, and multimorbidity (polypharmacy). An ISAR score higher than two points is considered positive for geriatric risk factors[21]. The CCI consists of 17 comorbidities, divided into 19 clinical situations with scores between 1 and 3; the sum indicates the chance of survival for one year[22]. CAM score 23 is composed of four attributes related to cognitive function: (1) mental confusion with acute onset and fluctuating course, (2) inattention, (3) disorganized thinking, altered level of consciousness, and (4) delirium symptoms. The diagnosis of delirium is confirmed when both items “1” and “2” and one of the items “3” and “4” are present. The GDS-4 evaluates indicators of Geriatric Depression; the score on this scale ranges from 0 to 4 points, and a score equal to or less than 1 point indicates depression[24].

In addition to these scales, information about the following clinical and functional variables presented

before hospitalization were also collected by trained researchers and evaluated here: older persons in need of caregiver support, living arrangements, social support, previous hospitalization in the last year, polypharmacy (five or more drugs daily used), body weight loss in the previous six months before hospitalization; urinary/fecal incontinence, delirium, immobility, main clinical conditions associated to hospital admission diagnosed by International Classification of Diseases (ICD-10)[25] that was in force during the period in which the study and data analysis were carried out. The in-hospital evolution of clinical and functional complications (delirium, immobility, urinary/fecal incontinence, nosocomial infection) was also evaluated.

Outcomes

The primary outcome measure was older adults' mortality, including those who died while hospitalized and those who died within 30 days of hospital discharge with and without PIM-ph use.

Statistical analysis

Descriptive statistics were presented as counts (n) and relative frequencies (%), mean ± standard deviation (SD), or median and 95% confidence interval according to variable type (quantitative or categorical). The interquartile range was used as a measure of median dispersion. Normal distribution previously determined by Kolmogorov-Smirnov test. The survival analyses were performed with multivariable Cox proportional hazard regression model analysis. The potential intervening variables included in the multivariate analysis were sex, age, and clinical and functional variables that showed significant differences between PIM-hp and controls. The significance level considered for the inclusion of variables in the model was $p<0.10$. In addition, the clinical diagnosis associated with hospitalization, and polypharmacy were included in the multivariate analyses. The proportional hazard assumption was checked, and the models were stratified as needed. The mean survival curves and relative risk estimates with 95% confidence intervals (CIs) were plotted using multivariable Cox regressions. In order, to compare two survival curves, the log-rank test was used. Statistical significance was set at $p<0.05$.

RESULTS

The mean age of the 318 older adults included in the study was 74.6 ± 7.6 years, median = 73 years (minimum = 65, maximum = 96 years). There were 169 (53.1%) males and 149 (46.9%) females. A total of 85 (26.7%) patients died during hospitalization or 30 days after hospital discharge. The prevalence of PIM-ph was estimated at 49.7% (n = 158). The baseline characteristics, functional and health pre-hospitalization indicators, evolution of in-hospital complications, and mortality were compared between PIM-ph and controls (Table 1).

PIM-ph group presented patients with less continued home support and a higher frailty risk (ISAR test) than controls. The other variables were similar between the two groups. In the PIM-hp group, 21 drugs listed in Table 2 were identified.

Among PIM-ph drugs identified here, at least five have their pharmacological action on the central nervous system (CNS). The most prevalent use of CNS drugs were benzodiazepines (BDZ) and antidepressants (serotonin inhibitors or tricyclics drugs). Others, such as opioids, sedatives, and barbiturates, were less prevalent in the patients included in this study. The main PIM-ph used by older adults in treating cardiovascular diseases were digoxin and loop diuretics. None of the PIM-ph used by less than ten patients were included in isolated analyses as they would not allow more consistent multivariate analyses.

Table 1. Comparison between Brazilian older adults with potentially inappropriate use of drugs before hospitalization (PIM-ph) and controls of baseline characteristics, functional/clinical pre-hospitalization indicators, the evolution of in-hospital complications, and mortality. Santa Maria, RS, 2023.

Variables		PIM-ph Use n (%)	Controls n (%)	*p*
Sex	Male	80 (47.3)	89 (52.7)	
	Female	78 (52.3)	71 (47.7)	0.372
Age groups (years)	65-69	47 (29.7)	50 (31.3)	0.137
	70-74	46 (29.1)	46 (28.8)	
	75-79	18 (11.4)	32 (20.0)	
	80-84	21 (13.3)	13 (8.1)	
	> 85	26 (16.5)	19 (11.9)	
Need caregiver		31 (19.9)	35 (22.0)	0.641
Living arrangements	Living alone	13 (8.2)	21 (13.2)	0.315
	Living with someone	143 (90.5)	136 (84.9)	
	Institutionalized	2 (1.3)	3 (1.9)	
Social support				
	Continued home-support	67 (42.4)	93 (58.1)	0.005
	Sporadic home-support	25 (15.8)	28 (17.5)	
	No home support	66 (41.8)	39 (24.4)	
Pre-hospitalization social and health indicators				
Previous hospitalization (one year)		63 (40.9)	52 (32.9)	0.143
Higher frailty risk (ISAR test)		96 (60.8)	68 (42.5)	0.001
Charlson Comorbidity Index (CCI)	One year survival chance			0.313
	98 %	23 (14.6)	28 (17.5)	
	89 %	60 (38.0)	72 (45.0)	
	79%	49 (31.0)	42 (26.3)	
	64%	26 (16.5)	18 (11.3)	
Confusion symptoms (CAM test)		14 (9.1)	6 (3.9)	0.064
Depressive symptoms (GDS-4 score)		69 (53.5)	73 (51.0)	0.688
Polypharmacy (≥ 5 drugs/day)		13 (8.2)	14 (8.8)	0.867
Loss body weight in the last 6 months		53 (33.5)	42 (26.3)	0.155
Urinary incontinence		52 (32.9)	44 (27.5)	0.293
Immobility		37 (23.4)	29 (18.1)	0.054
Main clinical conditions associated to hospital admission [a]				0.562
	Stroke	29 (18.4)	25 (15.6)	
	Cancer	24 (15.8)	33 (20.6)	
	Lung diseases	12 (7.6)	15 (9.4)	
	Gastrointestinal conditions	31 (19.6)	21 (13.1)	
	Infectious diseases	12 (7.6)	12 (7.5)	
	Trauma	29 (18.4)	37 (23.1)	
	Others	20 (12.7)	17 (10.6)	

to be continued

Continuation of Table 1

Variables	PIM-ph Use n (%)	Controls n (%)	*p*
Clinical and functional evolution during hospitalization			
Complications	88 (55.7)	78 (48.8)	0.215
Delirium	29 (18.4)	24 (15.0)	0.577
Immobility	77 (48.7)	66 (41.3)	0.054
Urinary/fecal incontinence	10 (6.3)	16 (10.0)	0.277
Nosocomial infection	28 (21.2)	22 (15.9)	0.265
In-hospital death	44 (27.8)	20 (12.5)	0.001
Death after hospital discharge	15 (13.5)	6 (4.7)	0.017
Total deaths	59 (37.3)	26 (16.3)	0.0001

[a]Diagnosed according to the International Disease Classification (ICD-10).

Table 2. Main potentially inappropriate medications used previously hospitalization (PIM-ph) by Brazilian older adults admitted to a hospital from the emergency room.

Drugs used before hospitalization by different body system targets	
Drug	n (%)
Nervous system	115 (72.0)
Antidepressants (Serotonin inhibitors, tricyclics) drugs	49 (15.4)
Benzodiazepines (BDZ)	32 (10.1)
Tricyclic antidepressants	8 (2.5)
Barbiturates/sedatives	5 (0.9)
Antipsychotics	3 (0.9)
Opioids	5 (1.6)
Other	13 (4.1)
BDZ plus Antidepressants	11 (3.5)
Cardiovascular system	64 (40.5)
Digoxin	15 (4.7)
Loop diuretics	29 (9.1)
Nifedipine	03 (0.9)
Other	17 (5.3)
Endocrine system	15 (9.5)
Glibenclamide	11 (3.5)
Corticoids	1 (1.9)
Other	3 (0.9)
Gastrointestinal system	7 (4.4)
Mineral oil	4 (1.3)
Other	2 (0.5)
Musculoskeletal system	7 (4.4)
Non-steroidal anti-inflammatory drugs	5 (1.6)
Other	
Nitrofurate	2 (0.6)

to be continued

Continuation of Table 2

In-Hospitalization used drugs	
Drug	n (%)
Antithrombotics/Anticoagulants	71 (22.3)
Antibiotics use	
Beta-lactam antibiotics	59 (18.6)
Nucleic acid synthesis inhibitors	17 (5.3)
Beta-lactamase inhibitors	18 (5.7)
Protein synthesis inhibitors	11 (3.5)
Glycopeptides	2 (0.6)
Cell membrane inhibitors	1 (0.3)

The influence of sex, age, leading functional and clinical indicators on survival of the hospitalized older adults from an emergency room was determined (Table 3). In the multivariate analysis, the following potential intervenient variables were included: sex, age, risk of frailty estimated by the ISAR test, previous existence of social support to an older adult patient, confusion symptoms measured by CAM test, and in-hospital evolution of geriatric complications. We also inserted in the multivariate model the ICD-10 clinical diagnosis at admission and polypharmacy prior hospitalization. These variables were selected from the univariate analyzes described in Table 1. However, as the Charlson test estimates the percentual chance of survival from variables already included in other scores tested here, we did not have this indicator as a potential intervening variable in the multivariate analysis that evaluated the association between PIM-ph use and older adults' mortality.

The general PIM-ph uses considering the whole of all drugs prescribed to older adults included in the study was significantly associated with lower in-hospital survival and death until 30 days after hospital discharge independent of all intervening variables included in the multivariate model. In addition, the specific use of BDZ, digoxin, and Loop diuretics was also independently associated with a lower survival rate in older adults (Table 3, Figure 1).

Table 3. Multivariate Cox regression analysis of mortality relative risk of Brazilian older adults hospitalized from the emergency room.

Variables		Deaths n (%)	RR	95% CI Upper-Lower	*p*
Sex	Female	39 (26.2)			
	Male	46 (27.2)	1.004	0.655-1.538	0.987
Age (years)	65-79	85 (23.4)			
	≥ 80	29 (36.7)	1.818	1.157-2.856	**0.010**
Functional and Clinical variables					
Frailty Risk (ISAR test)	Lower	33 (21.4)			
	Higher	52 (31.7)	1.451	0.933-2.255	0.098
Survival chance (CHARLSON test)	98%	05 (9.8)			
	89%	30 (22.7)	2.181	0.841-5.669	0.109
	79%	26 (28.6)	2.718	1.008-7.331	**0.048**
	64%	24 (54.5)	5.809	2.185-15.445	**0.0001**

to be continued

Continuation of Table 3

Variables		Deaths n (%)	RR	95% CI Upper-Lower	*p*
CAM-S test	No	67 (23.3)			
	Yes	10 (50)	2.470	1.215-5.023	**0.013**
GDS test (depressive symptoms)	No	27 (20.8)			
	Yes	36 (25.4)	1.179	0.708-1.964	0.526
Polypharmacy	No	77 (26.6)			
	Yes	08 (29.6)	1.085	0.521-2.226	0.828
In-hospital Complications	No	28 (18.4)			
	Yes	57 (34.3)	1.858	1.174-2.940	0.008
In-hospital antibiotics use	Yes	21 (29.6)	1.193	0.728-1.953	0.484
	No	64 (25.9)			
Use of PIM-ph by older adults (n = 158)[a]					
All PIM-ph[a]	No	26 (16.3)			
	Yes	59 (37.3)	2.269	1.416-3.635	0.001
Benzodiazepines	No	70 (24.6)			
	Yes	15 (44.1)	1.884	1.055-3.365	0.032
Antidepressives[b]	No	74 (27.6)			
	Yes	10 (20.4)	2.391	0.766-2.961	0.235
Opioids	No	82 (26.2)			
	Yes	03 (60.0)	1.687	0.703-8.128	0.163
Digoxin	No	76 (25.1)			
	Yes	09 (60.0)	3.382	1.623-7.048	0.001
Loop diuretics	No	72 (24.9)			
	Yes	13 (44.8)	1.858	1.000-3.455	0.05

RR = relative risk. CI 95% = confidence interval 95%. The estimated RR of death was determined by multivariate Cox proportional hazard regression inserting covariates in the model. (a) The analysis of PIM-ph (all or specific medicines) impact on RR to dead was corrected by the following covariates: sex, age, frailty risk determined by ISAR test, the existence of social support, presence of confusion symptoms evaluated by CAM test and in-hospital evolution of geriatric complications. The diagnosis of diseases identified by the ICD-10 and polypharmacy (>5 daily medicines) was also included in the model. (b) Serotonin inhibitors plus tricyclic antidepressant drugs.

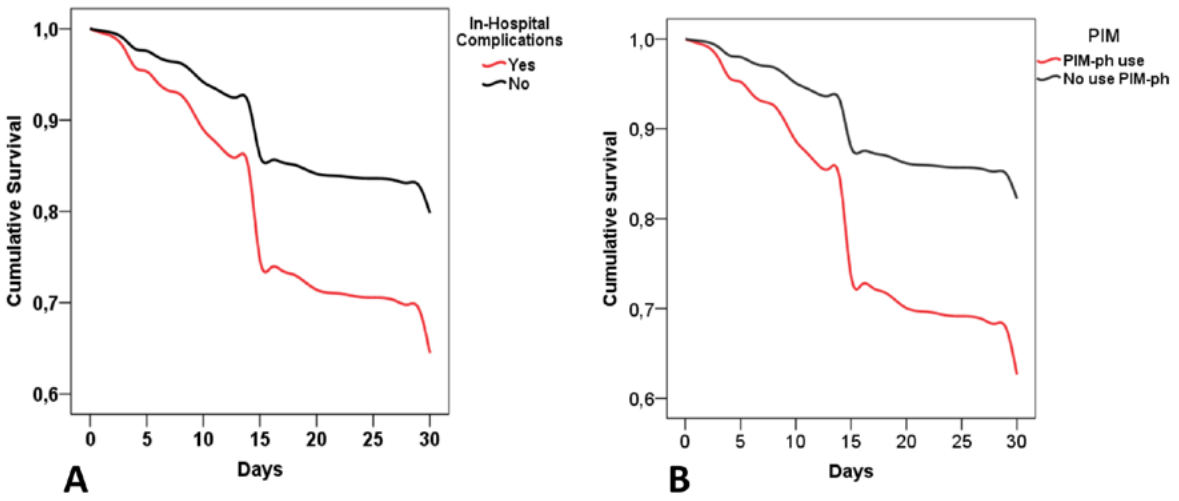

Figure 1. Cox regression survival analysis of potentially inappropriate medication used prior hospitalization (PIM-ph) of the older adults studied. (A) Comparison between older adults that presented in-hospital evolution of one or more of the following geriatric complications: delirium, immobility, urinary/fecal incontinence, and nosocomial infection) (*p≤0.001*); (B) with and without (controls) previous hospitalization use of potentially inappropriate medicines (PIM-ph). The cumulative survival was corrected by sex, age, frailty risk determined by the ISAR test, social support, confusion symptoms evaluated by the CAM test, and the in-hospital evolution of geriatric complications. The analysis of the curves observed the significance of $p<0,05$.

DISCUSSION

The present investigation observed that PIM-ph increased the mortality risk of older adults admitted in the emergency room at the University Hospital of the Federal University of Santa Maria (HUSM), Santa Maria, Rio Grande do Sul State, Brazil, up to 30 days after hospital discharge. This type of analysis has been little explored in previous studies, although it is well established that PIM use by older adults is a significant public health concern 5-6. Therefore, initially, it is relevant to comment that PIM-ph prevalence observed in the patients included in this study is similar to other investigations described in the literature [8,9,26].

Three specific PIM-ph were associated with a higher mortality risk: BDZ, digoxin, and loop diuretics. Among the PIMs associated with increased mortality, BDZ represents one of the most widely prescribed drugs in and out of hospital[27,28]. In pharmacological terms, BDZ effects involve an interaction with the central nervous system (CNS) mediated by the activation of GABA A receptors. Although a significant number of BDZs are approved by regulatory agencies, such as the Food Drug Administration (FDA) and *Agência Nacional de Vigilância Sanitaria* (ANVISA, Brazilian Health Ministry), these drugs have several side effects, including cognitive impairment, tolerance, rebound insomnia upon discontinuation, car accidents/falls, abuse, and dependence liability[29]. Moreover, BDZs can interact with other drugs, including sedatives, barbiturates, and ethanol, triggering respiratory depression owing to a synergistic effect[29]. BDZ can increase adverse effects in older patients due to age-related differences in pharmacokinetics and pharmacodynamics, leading to body BDZ accumulation and higher plasma concentrations[30]. Moreover, BDZ can cause physical dependence and withdrawal syndrome[27]. Therefore, the results described here suggest that, in addition to potential adverse effects, the use of BZP before hospitalization can impact the hospital outcome of older adult patients, increasing the risk of death.

Previous use of digoxin prescribed to treat cardiac conditions also increased mortality risk in the older adult investigated in this study. Cardiac glycosides, including digitalis and digoxin, have long been used in clinical practice. However, digoxin toxicity is clinically relevant as it can lead to fatal cardiac arrhythmias[28,31]. Some previous studies, such as those performed by Yang et al.[32] have described an association between digoxin use and mortality risk in patients with advanced chronic kidney disease. Results from a study that included 5.824 patients with atrial fibrillation (AF) taking digoxin showed an increased risk of death, regardless of heart failure[33]. The risk of digoxin intoxication in older adults with decreased kidney clearance is higher. The aging-associated pharmacological alterations could be the basis for explaining why the use of digoxin before hospitalization contributed to the increased mortality in the older adult investigated here.

Loop diuretics drugs were also identified as a PIM-ph capable of influencing the mortality rate of older adults. Loop diuretics are widely used to treat heart and renal failure, hypertension, and peripheral edema[33]. However, there are previous investigations, such as the study performed by Schartum-Hansen et al.[34], corroborating that loop diuretics could increase the risk of all-cause mortality in patients with suspected coronary artery disease.

Based on studies previously published in the literature, it is possible to infer that using some types of PIM-ph could increase mortality in hospitalized patients. However, studies with a design similar to the one described here are needed to identify to corroborate the relevance of identifying PIM used previously in the hospitalization of older adults. Another relevant limiting factor is the characteristics of hospital emergency, such as patient turnover and the absence of those responsible for information for the requested period.

CONCLUSION

The results described here show that the use of some types of potentially inappropriate drugs before hospitalization could represent a risk factor for mortality of older adults admitted from emergency rooms. These results represent a novelty, since in general the impact of this type of drug is evaluated when they are prescribed during hospitalization. In this context, the pharmacological management of elderly patients can be a factor that helps to prevent hospital complications and mortality.

AUTHORSHIP

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Factors associated with frailty in older users of Primary Health Care services from a city in the Brazilian Amazon

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Abstract

Objective: To estimate the prevalence of frailty syndrome and its association with socioeconomic, demographic and health variables, in elderly people treated at two Health Units in the city of Rio Branco, Acre, from October 2016 to June 2017. *Method:* The prevalence of frailty was measured using the *Edmonton Frail Scale (EFS)*, and associations were tested with selected variables. Poisson regression, with robust variance and 95% confidence intervals, was used to estimate the prevalence ratios and define the adjusted model. All analyzes took into account the sample weights and were performed using SPSS version 20. *Results*: It was found that 35.1% of the sample showed fragility. The prevalence of frailty was associated with being 75 years old or more, physical inactivity, nutritional risk, cognitive deficit, negative health perception, using 5 or more medications and having/history of cancer, falls in past year, living alone, unsatisfactory neighborhood safety and being of ethnicity/non-white color. *Conclusion*: The alert profile for screening for frailty was verified, which may assist in the clinical practice of FHS professionals in the study population, and also considers the need to implement and strengthen eldely's health care programs and performance of the Family Health Support Centers.

Keywords: Frailty. Aged. Primary health care. Prevalence.

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INTRODUCTION

In recent years, the number of studies investigating the factors that influence healthy longevity has grown. The link between genetic traits and environmental insults that promote a series of adaptive responses by the body is recognized, but in some cases these lead to diseases and faster aging[1]. The clinical syndrome of frailty is characterized by loss of body weight and muscle mass, decrease in bone mass and in strength, fatigue, slow gait, postural instability, reduced grip strength and diminished capacity of the body to maintain homeostasis. This syndrome increases the likelihood of an unfavorable prognosis when faced with external stressors and acute disease, representing a major risk factor for morbidity and mortality in older individuals[2].

In a 2018 systematic review by the Brazilian Consensus on Frailty, the rate of frailty ranged from 6.7-74.1%. This variability might be attributed to the instruments used to classify frailty in older people or the setting in question: community, hospital, outpatient or long-term care facility (LTCF)[3].

In the older population, frail individuals are those who most need health care and, for this reason, frailty can serve as a potential marker to help plan the health management of older patients. Frailty syndrome is associated with a major burden in terms of hospital and gerontological care, with the need for regular checkups, preventive interventions and multidisciplinary care, and constitutes a strong predictor of death in older people across all settings[2,3].

Determining the prevalence of frailty and its associated factors is important to inform health care policies, given the syndrome is both predictable and avoidable. The implementation of effective interventions helps toward treating the syndrome, and even reversing it, while improving the quality of life of older individuals and delaying the occurrence of adverse events[4].

Therefore, the primary objective of this study was to report the factors associated with the prevalence of frailty syndrome in older users of 2 health units in the city of Rio Branco, Acre state.

METHODS

A cross-sectional study of older users of 2 Basic Health Units in the city of Rio Branco, Acre state was carried out between October 2016 and June 2017.

Rio Branco, the capital city of Acre State, covers a land area of 9,222.58 km^2 and is situated in the North Region of the country. According to data from the Brazilian Institute of Geography and Statistics, the city has a population of 370,550 people. Regarding the Health System, the city relies chiefly on the Primary Health Network which provides coverage of 56.99% and is organized hierarchically under the framework of the National Health System (SUS)[5].

The Network is currently divided into 12 health regions, the catchment area of Basic Health Units, supported by 61 Family Health Teams (ESF), 8 Community Health Worker Program Teams (PACS), 5 Primary Care Referral Units (URAP), 7 Health Centers and a Multidisciplinary Home Care Team (EMAD type2)[5].

Drawing on the list of Health Units that make up the regional public health network, furnished by the Municipal Secretariat for Health, a Primary Care Referral Unit and a Family Health Unit located in 2 different health regions were selected for the study. The criteria for selection of these units were: having an up-to-date registry of families; and having the largest contingent of older people registered.

The eligibility criteria for participation in the study were older individuals of both sexes residing in the vicinity of, and registered with, the units selected. Exclusion criteria were institutionalized older individuals and subjects whose health status precluded participation, such as patients diagnosed with cognitive disorders. Losses were defined as cases in which subjects refused to answer the questionnaire, were not located at the household after 2 tries at the place of residence or due to change of address, and respondents that failed to fully complete all items required for classification on the frailty scale.

The sample size was calculated based on the number of older users registered at the Health Units

selected (N=953), an estimated frailty prevalence of 10%[6], 95% confidence interval, and sampling error of 3%, giving a sample required of 302 individuals. A further 20% margin was added to allow for possible sample losses, yielding an estimated final sample of 365 older patients. Simple random sampling was performed using the listings of older adults registered at the Basic Health Units involved in the study.

Data collection was performed by interviewing participants at their homes, after having signed the Free and Informed Consent Form. Interviews were conducted by a team comprising the coordinator of the study and medical students and health sciences graduates, all of whom underwent introductory training *in loco* of 4 hours covering the following topics: 1. Presentation of the relevance of the study and its objectives; 2. Ethical aspects during data collection for research, Resolution no. 466 of the 12th of December 2012 by the National Board of Health; and 3. Procedures and materials for data collection.

The instrument used was a validated questionnaire containing 13 theme-based blocks collecting socioeconomic and demographic information and data on life habits and health status. The Edmonton Frail Scale (EFS)[7] was applied, from which data was collected to assess the outcome of interest of the study.

Frailty was defined according to the version of the EFS, originally devised at the University of Alberta, Canada, and subsequently translated and validated for use in Brazil[8]. The EFS measures 9 domains: cognition (application of clock test), general health status, functional independence, social support, use of medications, nutrition, mood, continence and functional performance (Up and Go test). Scores on the scale range from 0-17 points and respondents are classified as follows: not frail (0-4 points); vulnerable (5-6); mild frailty (7-8); moderate frailty (9-10); and severe frailty (≥11). However, for the analysis of the data as an outcome, this variable was dichotomized into frail (mild, moderate and severe frailty) and not frail (not exhibiting frailty and vulnerable).

Based on the literature review, the exploratory variables were selected, as described in more detail in the study by Bezerra and Santos[9]. Briefly, the independent variables analyzed were: sex, age group (stratified by decade); self-declared ethnicity/skin color; place of birth; marital status; education (5 categories); family income (3 categories); perceived safety of home neighborhood; use of tobacco and alcohol; body mass index; engagement in physical activity (measured by International Physical Activity Questionnaire); perceived health (2 categories); cognitive deficit (measured using the Mini-Mental State Exam); depressive symptoms (measured by the Geriatric Depression Scale GDS-15); functional disability (measured by the basic and instrumental activities of daily living scale); nutritional risk; history of falls; polypharmacy; and self-reported comorbidities (disease name and number).

For prevalence estimates, Poisson Regression with robust variance, along with their respective confidence intervals ($CI_{95\%}$), was used to determine crude and adjusted prevalence ratios. Crude prevalence ratios were obtained on bivariate analyses and, based on their results, variables with $p \leq 0.20$ were included in the multivariate analysis. Only variables exhibiting goodness-of-fit for prevalence ratios and $p \leq 0.05$ were retained in the final model.

All statistical analyses were performed considering the effect of sample design, incorporating sample weights, i.e. the calculation of weighting factor (no. of individuals registered/no. actually assessed) at the respective health units. The parameters deviance, Akaike information criterion (AIC) and Bayesian information criterion (BIC) were used for the analysis of the fitted model and residuals.

The study was submitted to and approved by the Research Ethics Committee of the Sergio Arouca National School of Public Health - ENSP/FIOCRUZ (Permit no. 1.722.418), having complied with all recommendations of Resolution no. 466/12 and 510/2016, of the National Board of Health of the Ministry of Health.

RESULTS

There was a total of 67 losses, due to cases in which subjects were not located at the household after 2 tries at the place of residence or due to change of address (n=59); lacking all elements required to classify the frailty outcome; or refused to answer

the whole questionnaire (n=8). Thus, the final study population comprised 298 older adults aged 60-99 (mean 71.4; SD = 8.5) years.

Regarding overall prevalence of frailty syndrome strata in the sample, 35.1% were classified as having some level of frailty, with 15.6% mild, 11.3% moderate and 8.2% severe (Table 1). The rate of frailty syndrome was higher in women (37.5%) (p-value<0.05).

There was a predominance of females and subjects who self-declared as brown ethnicity/race (67.6%), whereas 2.1% of participants self-declared as indigenous (Table 2). For marital status, most were married or had a partner(47.4%) and were widowed (28.2%). Most participants had no education (42.5%) and almost 1 in 10 lived alone (9.8%). The analysis of sociodemographic factors for the different ages revealed that the rate of frailty increased with age group and exhibited statistically significant differences, except for self-declared ethnicity/skin color and living alone. Frailty prevalences were 29.6% in sexagenarians, 40.7% in septuagenarians, and 29.6% in octogenarians or older.

Frailty rates were higher among participants who were female (66.5%), (59.3%), had no partner (59.3%), were born in other cities in Acre or the North Region (73.9%), illiterate (59.0%), had a family income of under 1 minimum wage (54.1%) and who did not feel safe in their neighborhood (90.0%) (Table 2).

Of the group classified as frail, 83.0% rated their general and oral health as unsatisfactory and 3.3% reported alcohol abuse. Frailty rates were higher in participants with a morbidity (98.2%), that were sedentary (93.4%), exhibited depressive symptoms (90.7%), nutritional risk (82.4%), obesity (78%), cognitive deficit (65.3%), functional disability (63,8%), multimorbidity (54,4%), had a history of falls (58.3%) and polypharmacy (50.9%). With regard to the reported morbidities investigated, those with a significant p-value for frailty prevalence were arterial hypertension (78.1%), back/spine problems (65.3%), cardiovascular problem (40.0%), diabetes (37.2%), osteoporosis (35.8%) and cancer (11.2%).

Prevalence of frailty syndrome was associated with age ≥75 years (1.43; $CI_{95\%}$ 1.19 – 1.70), sedentarism (1.57; $CI_{95\%}$ 1.10 – 2.23), nutritional risk (1.76; $CI_{95\%}$ 1.43 – 2.17), cognitive deficit (1.22; $CI_{95\%}$ 1.03 – 1.43), negative perceived health (1.77; $CI_{95\%}$ 1.41 – 2.21), use of ≥ 5 medications (1.64; $CI_{95\%}$ 1.39 – 1.93), cancer history (1.86; $CI/_{95\%}$ 1.25 – 2.77), history of fall in past year (1.32 ; $CI_{95\%}$ 1.11 – 1.57), living alone (1.40; $CI_{95\%}$ 1.02 – 1.93), unsatisfactory neighborhood safety (1.27; $CI_{95\%}$ 1.07 – 1.50) and non-white ethnicity/skin color (1.26; $CI_{95\%}$ 1.03 – 1.55),on the final model of the multivariate analysis. Functional dependence (2.19; $CI_{95\%}$ 1.81 – 2.66) and the presence of risk for depression (2.02 $CI_{95\%}$ 1.49 – 2.73) were the variables most strongly associated with frailty syndrome (Table 4).

Table 1. Frailty Classification of participants assessed, according to sex (n=298). Rio Branco, Acre state, 2016 – 2017.

Frailty	Total		Sex	
	N	N Exp[a] (%)	Male	Female
			nExp[a] (%)	nExp[a] (%)
Not frail	135	424 (44.6)	184 (51.0)	240 (40.7)
Vulnerable	60	194 (20.4)	65 (18.0)	129 (21.9)
Mild frailty	50	148 (15.6)	57 (15.8)	91 (15.4)
Moderate frailty	32	107 (11.3)	27 (7.5)	80 (13.6)
Severe frailty	21	78 (8.2)	28 (7.8)	50 (8.5)

Source: Produced by authors based on data from study, 2023. P-value of distribution by sex 0.006. [a] N expanded based on weights and sample design

Table 2. Frailty Prevalence according to sociodemographic characteristics of participants assessed (n=298). Rio Branco, Acre state, 2016 – 2017.

Variables	Total sample		Frailty		
			Yes	No	
	n 298	N exp (%) 953	N exp (%) 334	N exp (%) 619	p-value
Sex					0.042
Male	116	361 (37.9)	112 (33.5)	249	
Female	182	592 (62.1)	222 (66.5)	370	
Age group (years)					<0.001
60- 69	140	445 (46.6)	99 (29.6)	346 (55.8)	
70- 79	103	324 (33.9)	136 (40.7)	188 (30.3)	
≥ 80	55	185 (19.4)	99 (29.6)	86 (13.9)	
Age group (years)					<0.001
< 75	205	652 (68.4)	184 (55.1)	488 (75.6)	
≥ 75	93	301 (31.6)	150 (44.9)	151 (24.4)	
Self-declared ethnicity/skin color					0.081
White	48	153 (16.0)	63 (18.9)	90 (14.5)	
Non-white[a]	250	801 (84.0)	271 (81.1)	530 (85.5)	
Place of birth					0.016
Rio Branco	64	198 (20.8)	65 (19.5)	133 (21.5)	
Other city in Acre	160	523 (54.9)	198 (59.5)	325 (52.5)	
Other cities in North Region	43	130 (13.7)	48 (14.4)	82 (13.2)	
Other cities in Brazil	31	101 (10.6)	22 (6.6)	79 (12.8)	
Has partner					0.003
Yes	145	451 (47.4)	136 (40.7)	315 (50.9)	
No	153	502 (52.6)	198 (59.3)	304 (49.1)	
Lives alone					0.082
No	269	860 (9.8)	309 (92.5)	551 (89.0)	
Yes	29	93 (90.2)	25 (7.5)	68 (11.0)	
Education (years)					<0.001
≥11	12	34 (4.3)	3 (0.9)	31 (5.1)	
8 – 10	31	101 (10.6)	16 (4.8)	85 (13.9)	
4 – 7	73	245 (25.8)	58 (17.5)	187 (30.5)	
1 – 3	57	160 (16.7)	59 (17.8)	101 (16.5)	
0	125	405 (42.5)	196 (59.0)	209 (34.0)	
Family income[a]					0.002
≥ 3 m.w	9	34 (3.5)	14 (42.0)	20 (3.2)	
1 to <3 m.w	72	242 (25.5)	106 (31.7)	136 (22.0)	
1 m.w	217	677 (71.0)	214 (64.1)	463 (74.8)	
Safety of neighborhood					0.043
Satisfactory	187	122 (13.0)	32 (9.9)	90 (14.6)	
Unsatisfactory	105	818 (87.0)	291 (90.1)	527 (85.4)	

Source: Produced by authors based on data from study, 2023. N exp = expanded N based on weights and sample design; % = proportion based on expanded N; χ^2= p-value= Pearson´s chi-square test. [a]Differences in absolute values of frequencies correspond to losses or not applicable .[a] Self-declared ethnicity/skin color. Non-white: yellow, black, brown, indigenous.

[b]m.w: minimum wage at time of study (2016:R$880.00 and 2017:R$937.00).

Table 3. Frailty Prevalence, according to lifestyle and health variables, of participants assessed (n=298). Rio Branco, Acre state, 2016 – 2017.

Variables	Total		Frailty		p-value
			Yes	No	
	n 298	N exp 953	N exp 334	N exp 619	
Tobacco use					0.482
No	94	277 (80.5)	91 (28.0)	186 (30.2)	
Yes	17	664 (19.5)	234 (72.0)	430 (69.8)	
Alcohol abuse[a]					<0.001
No	278	883 (92.8)	323 (96.7)	560 (90.5)	
Yes	20	70 (7.2)	70 (3.3)	59 (9.5)	
Engage in physical activity[*,b]					<0.001
Yes	64	205 (21.5)	22 (6.6)	183 (29.6)	
No	234	748 78.5)	312 (93.4)	436 (70.4)	
Level of physical activity[c]					0.057
Physically active	55	134 (17.4)	36 (13.8)	98 (19.3)	
Sedentary	243	635 (82.6)	225 (86.2)	410 (80.7)	
Nutritional risk[d]					<0.001
No	96	285 (38.2)	51 (17.6)	234 (51.3)	
Yes	146	460 (61.8)	238 (82.4)	222 (48.7)	
BMI[*,e]					<0.001
Normal weight	92	33 (4.4)	11 (3.8)	22 (4.8)	
Underweight	14	33 (4.4)	25 (8.6)	8 (1.8)	
Overweight	87	61 (8.2)	27 (9.3)	34 (7.5)	
Obese	66	619 (83.0)	227 (78.3)	392 (86.0)	
Self-rated health status[*]					<0.001
Very good	12	38 (4.1)	11 (3.5)	27 (4.4)	
Good	96	292 (31.3)	43 (13.6)	249 (40.4)	
Fair	131	424 (45.4)	139 (43.8)	285 (46.3)	
Poor	41	134 (14.4)	90 (28.4)	44 (7.1)	
Very poor	13	45 (4.7)	34 (10.7)	11 (1.8)	
Perceived health					<0.001
Satisfactory	108	330 (34.6)	54 (17.0)	276 (44.8)	
Unsatisfactory	185	603 (65.4)	263 (83.0)	340 (55.2)	
Perceived oral health					0.010
Satisfactory	163	330 (34.6)	54 (17.0)	276 44.8)	
Unsatisfactory	123	603 (65.4)	263 (83.0)	340 (55.2)	
Cognitive deficit[f]					<0.001
No	167	522 (57.2)	114 (34.7)	408 (70.0)	
Yes	119	390 (42.8)	215 (65.3)	175 (30.0)	

to be continued

Continuation of Table 3

Variables	Total		Frailty		p-value
			Yes	No	
	n 298	N exp 953	N exp 334	N exp 619	
Functional Disability[g]					<0.001
No	214	666 (71.2)	121 (36.2)	545 (90.5)	
Yes	81	270 (28.8)	213 (63.8)	57 (9.5)	
History of fall in past year					<0.001
No	166	529 (56.2)	138 (41.7)	391 (64.0)	
Yes	128	413 (43.80)	193 (58.3)	220 (36.0)	
Polypharmacy[h]					<0.001
No	216	685 (71.9)	163 (49.1)	522 (84.3)	
Yes	81	266 (28.1)	169 (50.9)	97 (15.7)	
Geriatric Depression[i] Scale					<0.001
No risk of depression	67	229 (25.5)	28 (9.3)	201 (33.6)	
Risk of depression	217	670 (74.5)	272 (90.7)	398 (66.4)	
Self-reported morbidities					0.031
No	9	34 (3.6)	6 (1.8)	28 (4.5)	
Yes	287	914 (96.4)	325 (98.2)	589 (95.5)	
Number of self-reported morbidities					<0.001
None	9	34 (3.6)	6 (1.8)	28 (4.5)	
1 - 3	178	547 (57.8)	145 (43.8)	402 (65.3)	
≥ 4	109	366 (28.6)	180 (54.4)	186 (30.2)	
Spine/Back problems					0.013
No	117	380 (40.1)	115 (34.7)	263 (43.0)	
Yes	179	567 (59.9)	216 (65.3)	351 (57.0)	
Hypertension					0.009
No	81	256 (27.1)	72 (21.9)	184 (29.9)	
Yes	214	689 (72.9)	257 (78.1)	432 (70.1)	
Rheumatism, arthritis, arthrosis					<0.001
No	169	534 (56.3)	159 (48.0)	375 (60.8)	
Yes	127	414 (43.7)	172 (52.0)	242 (39.2)	
Heart/cardiovascular disease					<0.001
No	214	675 (71.3)	197 (59.5)	478 (77.6)	
Yes	82	272 (28.7)	134 (40.5)	138 (22.4)	
Osteoporosis					<0.001
No	217	697 (73.5)	213 (64.2)	484 (78.6)	
Yes	79	151 (26.5)	119 (35.8)	132 (21.4)	
Depression					0.155
No	237	766 (81.2)	257 (78.8)	509 (82.6)	
Yes	57	176 (18.8)	69 (21.2)	107 (17.4)	

to be continued

Continuation of Table 3

Variables	Total		Frailty		p-value
			Yes	No	
	n 298	N exp 953	N exp 334	N exp 619	
Diabetes					<0.001
No	227	713 (75.2)	208 (62.8)	505 (82.0)	
Yes	69	234 (24.8)	123 (37.2)	111 (18.0)	
Cancer					<0.001
No	274	880 (92.8)	294 (88.8)	586 (95.1)	
Yes	22	67 (7.2)	37 (11.2)	30 (4.9)	

Source: Produced by authors based on data from study, 2023. N exp = expanded N based on weights and sample design; % = proportion based on expanded N.; χ^2 = p-value = Pearson´s chi-square test. *Differences in absolute values of frequencies correspond to losses or not applicable.

[a]Identified using Alcohol Use Disorders Identification Test.

[b]At least 3x/week

[c]According to International Physical Activity Questionnaire .

[d]Mini nutritional risk assessment used.

[e] BMI= body mass index calculated as weight/(height^2), classification for older people, according to the WHO.

[f] Mini-mental state exam.

[g] Instrumental activities of daily living.

[h] ≥ 5 medications.

[i] Geriatric Depression Scale.

Table 4. Analysis of Crude and Adjusted Prevalence Ratio by Poisson Regression, according to lifestyle and health variables, of participants assessed (n=298). Rio Branco, Acre state, 2016 – 2017.

Variables	PR_{Crude} ($CI_{95\%}$)	p-value	$PR_{Adjusted\ model}$ ($CI_{95\%}$)
Sex			
Male	1		
Female	1.22 (1.02 – 1.45)	0.030	
Age group (years)			
60- 69	1		
70 - 79	1.90 (1.55 – 2.34)	<0.001	
≥ 80 years	2.43 (1.97 – 3.00)	<0.001	
Age group (years)			
< 75	1	<0.001	1
≥ 75	1.79 (1.52 – 2.09)		1.43 (1.19 – 1.70)
Self-declared ethnicity/skin color			
White	1		1
Non-white[a]	0.82 (0.67 – 1.01)	0.060	1.26 (1.03 – 1.55)
Place of birth			
Rio Branco	1		
Other city in Acre	1.15 (0.92 – 1.43)	0.216	
Other cities in North Region	1.14 (0.86 – 1.51)	0.363	
Other cities in Brazil	0.66 (0.44 – 0.98)	0.41	

to be continued

Continuation of Table 4

Variables	PR $_{Crude}$ ($CI_{95\%}$)	p-value	PR $_{Adjusted\ model}$ ($CI_{95\%}$)
Has partner			
Yes	1		
No	1.31 (1.10 – 1.55)	0.002	
Lives alone			
No	1		1
Yes	0.74 (0.53 – 1.03)	0.075	1.40 (1.02 – 1.93)
Education (years)			
≥11	1		
8 – 10	1.95 (0.61 – 6.23)	0.262	
4 – 7	2.83 (0.94 – 8.55)	0.065	
1 – 3	4.40 (1.46– 13.22)	0.008	
0	5.76 (1.94– 17.08)	0.002	
Family income[a]			
≥ 3 m.w	1		
1 to <3 m.w	1.04 (0.69 – 1.56)	0.865	
<1 m.w	0.76 (0.51 – 1.14)	0.182	
Safety of neighborhood			
Satisfactory	1		1
Unsatisfactory	1.40 (1.02 – 1.89)	0.036	1.27 (1.07 – 1.50)
Tobacco use			
No	1		
Yes	1.06 (0.88 – 1.28)	0.515	
Alcohol abuse[a]			
No	1		
Yes	0.44 (0.26 – 0.74)	0.002	
Engage in physical activity[*,b]			
Yes	1		1
No	3.90 (2.65 – 5.74)	<0.001	1.57 (1.10 – 2.23)
Level of physical activity[c]			
Physically active	1		
Sedentary	1.30 (0.97 – 1.72)	0.077	
Nutritional risk[d]			
No	1		1
Yes	2.87 (2.24 – 3.69)	<0.001	1.76 (1.43 – 2.17)
BMI[*,e]			
Normal weight	1		
Underweight	2.25 (1.37 – 3.71)	0.001	
Overweight	1.30 (0.76 – 2.23)	0.330	
Obese	1.09 (0.68 – 1.75)	0.715	

to be continued

Continuation of Table 4

Variables	PR_{Crude} ($CI_{95\%}$)	p-value	$PR_{Adjusted\ model}$ ($CI_{95\%}$)
Self-rated health status[*]			
Very good	1		
Good	0.52 (0.30 – 0.89)	0.018	
Fair	1.15 (0.70 – 1.90)	0.577	
Poor	2.36 (1.44 – 3.85)	0.001	
Very poor	2.63 (1.58 – 4.35)	<0.001	
Perceived health			
Satisfactory	1	<0.001	1
Unsatisfactory	2.66 (2.08 – 3.41)		1.77 (1.41 – 2.21)
Perceived oral health			
Satisfactory	1	0.005	
Unsatisfactory	1.28 (1.08 – 1.52)		
Cognitive deficit[f]			
No	1	<0.001	1
Yes	2.51 (2.10 – 3.00)		1.22 (1.03 – 1.43)
Functional Disability[g]			
No	1	<0.001	1
Yes	4.23 (3.63 – 5.04)		2.19 (1.81 – 2.66)
History of fall in past year			
No	1	<0.001	1
Yes	1.76 (1.49 – 2.01)		1.32 (1.11 – 1.57)
Polypharmacy[h]			
No	1	<0.001	1
Yes	2.63 (2.25 – 3.07)		1.64 (1.39 – 1.93)
Geriatric Depression[i] Scale			
No risk of depression	1	<0.001	1
Risk of depression	3.36 (2.38 – 4.75)		2.02 (1.49 – 2.73)
Self-reported morbidities			
No	1	0.044	
Yes	2.13 (1.02 – 4.45)		
Number of self-reported morbidities			
None	1		
1 - 3	1.60 (0.76 – 3.37)	0.212	
≥ 4	2.93 (1.40 – 6.13)	0.004	
Spine/Back problem			
No	1		
Yes	1.26 (1.05 – 1.50)	0.011	
Hypertension			
No	1		
Yes	1.35 (1.09 – 1.66)	0.005	
Rheumatism, arthritis, arthrosis			
No	1		
Yes	1.36 (1.16 – 1.61)	<0.001	

to be continued

Continuation of Table 4

Variables	PR_{Crude} ($CI_{95\%}$)	p-value	$PR_{Adjusted\ model}$ ($CI_{95\%}$)
Heart/cardiovascular disease			
No	1		
Yes	1.65 (1.40 – 1.94)	<0.001	
Osteoporosis			
No	1		
Yes	1.53 (1.30 – 1.80)	<0.001	
Depression			
No	1		
Yes	1.20 (1.00 – 1.47)	<0.001	
Diabetes			
No	1		
Yes	1.76 (1.50 – 2.07)	<0.001	
Cancer			
No	1		1
Yes	1.69 (1.35 – 2.10)	<0.001	1.86 (1.25 – 2.77)

Source: Produced by authors based on data from study, 2023. PR: Prevalence Ratio; PRcrude: crude analysis; PRadjusted model: analysis adjusted by variables.

[a]Self-declared ethnicity/skin color. Non-white: yellow, black, brown, indigenous.

[b]m.w: minimum wage at time of study (2016:R$880.00 and 2017:R$937.00).

[c]Identified using Alcohol Use Disorders Identification Test.

[d]At least 3x/week.

[e]According to International Physical Activity Questionnaire.

[f]Mini nutritional risk assessment used.

[g]BMI= body mass index calculated as weight/(height^2), classification for older people, according to the WHO.

[h] Mini-mental state exam.

[i] Instrumental activities of daily living.

[j] ≥5 medications.

[k] Geriatric Depression Scale

DISCUSSION

The study centered on frailty syndrome and the factors associated with the condition in a sample of older users of 2 primary healthcare units in the city of Rio Branco, Acre state. The sociodemographic and health profiles were similar to those of a previous population-based study performed in Montes Claros, Minas Gerais state, for which the instrument used to determine frailty syndrome in the present investigation was validated[8] .

The overall prevalence of frailty identified in the present study sample was 35.1%. This rate proved higher than those found for both São Paulo of 8.5%[4] and Ribeirão Preto of 7.6%[10]. The international rate of frailty ranges from 4.2-15.0%[11,12], lower than the prevalence found nationally and in Rio Branco.

However, mirroring the elevated rate in the current sample, the prevalence of frailty found based on Fried´s frailty phenotype in a population-based study conducted in 2013 at 7 sites in Brazil was 39.1%[13]. Moreover, the rate identified by the above-cited study in Montes Claros of 47.2%[8] exceeded the prevalence found in Rio Branco. According to a systematic review on the prevalence of frailty syndrome in Brazil, rates were heterogeneous, where standardization of the method of screening for the frailty syndrome may aid comparison across studies

and help inform and guide intervention strategies, particularly in Brazil, a culturally diverse country with major regional disparities[14].

Functional dependence (2.19; 95%CI 1.81 – 2.66) and the presence of depression (2.02 95%CI 1.49 – 2.73) were the variables most strongly associated with frailty syndrome. The association between frailty and functional disability can negatively impact mobility, social interaction and motivation of older people. This situation places physical, material and emotional burden on the family and increases the demand for care from public and private health systems. It is important to gather data on this association and use them to help professionals perform prevention and early rehabilitation of functional capacity limitations[15].

Studies estimate that 1-9% of community-dwelling older individuals have depression[16]. The present study findings for depression are consistent with the results obtained by Liu et al. (2021)[17] in community-dwellers in the United States, showing an association between the prevalence of frailty and depression. According to Ramos et al. (2015)[18], frailty in older individuals is more strongly associated with depressive symptoms related to exhaustion than to affective symptoms. According to these authors, frailty may be more connected with neurovegetative aspects than with dysphoric or ideational aspects of the condition. This hypothesis is supported by Fiske et al. (2009)[19] who identified cognitive changes (psychomotor slowing, verbal fluency, naming, initiation/perseverance), somatic symptoms (gastrointestinal, loss of appetite, constipation, sleep problems) and loss of interests as the most common symptoms of depression in older people. Several different geriatric variants of depression have been proposed, such as "depression without sadness", "depletion syndrome" and "depression-executive dysfunction syndrome"[19].

In addition, for samples that are predominantly female, such as that of the present study, the association between menopause and depression should also be taken into account, along with the impact caused to other systems, such as vasomotor, genitourinary, cerebral, cutaneous, bone, joint and metabolic, among others, which may exacerbate factors predisposing to depression and stressor events. The social and structural changes that accompany this stage of the life cycle in women may also be a factor.

The present study results showed that frailty was 1.57 times more prevalent among participants who did not engage in physical activity compared with physically active individuals. Sedentarism leads to loss of muscle strength and reduction in muscle mass, important components of sarcopenia, a condition which is part of the frailty syndrome in older adults[2].

According to Tylutka et al. (2021)[21], regular physical activity can regulate the immune system, lower the release of inflammatory cytokines, as well as delay the onset of immunosenescence. Both functional disability and frailty are associated with depression[22], falls[23] and impaired physical mobility[24]. Some studies show that frailty is a significant predictor of mortality[25] and disability in older people[26].

Notably, almost all (96.6%) participants assessed in the present study self-reported at least 1 morbidity. This high prevalence of morbidities in older individuals has been confirmed nationally[13,27]. In the present investigation, of the different morbidities reported, cancer was retained in the descriptive model of frailty.

Population-based studies have shown a cancer prevalence of 6.5-26.5% in older Brazilians[13,27]. The study findings are consistent with the results of Perez and Lourenço (2013)[28], who found an association of cancer with risk of recurrent hospitalizations among frail older patients.

Another variable contributing to the prevalence of frailty was nutritional risk. In Recife, an investigation involving community-dwelling older people concluded that individuals subject to malnutrition have double the risk of developing frailty, while those at nutritional risk have a 5-fold higher risk of frailty.[23.]

More recently, studies have sought to correlate frailty with dietary patterns. In general, the data suggest a positive association of frailty with mixed dietary patterns in Asian countries and in those with less adherence to the Mediterranean diet [29]. The

traditional food culture of the region also plays a key role, with high intake of simple carbohydrates, such as manioc flour. No scientific studies are available investigating a protein-deficient diet in the region in question. Further studies are needed confirming the authors´ theory of a local dietary pattern which has low protein intake, a nutrient needed to maintain and build muscle mass.

Similar results regarding polypharmacy were found by the FIBRA study, where the breakdown of drugs consumed daily by the older participants was as follows: 15.5% used no medications vs 12.0% in Rio Branco; 42.1% used 1-2 medications daily vs 31.8% in Rio Branco, and 41.7% used ≥ 3 medications daily vs 56.2% in Rio Branco[13].

The physiological changes that typically accompany aging may have a significant effect on pharmacokinetics and pharmacodynamics in older patients. The greater the number of medications prescribed, the higher the risk of adverse reactions, drug-drug interactions and toxicity in older users. Drug-drug interactions and toxicity in older individuals tends to result in cognitive impairments and behavioral changes that are often mistaken for dementia[30]. Nevertheless, the prevalence ratio in Rio Branco was lower compared with that of Rio de Janeiro (PR 1.45, 95%CI 1.12 – 1.89) and São Paulo (PR 2.2, 95%CI 1.5 – 2.9)[26,29]. Greater use of medications was also associated with frailty in investigations conducted in China (≥3 or 4 medications), USA (≥5 medications), Japan and Sweden, among others[31,32].

The association of frailty syndrome with falls mirrors the findings of previous studies[2]. The relationship between frailty and the occurrence of falls can be bidirectional i.e. falls can lead to frailty while frailty can lead to falls. According to global data, falls in older individuals are associated with 12% of deaths in this group, and account for 40% of deaths due to resultant injuries. Estimates show that following a fall, 20% of older individuals who sustain hip fractures die within a year[33].

Many studies have shown that self-rated health is a predictor of death, particularly in the older population[7]. The finding of a higher prevalence of cognitive deficit among frail subjects is congruent with the hypothesis of common causes proposed by other authors[33]. These authors hold that the biological bases of the etiology for both these conditions are caused by markers of chronic inflammation, diabetes, cardiovascular problems and brain disorders (both vascular and neurodegenerative). Evidence indicates there is a cumulatively higher risk of the outcome of death in cases of co-occurrence of the two conditions[34].

With regard to sociodemographic factors, age ≥75 years, unsafe neighborhood, non-white ethnicity and living alone were the variables retained in the model of frailty in the present study. Age of 75 years and over remained in the descriptive model. By contrast, international studies report stronger association in older age strata, such as 80+ or 85+[24]. This indicates that frailty developed earlier in the present sample relative to the cited studies.

Some studies have found living alone to be associated with the profile of frailty risk[28]. Living alone may reflect preserved autonomy, social isolation or low social support when needing care. Regarding ethnicity, although the association with non-white ethnicity was shown in the classic study of the frailty phenotype by Fried et al. (2001)[2], this aspect has been little explored and/or reported in the recent scientific literature, hampering comparison of the present findings.

The unsafe neighborhood factor showed a positive association with frailty prevalence. Individuals residing in a neighborhood which evokes feelings of lack of public safety may promote a constant state of alert, starting a stress cascade with release of cortisol and cytokines, impacting homeostasis and triggering a cycle conducive to the development of frailty[35].

Another aspect may be the tendency to avoid the use of public spaces, and remaining house-bound and socially isolated, where this may give rise to frailty, besides other factors associated with the syndrome, such as sedentarism, depression, and telomere shortening, among others. Recent studies have shown that places with poor social cohesion are harmful for maintenance of telomeres and may increase the pace of shortening, a phenomenon that holds true for any level of income[35].

The data reported in the cited study should be interpreted with caution, since this does not involve a causal relationship, but rather an association detected in a cross-sectional study. Limitations inherent to an observational cross-sectional design include the inability to cover all possible confounding conditions of the relationship being investigated, although attempts were made to control for the most important ones cited in the literature. It is noteworthy that the syndrome studied has been a focus of scientific output in the area. However, further investigations focusing hitherto unexplored factors, such as the relationship with laboratory biomarkers, are warranted.

The present study has some limitation that should be noted, such as the high loss rate at one of the health units involved. These losses were largely due to changes of address during the period between sample selection and the field work, moves promoted by the authorities of the State because the area was considered high risk. Almost none of the participants approached refused to take part in the study. It is important to point out that the study design allows results to be extrapolated only for the catchment areas served by the health units investigated. However, the health units were chosen precisely because they had a high proportion of older users seen by the primary health service of Rio Branco. If the other regions of the city have a similar profile of older people to that of the study sample, then these results may be representative of the overall population of older users treated in primary care at the capital city of Acre. Further investigations are needed to confirm this theory. Another potential limitation was the exclusion of patients diagnosed with cognitive disorders, given that this group may constitute a specific stratum of frail subjects which is not represented in the study. Nonetheless, this criteria was applied to prevent information bias, in as far as most of the questionnaires used in the methodologies of similar studies are self-administered.

Strengths of the study include the use of a validated questionnaire, with broad themes collecting data on living and health conditions pertinent to the older population. This information allowed a comprehensive analysis that encompassed little explored aspects of frailty, especially in Brazil, for the first time exploring the nature of the association of the environmental variable "feeling unsafe in the neighborhood" with the frailty outcome. Another strength of the study was the sampling process, which ensured randomness and representativeness of the population of older people investigated.

Furthermore, the present study supports actions defined in public policies aimed at the older population to identify, at the primary care level, users who are frail or pre-frail and promote their rehabilitation, prevent functional decline, and restore maximal functional autonomy. From a scientific perspective, the results of descriptive studies are of utility to managers and clinicians.

CONCLUSION

Taken together, the results of this study showed a prevalence of frailty syndrome of 35.1% and identified its associated factors for the target population as age ≥75 years, self-declared non-white ethnicity/skin color, living alone, unsatisfactory neighborhood safety, cognitive impairment, functional disability, history of falls in past year, polypharmacy, depressive symptoms and history of cancer.

Thus, determining the screening profile that predicts frailty can help in the routine of health unit professionals in the delivery of care to the study population and in the planning of interventions, treatment plans to reduce excess risk of death and other complications associated with frailty in older people.

This knowledge can also inform prevention and care policies, actions and programs for older individuals in the region. The findings also reveal the need for implementing and strengthening specific programs, such as provision of healthcare for the older population and involvement of multi-professional groups supporting Family Health centers.

AUTHOR CONTRIBUTIONS

- Polyana C. L. Bezerra – conception, design, data analysis and interpretation; writing of article; approval of draft to be published, and

responsible for all aspects of the study, vouching for issues involving accuracy or integrity of any part of the work.

- Bruna L. Rocha – writing of article; approval of draft to be published, and responsible for all aspects of the study, vouching for issues involving accuracy or integrity of any part of the work.
- Gina T. R. Monteiro – conception, design, data analysis and interpretation; writing of article; approval of draft to be published, and responsible for all aspects of the study, vouching for issues involving accuracy or integrity of any part of the work.

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Frailty in community-dwelling older adults: a comparative study of screening instruments

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Abstract

Objective: to analyze the agreement between the Edmonton Frail Scale (EFS) and the Clinical Functional Vulnerability Index (CFVI-20). *Methods:* cross-sectional study, during which the Edmonton Frail Scale and the Clinical Functional Vulnerability Index were applied, at home, to older adults, registered in units of the Family Health Strategy of Montes Claros (MG) and randomly selected by lot. To evaluate the correlation and agreement between the instruments, *Pearson*'s correlation coefficient and the weighted *Kappa* were calculated, considering three levels of frailty classification, as follows: "robust", "risk of frail" and "frail" for the IVCF-20 and "not frail", "vulnerable" and "frail"' for the EFS. *Results:* We evaluated 673 older adults, predominantly brown, between 60 and 74 years old and female. According to the IVCF-20, 153 (22.7%) of the older adults were classified as "frail", 195 (29%) as "risk of frail" and 325 (48.3%) as "robust". According to the EFS, 159 older adults (23.6%) were classified as "frail"; 112 (16.6%) older adults "apparently vulnerable" and 402 (59.7%) "not frail". *Pearson*'s correlation coefficient was 0.865 (p<0.001) and showed a positive correlation between the instruments and *Kappa* statistics showed a value of 0.532 (p=0.027), revealing moderate agreement. *Conclusion:* The instruments evaluated showed moderate agreement and strong positive correlation, despite the differences between some of their components. Both showed to be compatible for the assessment of frailty in older adults in the context of Primary Health Care.

Keywords: Geriatric Assessment. Aged. Primary Health Care. Frailty.

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INTRODUCTION

Brazil, akin to most countries, is undergoing a major epidemiological transition driven by a rapid growth in the older population[1-3]. This increase in the contingent of older people places greater burden on public and private health systems with higher costs for treating chronic non-communicable diseases (NCDs) and their consequences, particularly multimorbidity and polypharmacy[4].

The frailty syndrome in older people is a clinically-preventable and reversible condition characterized by a cumulative decline in physiological systems which result in greater vulnerability to adverse health events[5]. Although no consensus exists, the most widely accepted concept defines frailty as a loss of physical functioning or accumulation of multiple deficits. An alternative conceptual approach describes frailty as a loss of interaction between genetic, biological, functional, cognitive, psychological and socioeconomic dimensions which leads to homeostatic instability[6].

The association between frailty and adverse health events underscores its importance as a marker of functional health in older people. Although the syndrome is associated with disabilities and multiple comorbidities, frailty can also occur in apparently healthy individuals, since its physiology is complex and involves interaction between diseases and aging-related decline[7].

A systematic review of instruments for assessing frailty in the older population found a lack of standardization across screening tools. The large number of instruments available for measuring frailty makes it difficult for researchers and clinicians to choose the most appropriate tool. Given the wide array of different instruments, researchers and clinicians are recommended to select the most suitable tool for the local context, evaluation goals, professional experience and time available[8].

Most available scales are not quick to apply during screening by frontline health professionals who provide care for older people. Multi-dimensional clinical data based on comprehensive geriatric assessment (CGA), and a specialized geriatric-gerontological team, are often required[8-10]. Many professionals typically diagnose frailty based on multiple diseases or comorbidities or on general appearance without taking into account aspects related to older people´s greater vulnerability to functional decline. These aspects can also be overlooked by instruments designed for assessing older individuals[9,10].

In this context, the Clinical Functional Vulnerability Index (CFVI-20) and Edmonton Frail Scale (EFS) constitute two scales used for assessment and screening of frail older individuals. Both these tools are deemed by their authors as reliable and easy-to-apply by non-specialists in geriatric medicine, often frontline health professionals who deliver care to the older population[9-12]. The two tools rank among the 4 most commonly used instruments for evaluating clinimetric properties, according to a systematic review involving studies from many countries, including Brazil [8]. The CFVI-20 is a practical rapid screening instrument developed in Brazil that can be applied by any health professional engaged in primary care, conferring utility for identifying frail older adults living in the community[9]. The EFS, developed in Edmonton city, Canada, is a one of the most internationally recognized scales, with a validated version in Portuguese[11,12].

The objective of the present study was to analyze the agreement between the Edmonton Frail Scale (EFS) and the Clinical Functional Vulnerability Index (CFVI-20).

METHODS

The scales were analyzed by applying both to a random sample of older individuals in a cross-sectional, analytical study conducted in the city of Montes Claros (Minas Gerais state), Brazil. The city is the largest most important urban center in the region. At the time of the study, the city had an estimated population of 400,000 people[13] and 132 Family Health Strategy (ESF) teams, providing 100% primary health coverage.

Two-stage cluster sampling was carried out. An initial total of 6 out of the 12 regional urban health centers of the city were randomized and ESF teams randomly selected from each. For each health region,

sub-regions were randomly selected, where all older residents were considered eligible for the study.

Data were collected at the homes of the older individuals by a previously trained data collection team comprising nurses and medical students engaged in a scientific initiation program. Interviews lasting around 40 minutes were conducted via household visits. Data collection was performed between March and June 2018. All older individuals aged ≥60 years registered with and followed by ESF teams were included. Individuals who had severe physical or cognitive disability precluding the answering of the questionnaire and no caregiver/guardian available during the data collection visit were excluded. Older individuals who were hospitalized or institutionalized at the time of interviews were also not included.

The sample size was calculated using Epi info software available for download at https://www.cdc.gov/epiinfo/support/downloads.html. The estimated parameters were: sample size 34,000 older adults[13]; expected prevalence 20.1% frail individuals, as determined in a previous study of the same region[14]; error margin 4%, confidence level 95%; and sample design effect correction 1.5. Based on these parameters, the minimum number of older participants to be included in the study sample was 572.

The following sociodemographic information was collected to characterize the sample: sex, age group, skin color, education, family income and living arrangements.

The data collection instruments applied were the Edmonton Frail Scale (EFS) and the Clinical Functional Vulnerability Index (CFVI-20). The EFS, adapted and validated for use in Brazil, measures 9 different domains: cognition, general health status, functional independence, social support, use of medications, nutrition, mood, continence and functional performance, investigated using 11 items. Maximum score on the scale is 17 points, representing the maximal level of frailty. Frailty status is determined by the scores: 0-4, not frail; 5-6, vulnerable; 7-8, mild frailty; 9-10, moderate frailty; ≥11, and severe frailty[11,12,15].

The CFVI-20 was devised and validated for use as a screening instrument in primary care to identify frail older individuals. The scale comprises 20 questions under 8 different sections including age (1 question), self-perceived health (1 question), activities of daily living (4 questions), cognition (3 questions), mood (2 questions), mobility (6 questions), communication (2 questions) and multiple comorbidities or recent hospitalization (1 question)[9]. Higher scores on the scale indicate worse clinical-functional state of the respondent. Based on CFVI-20 score, respondents are classified as: robust (0-6 points), exhibits good homeostatic reserve, independence and autonomy and no functional disability; risk of frailty (7-14 points), although manages life with independence and autonomy, has imminent risk of loss of functioning; and, lastly, frail (≥15 points), presenting functional decline and single or multiple disabilities, rendering the individual unable to manage own life[15,16].

Prior to analysis, the database was cleaned by identifying and removing outliers. The presence of normal distribution of variables was determined using the Kolmogorov-Smirnov test. Correlation between the instruments was assessed using Pearson´s correlation coefficient for total scores on each scale. Agreement between the EFS and CFVI-20 was determined using the weighted-kappa statistic for the 3 levels of frailty classification on each scale. Levels for the CFVI-20 were classified as "robust", "risk of frailty" and "frail". On the EFS, the 3 frailty levels "mild", "moderate" and "severe" were pooled into a single group rated as "frail", plus "not frail" and "vulnerable" levels. The value of the kappa statistic was interpreted as per Landis & Koch[17]. The final significance level of 5% ($p < 0.05$) was adopted for all statistical analyses.

The study was conducted in compliance with Resolution 466/12 of the National Board of Health of the Ministry of Health[18]. The research project was approved by the Research Ethics Committee (CEP) of the State University of Montes Claros, under permit no.1.629.395. All participants (or guardians) agreed to take part in the study by signing the Free and Informed Consent Form.

RESULTS

The study group comprised 673 older people registered with and followed by the ESF teams of the city. Of this total, 36 participants were lost due to refusals or exclusions. The sample contained older individuals who were predominantly brown (48.9%), female (63.2%), and aged 60-74 years (64.5%). Most participants were literate (but had <4 years of formal education), lived with others, and had a family income of 1-3 minimum wages (Table 1).

Performance on the CFVI-20 ranged from 0-40 points and 153 (22.7%) respondents were classified as "frail", 195 (29%) as "risk of frailty" and 325 (48.3%) as "robust".

The components of the instrument are described in Table 2. Highest positive response rates were for impairment of activities of daily living ("stopped bathing alone"), cognition ("forgetfulness prevents performing some daily activities") and mobility ("inability to handle/hold small objects" and "inability to raise arms above shoulder level"). Age, communication and comorbidities were the dimensions with the lowest rates of impairment in the frail group.

Table 1. Sociodemographic characteristics of older users of Family Health Strategy, Montes Claros (Minas Gerais state), 2018.

Variables	(n)	(%)
Sex		
Female	425	63.2
Male	248	36.8
Age (years)		
60 - 74	434	64.5
75 - 84	178	26.4
≥ 85	61	9.1
Skin color		
White	250	37.1
Black	84	12.5
Brown	329	48.9
Yellow	10	1.5
Education (years)		
< 1	72	10.7
1 - 4	225	33.4
5 - 8	249	37.0
≥ 9	127	18.9
Family income (minimum wages)*		
< 1	36	5.3
1 - 3	422	62.7
≥ 4	215	31.9
Living arrangements		
Lives alone	605	89.9
Lives with others	68	10.1

* Minimum wage at time of data collection = R$954.00.

Table 2. Positive response rates for items of dimensions of CFVI-20 in older users of Family Health Strategy, Montes Claros (Minas Gerais state), 2018.

CFVI-20 dimensions		Frail n (%)	Frailty risk n (%)	Robust n (%)
1.0	**Age** (years)			
	60-74	54 (13.4)	103 (25.5)	247 (61,1)
	75-84	61 (31.0)	65 (33.0)	71 (36,0)
	≥ 85	38 (52.8)	27 (37.5)	7 (9,7)
2.0	**Self-perceived health**			
	Excellent	3 (4.8)	17 (27.4)	42 (67,7)
	Very good	6 (8.6)	13 (18.6)	51 (72,9)
	Good	46 (14.2)	94 (28.9)	185 (56,9)
	Fair	73 (40.8)	64 (35.8)	42 (23,5)
	Poor	25 (67.6)	7 (18.9)	5 (13,5)
3.0	**Activities of Daily Living (ADLs)**			
3.1	Basic ADLs			
	Stopped bathing alone	54 (94.7)	3 (5.3)	0 (0.0)
3.2	Instrumental ADLs			
	Stopped doing shopping	122 (70.9)	44 (25.6)	6 (3.5)
	Stopped controlling finances	88 (73.3)	28 (23.3)	4 (3.3)
	Stopped doing domestic chores	108 (68.4)	48 (30.4)	2 (1.3)
4.0	**Cognition**			
	Becoming forgetful	112 (46.9)	72 (30.1)	55 (23.0)
	Worsening forgetfulness in recent months	67 (66.3)	24 (23.8)	10 (9.9)
	Forgetfulness preventing some daily activities	57 (87.7)	7 (10.8)	1 (1.5)
5.0	**Mood**			
	Dispiritedness, sadness or hopelessness in last month	97 (43.3)	82 (36.6)	45 (20.1)
	Loss of interest or pleasure, in last month, in previously enjoyable activities	88 (68.2)	32 (24.8)	9 (7.0)
6.0	**Mobility**			
6.1	Reach, grasp, and pincer grip			
	Inability to raise arms above shoulder level	27 (90.0)	2 (6.7)	1 (3.3)
	Inability to handle or hold small objects	11 (91.7)	1 (8.3)	0 (0.0)
6.2	Aerobic and/or muscle capacity			
	Unintentional weight loss	42 (50.6)	25 (30.1)	16 (19.3)
	BMI < 22	43 (35.0)	38 (30.9)	42 (34.1)
	Calf circumference < 31cm	23 (44.2)	19 (36.5)	10 (19.2)
	Gait speed (4m) > 5 sec.	133 (48.4)	96 (34.9)	46 (16.7)
6.3	Gait			
	Walking difficulties	118 (70.2)	47 (28.0)	3 (1.8)
	≥2 falls in last year	58 (47.9)	44 (36.4)	19 (15.7)
6.4	Incontinence			
	Involuntary loss of urine or feces	89 (50.9)	65 (37.1)	21 (12.0)

to be continued

Continuation of Table 2

CFVI-20 dimensions		Frail n (%)	Frailty risk n (%)	Robust n (%)
7.0	**Communication**			
	Vision problems	60 (43.8)	47 (34.3)	30 (21.9)
	Hearing deficits	40 (49.4)	32 (39.5)	9 (11.1)
8.0	**Comorbidities**			
	≥5 chronic diseases	68 (54.0)	45 (35.7)	13 (10.3)
	≥5 drugs used daily	103 (43.3)	76 (31.9)	59 (24.8)
	Hospitalization in last 6 months	34 (47.2)	21 (29.2)	17 (23.6)

Performance on the EFS ranged from 0-16 points, and 159 (23.6%) of respondents were classified as "frail", 112 (16.6%) as "vulnerable" and 402 (59.7%) as "non-frail". The positive response rates on EFS items for respondents are given in Table 3. The most frequent components among respondents with final classification of "frail" were poor self-perceived health, low functional performance, dependence, and high number of hospitalizations in last year.

The two scales were compared by calculating Pearson´s correlation coefficient. The result of 0.865 (p<0.001) demonstrated strong positive correlation between the instruments assessed (Table 4).

For the analysis of agreement, both scales were assessed for classification into 3 categories yielding a Kappa statistic of 0.532 (p=0.027), indicating moderate agreement (Table 5).

Table 3. Positive response rates for items of dimensions of Edmonton Frail Scale (EFS) in older users of Family Health Strategy, Montes Claros (Minas Gerais state), 2018.

EFS dimensions		Frail **n (%)**	Vulnerable **n (%)**	Not frail **n (%)**
1.0	**Cognition (clock test)**			
	Passed - no errors	16 (6.0)	33 (12.4)	218 (81,6)
	Failed – minor errors	17 (17.7)	19 (19.8)	60 (62,5)
	Failed – major errors	126 (40.6)	60 (19.4)	124 (40,0)
2.0	**General health status: hospital admissions in past year**			
	None	105 (18.1)	97 (16,8)	377 (65,1)
	1-2	50 (55.6)	15 (16,7)	25 (27,8)
	> 2	4 (100.0)	0 (0,0)	0 (0,0)
3.0	**Self-rated health**			
	Excellent	4 (6.9)	3 (5.2)	51 (87,9)
	Very good	4 (5.9)	5 (7.4)	59 (86,8)
	Good	58 (17.0)	47 (13.8)	236 (69,2)
	Fair	64 (37.9)	53 (31.4)	52 (30,8)
	Poor	29 (78.4)	4 (10.8)	4 (10,8)
4.0	**Functional independence: number of activities requiring help**			
	0-1	24 (5.2)	61 (13.1)	381 (81.8)
	2-4	22 (27.8)	37 (46.8)	20 (25.3)
	5-8	113 (88.3)	14 (10.9)	1 (0.8)

to be continued

Continuation of Table 3

EFS dimensions		Frail n (%)	Vulnerable n (%)	Not frail n (%)
5.0	**Social support (when need help, can count on someone)**			
	Always	133 (21.7)	101 (16.5)	379 (61.8)
	Sometimes	24 (42.9)	9 (16.1)	23 (41.1)
	Never	2 (50.0)	2 (50.0)	0 (0.0)
6.0	**Use of ≥5 medications**			
	No	56 (12.2)	66 (14.4)	337 (73.4)
	Yes	103 (48.1)	46 (21.5)	65 (30.4)
7.0	**Forget to take medications**			
	No	35 (8.2)	57 (13.3)	335 (78.5)
	Yes	124 (50.4)	55 (22.4)	67 (27.2)
8.0	**Nutrition (weight loss)**			
	No	98 (18.0)	88 (16.1)	359 (65.9)
	Yes	61 (48.0)	23 (18.1)	43 (33.9)
9.0	**Mood (sad or depressed)**			
	No	58 (12.7)	58 (12.7)	342 (74.7)
	Yes	101 (47.0)	54 (25.1)	60 (27.9)
10.0	**Urinary incontinence**			
	No	72 (14.4)	66 (13.2)	363 (72.5)
	Yes	87 (50.6)	46 (26.7)	39 (22.7)
11.0	**Functional Performance (Timed Up and Go test)**			
	0-10 seconds	8 (2.4)	36 (10.7)	293 (86.9)
	11-20 seconds	70 (28.8)	69 (28.4)	104 (42.8)
	> 20 seconds	81 (87.1)	7 (7.5)	5 (5.4)

Table 4. Comparison of frailty classifications on CFVI-20 with 3 categories and EFS with 5 categories in older users of Family Health Strategy, Montes Claros (Minas Gerais state), 2018.

CFVI-20 classification	Edmonton Scale Classification					Total
	Severe frailty	Moderate frailty	Mild frailty	Vulnerable	Not frail	
Frail	44 (28.8%)	40 (26.1%)	35 (22.9%)	28 (18.3%)	6 (3.9%)	153 (100.0%)
Frailty risk	1 (0.5%)	5 (2.6%)	32 (16.4%)	61 (31.3%)	96 (49.2%)	195 (100.0%)
Robust	0 (0.0%)	1 (0.3%)	1 (0.3%)	22 (6.8%)	301 (92.6%)	325 (100.0%)
Total	45 (6.7%)	46 (6.8%)	68 (10.1%)	111 (16.5%)	403 (59.9%)	673 (100.0%)

Linear correlation (Pearson´s): r =0.865 (p<0.001)

Table 5. Comparison of frailty classifications on CFVI-20 with 3 categories and EFS with 3 categories in older users of Family Health Strategy, Montes Claros (Minas Gerais state), 2018.

CFVI-20 classification	Edmonton Scale Classification			
	Frail	Vulnerable	Not Frail	Total
Frail	119 (77.8%)	28 (18.3%)	6 (3.9%)	153 (100.0%)
Frailty risk	38 (19.5%)	61 (31.3%)	96 (49.2%)	195 (100.0%)
Robust	2 (0.6%)	22 (6.8%)	301 (92.6%)	325 (100.0%)
Total	159 (23.6%)	111 (16.5%)	403 (59.9%)	673 (100.0%)

Agreement statistic Kappa = 0.532 (p=0.027)

DISCUSSION

The prevalence of frailty found using the CFVI-20 and EFS proved similar, with a slightly higher rate measured by the EFS. These rates are consistent with those found by other studies involving the Brazilian population[15,16,19,20]. A higher range of prevalence was observed for vulnerable and pre-frail individuals. This result shows the role of the CFVI-20 in assessing patients susceptible to developing frailty syndrome, reiterating its screening function.

The equivalence of the scales assessed in the present study, measured both in terms of linear regression among total scores and for level of agreement, corroborates previous studies in Brazil, but for a larger sample of randomly selected community-dwelling older people[15,19]. The results, however, differ from those of a previous study assessing the level of agreement between the Clinical Functional Vulnerability Index (CFVI-20) and another screening instrument, the Subjective Frailty Assessment (SFA). The results of the cited study showed low-to-moderate agreement, underscoring the need for a standardized instrument for measuring frailty in community-dwelling older adults and the risk of bias in using instruments with subjective assessment components[21].

Frailty in older adults is a complex, multifactorial condition that can and should be prevented[8,22]. This makes the use of instruments capable of rapidly identifying frail individuals in the community extremely desirable and useful for prioritizing and supporting early interventions. However, given the host of instruments available, it is important to consider, besides psychometric properties (mainly validity and reliability), the context of the lives of the people being assessed and the process of applying the instruments.

In this respect, it is noteworthy that, although evaluating the same construct, scales contain different items and may assess the same items in different ways. The use of different instruments for assessing frailty in older people can hamper standardization of screening of the syndrome, hence the importance of comparative studies in helping to standardize reliable, easy-to-apply diagnostic tools for use in different healthcare settings[23].

The cognitive dimension of older people in EFS is evaluated by the clock test. The use of this test may represent a barrier hampering the assessment in the population investigated given that the results for this item revealed that a similar proportion of frail and non-frail respondents failed the test with major errors. Thus, relying on the clock test as the sole item in the EFS for assessing cognition may introduce bias for some populations by assuming they hold previous knowledge on mathematics. Overall, the study population assessed had a low educational level, comprising individuals with less than 4 years of formal education, perhaps explaining the results on this component. The study by Ribeiro[15], analyzing performance on the clock test in a population with an average educational level of 7.13 years, reported a similar result. Other authors have voiced similar reservations regarding the clock test owing to its potential to overestimate the prevalence of frailty and classify low-educated older people as having cognitive problems[24].

The CFVI-20 measures two dimensions not contained in the EFS, namely, age (stratified into 3 categories) and communication aspects, including assessments of vision and hearing. The use of age as a dimension implicated in the process of frailty can be confirmed in the data obtained revealing that patients aged ≥85 years are proportionally more frail, while those aged 60-74 years have more favorable parameters regarding the syndrome. Nevertheless, the present results differ to those of other studies in which all patients aged ≥85 years were rated as frail[25].

Self-reported visual and hearing deficits were associated with poorer functioning among older individuals and, thus, contribute to a worsening of frailty, as reported by other studies employing the instrument[15]. The lack of criteria evaluating these two dimensions in the EFS may have been another factor contributing to the disparities observed in the results obtained when applying the two scales.

The EFS includes a dimension assessing social support, a component not measured by the CFVI-20. The results found showed that fewer frail or pre-frail patients reported being able to count on the help of others who could meet their needs.

Frailty syndrome is not associated with the physical realm alone, where variables related to emotional aspects, social conditions, as well as interpersonal and family relationship, also exert an influence[26,27]. Although the social component furnishes information on care provided to older people, the results are insufficient to conclude that absence of social support is a causal factor or an effect of frailty syndrome. The failure to assess social and environmental contexts is highlighted in a systematic review on the topic[8].

Activities of daily living are assessed by both scales, although the CFVI-20 has the feature or measuring this dimension by comparing different stages in the life course. To this end, the item is rated by probing loss of functioning due to health-related issues or unfavorable physical conditions. In addition, only the CFVI-20 evaluates loss of ability to perform basic activities of daily living, with being able to bathe alone defined as a key activity. In the study by Ribeiro et al.[15] , the authors also noted that most older individuals assessed required help performing an ADL and highlighted the association between loss of autonomy and frailty syndrome.

Despite the difference in the constituent components of the instruments, most of the dimensions are evaluated in a similar fashion. The use of different variables to measure the dimensions in the EFS and CFVI-20 may have further contributed to the disparities in results when applying the two scales. These differences, however, do not prevent the use of these tools, in view of the statistical values of agreement and correlation obtained.

The EFS provides a final classification containing 3 levels of frailty (mild, moderate and severe), a positive aspect in allowing immediate, more timely interventions for those who most require treatment. Despite the dynamic nature of frailty, potentially transitioning between levels over time, a reversal in status from "very frail" to "not frail" is highly unlikely"[20,28]. Given this scenario, older patients identified as more critical cases should be treated with more urgency.

The CFVI-20 proved able to identify pre-frail patients, constituting a sensitive instrument that can aid health professionals in the management and reversal of modifiable risk factors for frailty[9].

As a simple, brief, easy–to-apply tool, that can be readily interpreted by nonspecialist professionals, the CFVI-20 constitutes an effective instrument for health care planning to not only help cure and rehabilitate older patients, but also to guide health prevention and promotion actions. Therefore, use of the tool can help inform planning of preventive measures, as well as optimize the flow of referrals to specialized geriatric-gerontological services, particularly amid scenarios where there is a shortage of specialists in geriatric medicine[8,9].

This study has some limitations, such as the fact that it was conducted within a primary care setting involving community-dwelling older adults, given that frailty assessment may be necessary and useful in other contexts, including long-term care facilities (LTCFs). Both of the tools used center strongly on clinimetric measures, without considering the social and environmental context, which may, to some degree, be modulators of frailty status.

Notwithstanding, the study drew on data obtained from a large representative sample of the population, selected probabilistically, and reports results for an easy-to-apply, home-grown instrument for early detection of frail or pre-frail older patients in a primary care setting.

In this respect, such a standard tool can better cater for the needs of this age group, consolidating the role of the ESF in the national care policy for the older population.

CONCLUSION

The prevalence of frailty measured by the CFVI-20 and EFS screening instruments was 22.7% and 23.6%, respectively. The results of comparisons showed moderate agreement and strong positive correlation between the instruments, despite some differences for some components.

Both instruments proved appropriate for home assessment of frailty in older adults within a primary care setting. The instruments evaluated are suitable for screening, offering ease-of-application by non-specialists in geriatrics and gerontology, besides the ability to classify pre-frail individuals.

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Cervical human papillomavirus infection in older women

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Abstract

Objective: To investigate the presence of cervical infection by human papillomavirus (HPV) and associated factors in older women. *Method:* A cross-sectional, retrospective descriptive study with a quantitative approach was conducted. The sample comprised 106 women aged 60 years or over, seen at public health services of a city in southern Brazil, who underwent cervical cell collection for cytological analysis and molecular detection of HPV DNA. Clinical and sociodemographic data were collected using a standardized questionnaire and from Pap test results. *Results:* Patient age was 60-82 years, with a mean of 64.9 ± 5.1 years. HPV was detected in 14 (13.2%) of the study participants and 8 viral types were identified, the majority (n=7; 87.5%) of high oncogenic risk. Chi-square analysis revealed that positive HPV cases were associated with a higher number of sexual partners (p= 0.018). On cytology, most of the women (n=102; 96.2%) had a negative result for intraepithelial lesion or malignancy, and two (1.8%) had abnormal cytology, but neither were positive for HPV infection on molecular testing. Of the 10 women evaluated at two visits, seven (70%) tested negative for HPV infection on both evaluations, two (20%) eliminated the HPV infection, and one (10%) showed conversion to positive infection status. None of the cases had persistent infection. *Conclusion:* Older women are susceptible to HPV infection and to the lesions caused by the virus. This group should therefore continue regular cytological screening.

Keywords: Screening. Papanicolaou test. Women's Health. Cervical Neoplasms.

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INTRODUCTION

The human papilloma virus (HPV) can infect the epithelial coating of the anogenital tract and other mucosa areas of the body and is responsible for the occurrence of a number of diseases, including cervical cancer[1].

The global incidence of cervical cancer in women aged over 60 years is 35.1 per 100,000 population. In Brazil, this rate is higher at 39.5 per 100,000 population[2]. Persistent infection by oncogenic types of HPV is the main risk factor for developing this neoplasm[3].

The main risk factors for acquisition of HPV infection include number of life-time sexual partners, age at sexual debut, smoking, use of birth control pill, other sexually-transmitted infections (STIs), chronic inflammation, immunosuppression, and parity. Age has also been implicated as a risk factor for the development of cancer, due to cellular changes which take place during the aging process, favoring cellular errors and differentiation[4].

The prevalence of HPV in younger women is high, but declines from age 30 onwards, irrespective of sexual behavior, suggesting that immune response plays a role. However, in some regions of the world, women experience a second peak from 50 years and older[5]. One proposed explanation for this second peak is multiple partners, through which women may be exposed to different types of HPV or to reactivation of latent infection, owing to progressive reduction in specific immunity, exposure to infected partners and hormonal fluctuations. Also, due to the immunosenescence process in older individuals, the virus is not eliminated effectively, particularly for multiple infections that involve different viral types[6,7].

The cytopathological (Pap) test is used in routine screening for cervical cancer[8] as this enables identification of precursor lesions or invasive forms of the cancer[9]. Molecular detection of high-risk HPV can identify women at greater risk of developing neoplasia. Combined use of these two approaches (Pap-HPV co-testing) is recommended by some health organizations and societies and has become part of routine practice in many countries[10].

In Brazil, the Ministry of Health recommends cytopathological testing every 3 years for women aged 25-64 years after 2 consecutive normal annual tests. This testing regimen should continue until the age of 64 and be suspended after at least 2 consecutive positive tests within the past 5 years[8]. However, in women that continue to have an active sexual life after this age, further routine screening may be pertinent, given that the second peak of HPV occurs at older ages[11].

Moreover, it important to emphasize that the older population does not necessarily stop experiencing their sexuality. However, unsafe sex makes this group vulnerable to STIs, including HPV. Additionally, the lack of specific guidelines for management of STIs in older people hampers the individualized care of this group[12].

In this context, although older women are vulnerable to infection by HPV, few studies on this topic involving this population have been conducted[13]. This scenario highlights the need to further investigate and elucidate cervical infection by HPV in older women, allowing the devising of strategies for the prevention and early detection of HPV-induced lesions in this group, including cervical cancer.

Therefore, the objective of this study was to investigate the presence of cervical infection by HPV and associated factors in older women.

METHOD

Study characteristics and ethics aspects

A retrospective, descriptive, cross-sectional study with a quantitative approach analyzing data from studies performing cytological assessment and detection of DNA-HPV in cervical samples was conducted. These studies are in compliance with Resolution nos. 466/2012 and 510/2016, and were approved by the Research Ethics Committee under permits 078.0.417-09, 1.506.860, 2.790.225 and 4.984.176.

Sample characteristics

A total of 106 older women were included in the sample, drawn from the database associated with the projects outlined above, according to the inclusion criteria of the present study, namely: age ≥60 years, and results of Pap and HPV molecular tests available on the database.

The sample of women studied was seen under the Cervical Cancer Screening Program, run as part of the Family Health Strategies, at the city of Cruz Alta (RS) to perform routine cytopathology tests during the periods January-June, 2010 (n=337), January-November, 2012 (n=285), March-November, 2013 (n=374), August-November, 2018 (n=89) and April-June, 2019 (n=78). The women were seen under the screening program both opportunistically, i.e. underwent testing when seeking health services for other reasons, or by prior appointment for the test.

Intentional sampling was used and participants included in the study were grouped as follows: (i) women who made only one visit to the services included over the study period; and (ii) women who made 2 visits to the services included in the study, with a minimum interval of 1 year between them, over the study period (Figure 1).

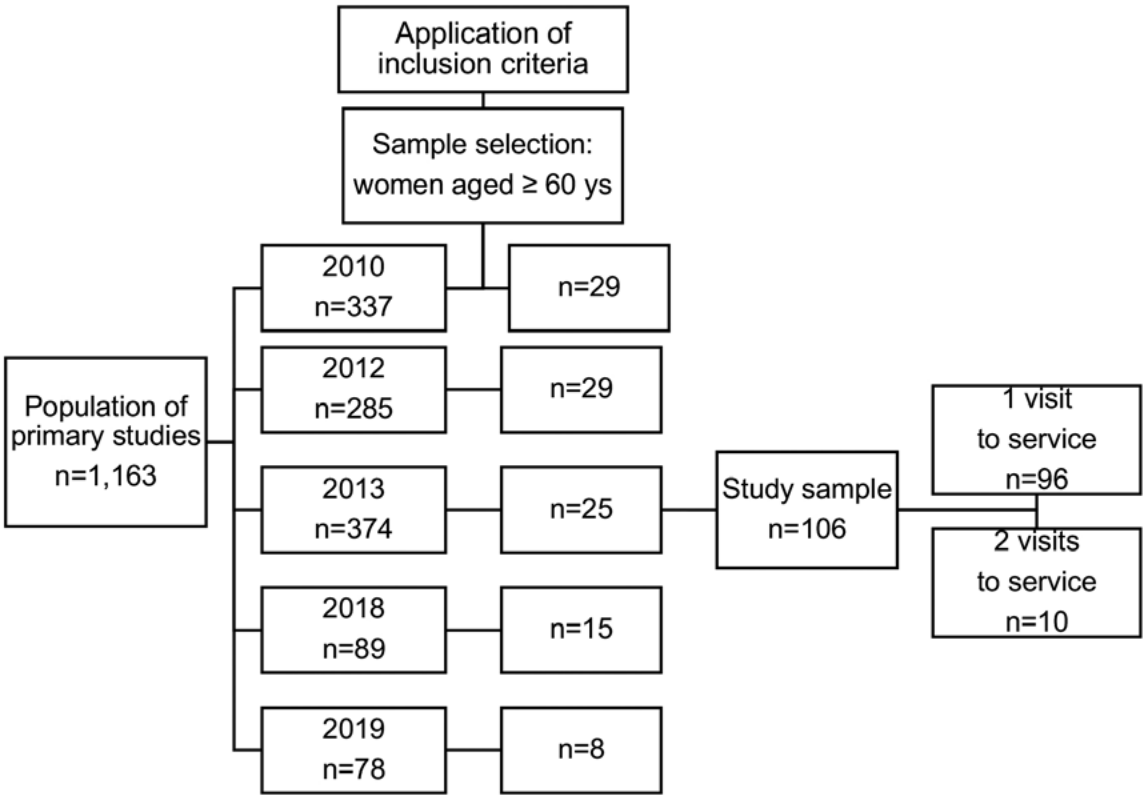

Figure 1. Flow diagram of sample selection process. Cruz Alta, Rio Grande do Sul state, 2023.

Current guidance for screening in Brazil recommends that collection of this test should commence at 25 years of age for women who have debuted or are sexually active and cease at 64 years, for individual with no prior history of pre-neoplastic disease and at least 2 consecutive negative tests in the past 5 years. Women aged older than 64 years who have never performed the test should undergo 2 tests with a 3-year interval between them. In the event that both tests prove negative, these individuals need undergo no further testing[7].

Data Collection

The following information were obtained from the database of the primary studies: results of cytological (Pap) test, results of HPV detection test, and both clinical and sociodemographic data.

The result of the cytological test was based on the Papanicolaou technique, with samples examined by 2 cytopathologists and results classified according to the Bethesda system[9]. Data for the HPV test were obtained using molecular biology techniques, with DNA extraction by the silico method, DNA amplification using Nested-PCR assays[14] and genotyping by direct sequencing or restriction fragment length polymorphism (RFLP) from PCR-amplified DNA fragments, with classification of viral types according to de Villiers et al.[15] and de Villiers[16].

Women who had made two visits to the services included in the study, at least 1 year apart, were assessed on both occasions by applying the Pap test and molecular HP detection test to check for the persistence, conversion to positive status, or elimination of the infection. This group was categorized according to HPV infection status, as follows: (1) persistent infection, when DNA-HPV was detected at both assessments; (2) conversion, when DNA-HPV was negative at the first consultation, but subsequently detected during follow-up; (3) elimination, when the presence of DNA-HPV was detected only at the first assessment; and (4) no HPV infection, when DNA-HPV was negative at both visits.

Clinical data (sexual debut, date of last Pap test, use of condom during sexual intercourse, number of sexual partners) and sociodemographics (age, education, number of children) were obtained by applying a standardized questionnaire and from the findings of the Pap test applied to participants.

Statistical Analysis

Statistical differences among qualitative variables were determined using Pearson´s chi-square test or Fisher´s Exact Test, as applicable. All statistical analyses were two-tailed with a pre-defined significance level for alpha error of 5% ($p < 0.05$).

RESULTS

HPV was detected in 14 (13.2%) of the 106 women assessed in the study. A total of 8 viral types were identified, including 7 (87.5%) of high-oncogenic risk (16, 31, 45, 53, 58, 64 and 70) and 1 (12.5%) of low oncogenic risk (cp8304). For 5 of the positive samples, the type could not be determined due to insufficient sample to perform the technique available to the research group. The most prevalent type was HPV 53 (2 cases).

Patient age ranged from 60-82 years, with a mean of 64.9 (SD±5.1) years. The other characteristics of the study population, according to HPV infection status, are presented in Table 1. The chi-square analysis revealed that positive HPV cases were associated with higher number of sexual partners (p= 0.018).

For cytological characteristics, most participants (n=102; 96.2%) tested negative for intraepithelial or malignancy, while only 2 (1.8%) individuals exhibited changes in cell cytology. Of the cases with abnormal cytology, none were positive for HPV infection on molecular testing (Table 1).

Table 1. Characteristics of population assessed, according to Human Papillomavirus (HPV) infection status (N= 106). Cruz Alta, Rio Grande do Sul state, 2023.

Variables	All participants (N= 106) n (%)	HPV absent (n= 92) n (%)	HPV present (n= 14) n (%)	*p-value*[c]
Education[a]				
≤ Primary	64 (82.0)	57 (83.8)	7 (70.0)	0.373
≥ Secondary	14 (18.0)	11 (16.2)	3 (30.0)	
No. of children[a]				
≤ 2	22 (41.5)	20 (43.5)	2 (28.6)	0.686
≥ 3	31 (58.5)	26 (56.5)	5 (71.4)	
Sexual debut[a]				
< 20 years	21 (38.8)	18 (38.3)	3 (42.9)	0.999
≥ 20 years	33 (61.2)	29 (61.7)	4 (57.1)	
No. of partners[a]				
< 2	43 (81.1)	40 (87.0)	3 (42.9)	**0.018**
≥ 3	10 (18.9)	6 (13.0)	4 (57.1)	
Use of condom[a]				
Yes	05 (9.4)	03 (6.5)	02 (28.6)	0.124
No	48 (90.6)	43 (93.5)	5 (71.4)	
Last Pap test				
Does not remember	2 (1.9)	1 (1.1)	1 (7.1)	0.610
≤ 3 years	94 (88.7)	83 (90.2)	11 (78.6)	
≥ 4 years	10 (9.4)	8 (8.7)	2 (14.3)	
Papanicolaou test				
Normal	102 (96.2)	88 (95.7%)	14 (100.0)	0.729
Abnormal[b]	2 (1.8)	2 (2.2)	0 (0.0)	
Unsatisfactory	2 (1.8)	2 (2.2)	0 (0.0)	

[a] Total tally does not match due to missing data for this variable.

[b] Includes 1 case of atypical squamous cells of undetermined significance (ASC-US) and 1 case of atypical squamous cells, cannot exclude high-grade squamous intraepithelial lesion (ASC-H).

[c] Pearson´s or Fisher´s Exact tests, as applicable

Of the 10 participants assessed at 2 visits, with at least a 1-year gap between consultations, most (n=7; 70%) tested negative for HPV infection on both assessments. Two individuals (20%) eliminated the HPV infection, where 1 case initially tested positive for HPV 16 and the other for HPV 53, both of whom had normal cytology findings on the two Pap tests performed. Only 1 (10%) participant showed conversion to positive status, exhibiting infection by HPV 31 at the second visit, but no cytological abnormalities. There were no cases of persistent infection.

DISCUSSION

The present cross-sectional study involved older women seen by the public health services of the city of Cruz Alta, situated in the interior of Rio Grande do Sul state. The 13.2% prevalence of HPV infection found is higher than the 4.3%[11] and 4.1%[13] rates reported by previous studies investigating older women[13]. With regard to viral types, the most commonly identified type was HPV 53, differing to the types found by other studies cited[11,13].

In Brazil, studies investigating the prevalence of cervical infection by HPV reported type 16 as the most common type detected, both in younger and older women[17-20]. Similarly, worldwide, HPV 16 is the most prevalent type in women with cervical cancer and also in individuals presenting cytological changes[1]. Nevertheless, it is important to note that the HPV 53 type is also frequently detected in women. This type is classified is as high oncogenic risk and is associated with malignant lesions, but can also be found in benign lesions[14].

In the present study, HPV infection was found to be associated with a higher number of sexual partners (p= 0.018). Increased life expectancy[21,22] and changes in sexual behavior, including higher divorce rates, contribute to multiple and new sexual partners, factors associated with greater risk of HPV acquisition[4,23].

The prevalence of HPV peaks in younger women (age 20-24 years) and steadily declines with age. However, curves of HPV prevalence versus age are parabolic, i.e. show an increasing prevalence in older women. This pattern might occur due to reactivation of HPV infection and by changes in sexual behavior of middle-aged men and women[24]. Hormonal changes which alter immunological function may also contribute to reactivation of latent HPV infection in older women, particularly among those infected by types of high oncogenic risk[25].

The study by Strander, Hällgren & Sparén[26] showed that women previously diagnosed with Cervical Intraepithelial Neoplasia – Grade 3 (CIN 3), which corresponds to High Grade Squamous Intraepithelial Lesion (HSIL), have high risk of progressing to invasive cervical cancer, a risk which increases after age 60, in the same way as risk of death rises after age 70.

On the cytological analysis performed in the present study participants, only 1.8% exhibited abnormal changes. However, unexpectedly, HPV infection was not detected on molecular testing in these cases. Analysis of Pap tests of post-menopausal women should be performed with caution, especially in the presence of atrophic changes, which may exhibit different cytomorphological patterns owing to low hormone concentration in epithelial tissues[8]. Atrophic changes associated with vaginitis pose a diagnostic challenge because degenerated cells may resemble tumor cells[27]. Moreover, due to hormonal changes in post-menopausal women, the squamocolumnar junction – a preferential region for the development of precursor lesions of cervical cancer – is situated within the cervical canal, hampering access for biopsy and collection of adequate sample size for cytological study, reducing its sensitivity[28].

In this study, one of the patients with abnormal cytology findings had a result consistent with Atypical Squamous Cells of Undetermined Significance (ASC-US). The prevalence of ASC-US and positivity for HPV DNA of high oncogenic risk tends to decline with age[29]. Hence, the cytological analysis of samples obtained from women peri and post-menopause should be rigorous, since slight nuclear increase may suggest an ASC result. However, this change without significant hyperchromasia or irregular nuclei is generally not associated with the cytopathic effect of HPV, but rather with inflammatory modifications[9].

One case of atypical squamous cells, cannot exclude high-grade squamous intraepithelial lesion (ASC-H) was detected in a woman with an atrophic smear. In patients deemed high risk, the presence of atypia on atrophic smear can explain this result. Nonetheless, the interpretation of atypia can be difficult in an atrophic context due to the lack of maturity and high nucleus-cytoplasm ratio of the cell, which resemble small atrophic cells and dysplastic cells[9]. In these case with diagnostic difficulty because of atrophy, estrogenization can be an alternative, improving the quality of the smear and reducing degenerative cell changes[8].

When the organism develops an efficient cell immune response, regression of HPV infection and control of viral replication occur[22], thus, immune response is a determinant of the progression of carcinogenesis. None of the study participants assessed at 2 visits to the services had persistent infection. However, the literature shows persistency

occurs in older women[11,13]. It is therefore critical to perform cytological follow-up in these women in order to allow monitoring and early detection of precursor lesions of cervical cancer[27], with implementation of interventions where necessary.

In immunocompetent women, most HPV infections are detected transiently, with subsequent loss of viral detection. However, the infection can persist in a non-productive stage, which is not eliminated and becomes latent in undifferentiated basal calls of the cervical epithelium. In this case, among older women, reactivation of the infection can occur when they undergo age-related hormonal and immunologic changes[30]. Nevertheless, a proportion of HPV infections may also be attributed to new sexual partners, including in older people[26], perhaps explaining the current study finding of conversion of the infection status in 10% of participants between the two assessments performed during the course of the study.

Prevention of cervical cancer in older women remains a challenge, because of the lack of specific guidelines and of consensus on the age at which routine screening should cease. The Brazilian guidelines for cervical cancer screening emphasize there is scant objective evidence on when women should cease screening for the disease[8].

The literature suggests that, upon leaving the screening program, women should be tested for HPV, with continued monitoring of those who test positive for HPV. Furthermore, the impact of changes in hormonal and immunologic factors with advancing age on reactivation of latent HPV infection or the reduced likelihood of eliminating a new infection, and the course of new HPV infections in older women, all warrant future investigation.

Thus, although older women are vulnerable to infection by HPV, scant evidence exists on the course of HPV infection in this population group. The ideal age at which screening should be discontinued is also unclear and a topic requiring further debate. Hence, future studies focusing on this population are needed to devise strategies for prevention and early detection of HPV infections, effectively reducing cervical cancer rates in this age group.

Limitations of the study include the small sample size, perhaps due to the low number of older women seeking testing, and also the fact that almost half of the HPV-positive samples were not genotyped.

CONCLUSION

The results of this study showed that, although no intraepithelial lesions or neoplasia were detected on the Pap tests performed, older women are infected by HPV and should therefore continue to undergo routine cytological screening. This recommendation is supported by the finding of conversion of infection status (when DNA-HPV was negative at first consultation, but subsequently detected during follow-up) between health service visits in 10% of the women assessed. The study found that older women with multiple sexual partners were more susceptible to HPV infection and so this group should be prioritized in screening programs for cervical cancer.

In addition, this investigation also prompts reflection on the guidelines of the current cervical cancer screening program proposed in Brazil, which recommend routine Pap smears for women aged between 25-64 years. Beyond this age, screening is automatically halted when the woman has at least 2 negative consecutive tests in the past 5 years. The present study underscores the importance of continued cytological screening in older women for prevention and control of HPC-induced lesions, particularly cervical cancer, given that under the current program, many may go unmonitored having discontinued Pap smears in later life, despite still engaging in an active sexual life.

AUTHOR CONTRIBUTIONS

- Jaqueline A. Bessa – Involved in all aspects of the study.
- Tatiana Mugnol – Data analysis and interpretation, writing of article and critical review.

- Jonas Wolf – Data analysis and interpretation, analysis and approval of draft to be published.
- Thais R. Boeira – Data analysis and interpretation, analysis and approval of draft to be published.
- Vagner R. Lunge – Data analysis and interpretation, analysis and approval of draft to be published.
- Janaina Coser – Involved in all aspects of the study.

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Factors associated with high exposure to sedentary behavior in older adults: analysis of data from the National Health Survey, 2019

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Abstract

Objective: To analyze the factors associated with sedentary behavior in older adults. *Method*: A cross-sectional study of data from the 2019 National Health Survey involving 22,728 older Brazilian adults was conducted. The outcome was sedentary behavior and the exposures included sociodemographic characteristics, lifestyle, household characteristics and chronic diseases. Multiple logistic regression was used: with a significance level of 5%. *Results*: The prevalence of sedentary behavior was 32.8% (95%CI: 31.8-33.8) There was a greater chance for the outcome in individuals that were female (OR=1.20; 95%CI: 1.08-1.34); aged 70-79 years (OR= 1.22; 95%CI: 1.09-1.36); aged ≥80 years (OR=1.18; 95% CI: 1.02-1, 36); had no partner (OR= 1.27; 95%CI: 1.14-1.41); were diabetic (OR =1.17; 95%CI: 1.06-1.30), had systemic arterial hypertension (OR =1.34; 95%CI: 1.18-1.51). previous stroke (OR = 1.61; 95%CI: 1.32-1.96), and no place to perform physical activity close to home (OR=1.16; 95%CI: 1.05-1.29). Older adults with low education (OR= 0.71; 95%CI: 0.61-0.82), and that resided in rural areas (OR=0.53; 95%CI: 0.47-0.61) were less likely to be sedentary. *Conclusion:* Individuals that were female, older(ager > 70 years), had diabetes, hypertension, previous stroke, and no place to perform physical activity close to home, were associated with high exposure to sedentary behavior. Living in rural areas and having less education were inversely associated with this risk behavior.

Keywords: Aging. Sedentary Behavior. Epidemiology.

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INTRODUCTION

Sedentary behavior can be defined as any behavior characterized by an energy expenditure of 1.5 or less metabolic equivalents (METs) in a sitting, reclining or lying position[1]. Screen time (television, computer, tablet, smartphone) in a seated, recline or laying down position, as well as activities such as reading, writing and speaking in a seated position in a bus, car or train, are examples of sedentary behavior in adults and older individuals[1].

Sedentary behavior time is increasing globally and older people constitute the age strata with the highest prevalence of this lifestyle[2]. There is robust evidence that longer sedentary behavior time is associated with a number of different chronic non-communicable diseases (NCDs), such as type II diabetes, cancers, cardiovascular diseases, besides obesity and multimorbidity, and impacts cardiovascular-related and all-cause mortality[3]. Chronic NCDs alone account for 74% of all deaths worldwide[4].

It should be noted that sedentary behavior is a modifiable risk factor for these chronic conditions and a potential variable of focus in both the prevention and treatment/control of these diseases[5,6]. Moreover, evidence shows that, irrespective of level of physical activity, exposure to sedentary behavior can have deleterious effects on health[7]. However, recent evidence also suggests that the effects of sedentary behavior can be attenuated by increasing energy expenditure through engagement in moderate-to-vigorous physical activity[8].

International studies reveal that children, adolescents, adults and older individuals have a high prevalence of sedentary behavior. North-Americans, for example, watched an estimated 2 hours or more of television and videos daily[9]. In 2019, 34.7 million Brazilians (21.8% of adult population) reported watching television for 3 hours or more per day[10]. By comparison, in 2013, this rate was observed in 29.0% of people aged 18 or older[10].

Studies exploring this issue are relatively recent and have grown in the last 10 years[11]. Also, study results are conflicting regarding the association of sociodemographic characteristics, such as sex and marital status, with sedentary behavior in older people, with no consensus on whether an association exists[12-14]. Moreover, there is a dearth of studies based on nationally representative data estimating the prevalence of this risk behavior in the older population in Brazil, with some studies limited to specific regions and/or states in the country[15].

Against this background, given the potential impacts of sedentary behavior on health and mortality, together with the gaps outlined, the present study draws on a nationally-distributed sample. The results can contribute to the field of health management and health care and treatment for older individuals by shedding light on the extent of sedentary behavior among older Brazilians, while promoting a deeper understanding of sociodemographic factors, characteristics pertaining to households, and of chronic conditions which may be associated with high exposure to sedentary behavior.

This knowledge is important to help identify groups in the older population that have greater exposure to sedentary behavior and thereby guide actions aimed at reducing this exposure time and mitigating the deleterious health effects in these individuals. Thus, the objective of the present study was to analyze the factors associated with sedentary behavior in older people.

METHOD

A cross-sectional analytical study drawing on secondary data from the 2019 National Health Survey (PNS) was conducted. The PNS micro-datasets are available from the website of the Brazilian Institute of Geography and Statistics (IBGE): http://www.ibge.gov.br. The PNS is a household survey whose data are representative of the population living in private households nationwide, intended to provide information on the health determinants, mediating factors and needs of the Brazilian population[16].

The sampling plan for the PNS was based on 3-stage clustering. Census sectors were made up of primary sample units (PSUs), giving a total of 8,036. Within each PSU, a fixed number of permanent private households were selected using random sampling (15 households/PSU or 18 households/PSU, depending on the Brazilian state)[10]. A total of

108,457 households were selected for all Brazil, and 94,114 household interviews conducted[16]. Within each household, a dweller aged 15 years or older was selected using simple random sampling to answer a specific questionnaire[16]. Overall, a total of 90,846 individual interviews with the selected dwellers were carried out[10].

Households located in census sectors with small populations, e.g., indigenous areas, barracks, housing estates, encampments, boats, penitentiaries, penal colonies, military bases, prisons, jails, long-term care facilities for older people, care homes for children and adolescents, convents, and hospitals etc. were excluded from the PNS[10].

The population included in the study comprised 90,846 respondents of individual interviews at the third stage of selection of the PNS[10]. The sample included only older people, from all Brazilian states, that completed the individual interview. The sample employed in the present study consisted of 22,728 community-dwelling older people, selected by simple random sampling for all Brazilian states[16].

The PNS used a questionnaire devised and validated by Health Ministry technicians that underwent pilot testing and contained 3 parts: household, questionnaire for all dwellers in the household, and a questionnaire applied to the selected dweller[15]. The present study drew on data from the following questionnaire modules: Module C (general characteristics of the dwellers); Module D (characteristics of education of the dwellers); Module P (lifestyles) and Module Q (Chronic diseases); and Module M (Employment and Social Support).

Data collection took place between August 2019 and March 2020 by IBGE technicians and with the aid of a mobile device[14]. Data collection agents were previously trained by heads of the state units[15]. Prior to collection, the agent explained the objectives of the survey, the collection procedure itself and the importance of the dweller taking part[14]. Further details on the method for the 2019 PNS can be found in a methodological article about the survey[15].

The outcome of interest was sedentary behavior. This variable was based on 2 questions: On average, how many hours per day do you usually watch television? In a day, how many hours of your free time do you usually use a computer, tablet or cell phone for leisure, such as: to use social networks, see the news, watch videos, play games etc.? Sedentary behavior was defined as habitually spending 3 or more hours a day watching TV or using other screens[10]. Thus, this variable was categorized as: 0- does not exhibit sedentary behavior (uses TV or other screens for less than 3 hours/day; and 1- exhibits sedentary behavior (watches TV and other screens for 3 or more hours per day).

The components of the social network of the older respondents (number of friends and family members the elder can count on for almost everything, and frequency of meetings with others to engage in physical activity) were considered, adjusting for confounding variables, given that sedentary behavior or lifestyle are influenced by social network contacts, as described in the theoretical model of the Social Determinants of Health proposed by Dalgreen & Whithead[17].

Descriptive analyses of the exposures and outcomes was performed. Results were expressed as measures of simple frequency and percentage with respective 95% Confidence Intervals (95%CI). For the descriptive analysis of the outcome, an analysis stratified by sociodemographic characteristics was carried out.

To assess the association of the independent variables with sedentary behavior, a bivariate step was employed involving the chi-square test to determine possible differences in the distributions of proportions. In this step, variables with a p-value <0.20 were selected for inclusion in the multiple logistic regression model. The measure of association used was Odds Ratio (OR).

For the multiple analysis, the Stepwise method using Forward criteria was used, in which all variables selected in the bivariate stage were input one by one into each model. This procedure reveals changes in the size of the odds ratios and tests possible interactions after introducing each variable individually.

The introduction of variables began with the outcome, and the exposures of interest were then introduced in a stepwise fashion, with subsequent inclusion of confounding factors. The variables which remained associated, with level of significance <5% on the Wald test, were included in the adjusted models. For the purpose of analysis, 2 multiple models were built. The first model was adjusted for sociodemographic characteristics, place near household to engage in physical activity, and chronic diseases. The second multiple model was adjusted for characteristics of the first model, plus the confounding factors of the social network.

Besides the probability value of the Wald test, for analysis of the variables associated with sedentary behavior in multiple models, the 95% Confidence Interval (95%CI) was also used as a hypothesis test. In cases where the 95%CI of the adjusted OR exceeded 1.00, the exposure variable was considered not to be associated with sedentary behavior.

The Goodness-of-fit test for the *svy* module was used to check the fit of the final individual models. On the descriptive, bivariate and multivariate analyses, the sample weights were used to calibrate the complex sample design. The analyses were carried out on the Survey module for complex samples using data processing software.

The study drew on secondary data from the 2019 PNS, available for access in the public domain and, thus, approval of the project by the Research Ethics Committee was waived since the microdata sets provided by the IBGE ensured confidentiality and anonymity of the participants, whose identities could not be discerned by manipulating the data. Therefore, this study met the requirements of resolution 466/12 of the National Board of Health, guaranteeing confidentiality and anonymity of participants in compliance with ethical precepts.

RESULTS

The sample comprised participants that were predominantly women (55.5%; 95%CI:545-56.5), aged 60-69 years (54.8%: 95%CI: 53.8-55.8), self-declaring as white (51.3%:95%CI: 50.2-52.4) and low-educated – 0-8 years (70.4%; 95%CI: 69.2-71.5). Regarding area of residence, the majority of participants lived in the urban area (85.5%) (Table 1).

The rate of high exposure to sedentary behavior was 32.8% (95%CI: 31.8-33.8). Also, there was a higher rate of this risk behavior in participants that were female (35.6%; 95%CI: 34.2-37.1), aged 70-79 years (35.3%; 95%CI: 33.4-37.3) and ≥80 years (34.4%; 95%CI: 31.7-37.2), and with higher socioeconomic level "Class A" 44.4% (95%CI: 36.1-53.2). Further information is given in Table 2.

The unadjusted analysis of the sociodemographic factors, characteristics of the household neighborhood and chronic disease with sedentary behavior of the participants revealed that female gender (OR = 1.34; 95%CI: 1.22-1.48); older age groups – ≥ 80 years (OR = 1.35; 95%CI: 1.17-1.55) and 70-79 years (OR =1.21; 95%CI: 1.08-1.34); marital status without partner (OR = 1.36; 95%CI: 1.24-1.49); having no area nearby for physical activity (OR = 1.37; 95%CI: 1.24-1.50); having diabetes (OR =1.40; 95%CI: 1.25-1.57); Systemic Arterial Hypertension (OR =1.24; 95%CI: 1.12-1.36); or stroke (OR = 1.60; 95%CI: 1.32-1.92), were positively associated with sedentary behavior in participants (Table 3).

Also on the unadjusted analysis, brown skin color (OR = 0.82; 95%CI: 0.74-0.90), low education of 0-8 years (OR = 0.70; 95%CI= 0.61-0.80), belonging to social classes C, D and E (OR = 0.57; 95%CI: 0.58-1.28), and living in a rural area (OR = 0.39; 95%CI: 0.35-0.44), were associated with lower odds of sedentary behavior (Table 3).

On the multivariate analysis (model 2), sedentary behavior remained positively associated with female gender (OR = 1.20; 95%CI: 1.08-1.34); age groups 70-79 years (OR = 1.22; 95%CI: 1.09-1.36) and ≥80 years (OR = 1.18; 95%CI: 1.02-1.36); having no partner (OR = 1.27; 95%CI: 1.14-1.41); living in the Southeast (OR = 1.85; 95%CI: 1.59-2.15), Northeast (adjusted OR=1.40; 95%CI: 1.21-1.63) or South (OR = 1.36; 95%CI: 1.15-1.62) regions compared with the Mid-West, and not having anywhere to do physical activity nearby (OR = 1.16; 95%CI:1.05-1.29) (Table 3).

In addition, the outcome remained associated with chronic health conditions, such as: Diabetes (OR = 1.17; 95%CI: 1.06-1.30); Systemic Arterial Hypertension (OR =1.34; 95%CI: 1.18-1.51); and Stroke (OR = 1.61; 95%CI: 1.32-1.96) (Table 3). On the adjusted analysis, only low education (0-8 years) (OR = 0.71; 95%CI: 0.61-0.82) and living in a rural area (OR = 0.53; 95%CI: 0.47-0.61) continued to reduce the odds for sedentary behavior (Table 3).

Table 1. Sociodemographic characteristics of older adults brazilians (n=22,728). Brazil, 2019.

Sociodemographic characteristics	n[a] (%[b])	95%CI[c]
Sex		
Male	10,193 (44.5)	43.5-45.5
Female	12,535 (55.5)	54.5-56.5
Age group		
60-69 years	12,555 (54.8)	53.8-55.8
70-79 years	7,157 (31.1)	30.2-32.0
≥ 80 years	3,016 (14.1)	13.3-14.8
Skin color**		
White	9,901 (51.3)	50.2-52.4
Black	2,455 (10.2)	9.6-10.8
Brown	10,001 (36.7)	35.7-37.7
Yellow or Indigenous	369 (1.8)	1.5-2.1
Marital status		
With partner	9,946 (43.3)	42.3-44.3
Without partner	12,782 (56.7)	55.7-57.8
Education		
≥12 years	2,701 (13.1)	12.2-13.9
9-11 years	3,616 (16.5)	15.7-17.4
0-8 years	16,414 (70.4)	69.2-71.5
Social Class*		
A	240 (1.5)	1.1-2.0
B	2,810 (13.8)	12.9-14.7
C, D and E	19,675 (84.7)	83.5-85.7
Area of residence		
Urban	17,313 (85.5)	84.8-86.1
Rural	5,415 (14.5)	13.9-15.2
Region		
Southeast	5,825 (46.4)	45.3-47.6
South	3,307 (15.7)	15.0-16.4
Mid-West	2,373 (6.4)	6.0-6.8
North	3,487 (6.1)	5.7-6.4
Northeast	7,736 (25.4)	24.5-26.2

[a] Sample size; [b] Population estimate in Survey, based on weightings of complex sampling plan; [c] 95% Confidence Interval; **Variable has 2 missing values. * Variable has 3 missing values.

Table 2. Prevalence of sedentary behavior in older Brazilians according to sociodemographic variables (n=22,728). Brazil, 2019.

Sociodemographic characteristics	Sedentary Behavior (SB)[1]		
	Yes[a]	No[b]	
	% (95%CI)	% (95%CI)	*p-value*[c]
Sex			
Male	29.1 (24.5-27.4)	70.9 (69.4-72.3)	<0.0001
Female	35.6 (34.2-37.1)	64.4 (62.9-65.8)	
Age group			
60-69 years	31.1 (29.8-32.4)	68.9 (67.6-70.2)	0.0008
70-79 years	35.3 (33.4-37.3)	64.7 (62.7-66.6)	
≥80 years	34.4 (31.7-37.2)	65.6 (62.2-68.2)	
Skin color**			
White	34.2 (32.7-35.8)	65.8 (64.3-67.3)	0.0009
Black	35.9 (32.7-39.2)	64.1 (60.7-67.3)	
Brown	29.9 (28.4-31.4)	70.1 (68.5-71.5)	
Yellow or Indigenous	36.3 (27.5-45.9)	63.7 (54.0-72.4)	
Marital status			
With partner	29.4 (28.0-30.8)	70.6 (72.9-75.7)	< 0.0001
Without partner	36.3 (34.8-37.7)	63.7 (64.9-67.8)	
Education			
≥12 years	37.9 (35.0-40.9)	62.1 (69.1-64.9)	< 0.0001
9-11 years	40.5 (37.8-43.1)	59.5 (56.8-62.1)	
0-8 years	30.0 (28.8-31.1)	70.0 (68.8-71.1)	
Social Class*			
A	44.4 (36.1-53.2)	55.6 (46.7-63.9)	<0.0001
B	37.9 (34.9-40.9)	62.1 (59.0-65.0)	
C, D and E	31.5 (30.5-32.6)	68.4 (67.3-69.5)	
Area of residence			
Urban	35.3 (34.2-36.4)	64.6 (63.5-65.7)	<0.0001
Rural	17.8 (16.3-19.4)	82.1 (80.5-83.6)	
Region			
Mid-West	24.4 (22.2-26.7)	75.7 (73.2-77.7)	<0.0001
North	24.5 (22.4-26.8)	75.4 (73.1-77.5)	
South	29.1 (26.8-31.5)	70.8 (68.4-73.1)	
Northeast	28.7 (27.2-30.3)	71.2 (69.6-72.7)	
Southeast	38.4 (36.7-40.2)	61.5 (59.7-63.2)	

[1] SB defined as time using TV and other screens (computer, tablets or cell phone) of > 3 hours per day; [a] SB prevalence according to sociodemographic characteristics for 95% confidence interval; [b] Non-SB prevalence according to sociodemographic variables; [c] probability value for chi-square test; **Variable has 2 missing values. * Variable has 3 missing values.

Table 3. Association of sociodemographic factors, household neighborhood characteristics and presence of chronic diseases with sedentary behavior in older Brazilians (n=22,728). Brazil, 2019.

Variables	Sedentary Behavior (SB)			
	unadjusted OR[a] (95%CI)[d]	p-value[e]	Model 1 OR adjusted[b] (95%CI)	Model 2 OR adjusted[c] (95%CI)
Sex (ref. Male)				
Female	1.34 (1.22-1.48)	<0.001	1.20 (1.07-1.33)	1.20 (1.08-1.34)
Age group (ref. 60-69 years)				
70-79 years	1,21 (1,08-1,34)	<0.001	1.21 (1.09-1.36)	1.22 (1.09-1.36)
≥80 years	1,35 (1,17-1,55)	0.031	1.18 (1.02-1.36)	1.17 (1.01-1.35)
Skin color (ref. White)**				
Black	1.07 (0.92-1.25)	0.360	-	-
Brown	0.82 (0.74-0.90)	0.001	-	-
Other (Yellow or Indigenous)	1,09 (0,72-1,65)	0.674	-	-
Marital status (ref. With partner)				
Without partner	1,36 (1,24-1,49)	<0.001	1.27 (1.14-1.41)	1.27 (1.14-1.41)
Education (ref. ≥12 years)				
9-11 years	1,11 (0,93-1,31)	0.215	-	-
0-8 years	0.70 (0.61-0.80)	<0.001	0.74 (0.64-0.80)	0.71 (0.61-0.82)
Social Class (ref. A)*				
B	0.76 (0.59-1.33)	0.154	-	-
C, D and E	0.57 (0.58-1.28)	0.002	-	-
Zone of residence (ref. Urban)				
Rural	0.39 (0.35-0.44)	<0.001	0.53 (0.46-0.60)	0.53 (0.47-0.61)
Region (ref. Mid-West)				
North	1.00 (0.85-1.19)	0.934	-	-
South	1,27 (1,07-1,50)	0.005	1.36 (1.15-1.62)	1.39 (1.17-1.65)
Northeast	1.24 (1.08-1.43)	0.003	1.40 (1.21-1.63)	1.39 (1.20-1.62)
Southeast	1.93 (1.67-2.22)	<0.001	1.86 (1.61-2.16)	1.85 (1.59-2.15)
Place nearby for physical activity (ref. Yes)				
No	1.37 (1.24-1.50)	<0.001	1.16 (1.05-1.29)	1.17 (1.06-1.30)
Diabetes (ref. No)				
Yes	1.40 (1.25-1.57)	<0.001	1.35 (1.20-1.53)	1.34 (1.18-1.51)
HAS (ref. No)				
Yes	1.24 (1.12-1.36)	<0.001	1.14 (1.03-1.27)	1.15 (1.04-1.28)
Stroke (ref. No)				
Yes	1.60 (1.32-1.92)	<0.001	1.63(1.34-1.99)	1.61 (1.32-1.96)
Chronic back problem (ref. No)				
Yes	1.02 (0.92-1.13)	0.694	-	-
Depression (ref. No)				
Yes	1.19 (1.02-1.38)	0.020	-	-

[a] Unadjusted odds ratio; [b] Odds ratio adjusted for sociodemographic characteristics, place near household for physical activity, and chronic diseases; [c] Odds ratio adjusted for sociodemographic characteristics, place near household for physical activity, chronic diseases, and confounding factors of social network. [d]95% Confidence Interval. [e] probability value from Wald´s test.

DISCUSSION

The results of this study showed that around a third of the older residents of private households in Brazil spent 3 hours or more using screens, including television, smartphones, computer, tablets among others. This behavior was found to be more common in participants who were from older age groups, living without a partner and high-educated.

These findings are consistent with a previous study in European countries which reported a prevalence of sedentary behavior of 37.1%, albeit for a cut-off of over 5.5 hours per day of screen time[18]. In Brazil, higher prevalences of this behavior, ranging from 53%[19] and 68.8%[20], have been observed in community-dwelling older adults.

However, these higher estimates might be explained by the fact they were established in lockdown during the COVID-19 pandemic[19]. The wide range of prevalence might also be due to different definitions of sedentary behavior, with a lack of consensus among studies regarding the metrics adopted, e.g., which activities are performed in a sitting position, and the cut-off point for time in this position[21].

Conversely, another study found that sedentary behavior was more common among older married people, and was more frequent in high-educated older individuals and in the top-income quartile - relationships corroborated by the present findings[2].

Irrespective of the components of social media, sedentary behavior was positively associated with female gender in the present investigation. By contrast, the results of a recent review involving institutionalized older individuals found that men from older age groups were more vulnerable than women to a sedentary lifestyle[21]. One study showed than men watched less TV daily than women[13], whereas another found no gender difference for sedentary behavior patterns[14].

With regard to age, in the present study, a positive association between older age groups and sedentary behavior was evident, whereas another study found an inverse relationship between this behavior and age[22]. For example, oldest-old (i.e., ≥70 years of age), can be more prone to sedentary behavior, owing to physiological and neurophysiological declines, natural or otherwise, associated with aging, preventing a routine involving domestic, sports or leisure-time activities, with the result that the individual has longer screen time as a recreational pursuit[23].

Another important finding of the present study was that low level of education and living in a rural area reduced the likelihood of sedentary behavior, suggesting this pattern may be correlated with the economic and social level of the individual. The explanation for this result may be directly linked with poorer access to technological tools and with work activities involving more manual activities among individuals with a lower educational level and, hence, lower income. Low-educated individuals may be exposed to work situations involving greater energy expenditure, carrying out manual activities which reduce sedentary behavior.

Thus, the way in which people engage with their surrounding environment is pivotal toward maintaining good health and quality of life. Hence, older individuals living in rural areas are able to be better connected with the environment and more able to maintain their formal and social relationships, engaging in group activities to improve health and prevent loneliness which, in turn, can contribute to reducing sedentary behaviors[24].

In the present study, participants with type II diabetes, high blood pressure or history of stroke were more likely to be sedentary than their counterparts without these conditions, highlighting that time spent sedentary constitutes a good predictor of the presence of diabetes mellitus[25]. Diabetics have a higher risk of developing diabetic foot, a condition responsible for 60-70% of lower-limb amputations, preventing these individuals from leading a less sedentary life[26].

Consistent with the present findings, a previous international study found an association between being hypertensive and higher risk of exhibiting sedentary behavior[27]. Moreover, there is a consensus that sedentary behavior may be a factor that increases the risk of arterial hypertension. Individuals affected by stroke typically remain in a sitting or lying position, due to the sequela of the infarction event,

which causes disabilities that can limit mobility and preclude the performing of physical activity[28,29].

In addition, older individuals that spend over 3 hours a day in a sedentary state are more likely to have 2 or more chronic health conditions compare to those who are sedentary for less than 3 hours daily[20]. Therefore, engagement in physical activity, besides being protective against these chronic diseases, also contributes to their treatment and control, representing a potential strategy for implementation in groups of older people, including among hypertensive and diabetics. People who remain sedentary are more prone to doing less physical activity during their leisure-time and to having higher adiposity[30].

However, the result of this study revealed that sedentary behavior was more prevalent in the Southeast which, although one of the most developed and populous regions, also has lower availability of inclusive places for older people to perform leisure-time physical activity[10]. This lack of venues may partially explain why older individuals from this region have a greater risk of sedentary behavior compared to those living in the Mid-West.

This situation highlights the need for areas that are more accessible to older users, given this group may have lower ability to engage in leisure-time activity and, as a consequence, spend more time on activities that demand low energy expenditure. This pattern of activity may result in these individuals being more housebound with negative impacts on quality of life, mental health, and on the development of chronic diseases, cancerous cells and mortality[4,30].

This need is corroborated by the study findings showing that, irrespective of sociodemographic aspects, having chronic diseases such as DM, SAH and stroke, components of the social network, a lack of venues to engage in physical activity near home, can all increase the chances of the older individual spending 3 or more hours per day in a sitting or lying position using screens.

Performing at least 150 minutes of moderate physical exercise, or 75 minutes of intense or vigorous exercise, per week promotes positive effects for healthy functioning of people aged 65 years or older[31]. Nevertheless, remaining in a sitting position for long periods of time, for example, can have deleterious health effects, regardless of the level of physical activity performed[7].

Therefore, exposure time to sedentary behavior should be mitigated, i.e., health professionals should encourage older individuals to incorporate frequent breaks in sedentary behavior, switching to a standing position, particularly at nighttime, because this can help maintain and improve physical health, by improving upper-limb strength for example[32]. Additionally, experimental evidence suggests that remaining in the standing rather than sitting position for 2 hours, increases muscle activity, improving lipid oxidation and glycemia[33].

This study has some limitations, for instance, the past pattern of exposures regarding the outcome could not be ascertained, particularly for chronic diseases and, hence, the relationships found are associative in nature and do not reflect cause and effect. Nonetheless, the data reported are representative for Brazil, conferring greater accuracy to estimates of sedentary behavior in older people and to the external validity of the study.

CONCLUSION

Drawing on representative data for Brazil, a third of the older individuals investigated exhibited sedentary behavior at the time of the survey. Participants who were female, from older age groups (≥70 years), diabetic, hypertensive, with history of stroke, and high-educated may be more susceptible to exposure to sedentary behavior.

Moreover, older participants residing in the Southeast, Northeast or Southern regions may be more prone to being sedentary than those living in the Mid-West. The lack of places to engage in physical activity nearby also emerged as a potential factor which may increase the likelihood of sedentary behavior in older people. The use of facilities in the neighborhood that encourage engagement in physical activities should be promoted as a government initiative, involving actions and programs linked to public policies for health promotion in the older population.

Also, health professionals should encourage older people, particularly those who spend more time engaged in sedentary behavior, to adopt a strategy of breaks in sedentary periods, alternating with the standing position, as an alternative to mitigate the impact of high exposure to this risk behavior.

The study findings can help inform public policymaking toward devising strategies that mitigate time engaged in sedentary behavior in the older population. Lastly, the results can aid health professionals who are directly involved in promoting health education actions.

AUTHOR CONTRIBUTIONS

- Oliveira-Figueiredo DST – Study conception, data analysis and interpretation, writing and approval of draft to be published.
- Silva MPGPC – data analysis and interpretation, writing and approval of draft to be published.
- Feitosa PYO – writing and approval of draft to be published.
- Miranda APM – writing and approval of draft to be published.

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Body mass index cutoff points and their relationship to chronic non-communicable diseases in older people

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Abstract

Objective: To determine the association between nutritional status according to different cutoff points for body mass index (BMI) and the occurrence of noncommunicable chronic diseases (NCD) in older people. *Methods:* A cross-sectional study of 365 older people was conducted using a questionnaire collecting information on health variables, body weight and height measurements. The association between classification of nutritional status using BMI and occurrence of NCD was estimated by the Odds Ratio (OR) and 95% Confidence Intervals (95%CI). *Results:* As measured by the different BMI classification criteria, nutritional status varied: for normal weight (24.9-32.3%), excess weight (57.3-73.2%) and for underweight (1.9-15.3%). According to the Lipschitz classification, underweight was associated with lower occurrence of osteoarticular diseases (OR=0.38; 95%CI: 0.15-0.93) and cardiometabolic diseases (OR=0.42; 95%CI: 0.19- 0.94); while overweight was associated with higher occurrence of cardiometabolic diseases (OR=2.26; 95%CI: 1.30-3.93). According to the World Health Organization criteria, underweight was associated with lower occurrence of cardiometabolic diseases (OR=0.09; 95%CI: 0.01-0.61), overweight with lower occurrence of neuropsychological diseases (OR=0. 47; 95%CI: 0.26-0.87), while obese status was associated with higher occurrence of osteoarticular (OR=1.95; 95%CI: 1.08-3.52) and cardiometabolic (OR=3.02; 95%CI: 1.54-5.93) diseases. According to the Pan American Health Organization criteria, underweight was associated with lower occurrence of cardiometabolic diseases (OR=0.45; 95%CI: 0.22-0.91) and obese status with higher occurrence of osteoarticular (OR=1, 91; 95%CI: 1.16-3.15), cardiometabolic

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(OR=2.58; 95%CI: 1.36-4.85) and respiratory (OR=1.96; 95%CI: 1.16-3.16) diseases. *Conclusion:* The classification criteria for BMI were negatively (underweight) and positively (excess weight) associated with the occurrence of NCD, exhibiting a stronger association when the overweight classification was differentiated from the obese classification.

INTRODUCTION

The Brazilian population has undergone a major change in the last few decades in line with global trends. The increase in proportion of older people[1] has been promoted by shifts in the health profile of the population as a result of epidemiological transitions. These changes include a decline in infectious parasitic diseases, a rise in chronic non-communicable diseases (NCD) and nutritional changes, characterized by a fall in cases of malnutrition and undernutrition, together with a rise in the prevalence of excess weight[2]. This dynamic has contributed to an increase in the incidence and prevalence of chronic NCD across all age groups and regions of Brazil[3].

The aging process promotes physical, physiological and behavioral changes which lead to alterations in body composition, favoring the occurrence of nutritional inadequacies and comorbidities in this age group. On a national level, rates of excess weight in the older population have risen significantly. Overweight in people aged older than 65 years was 43.9% in 2010, rising to 51.74% in 2020, when a total of 1,373,147 older individuals were classed as overweight[4]. In addition, the prevalence of diseases associated with metabolic syndrome (arterial hypertension, diabetes mellitus, central obesity and dyslipidemia) is greater among excess weight older adults[5].

Assessing the nutritional status of older people is an important tool in health care, requiring accurate reliable methods that are low-cost and easily-applied in population-based studies and in routine clinical practice[6]. The body mass index (BMI) is a proxy measure widely used in these settings. While this index possesses most of the necessary characteristics, its accuracy is questionable for individual assessment because, when applied alone, it cannot provide information on body composition or fat distribution, parameters affected by sex, race, ethnicity and, principally, by the age of the subject evaluated[6].

Another limiting factor of applying BMI in assessments of nutritional status of older individuals is the lack of consensus on the ideal cutoff points to be adopted. The classification proposed by the World Health Organization[7] (WHO) draws on an extensive North American population base that encompasses people of all ages, including older individuals. The cut-off points proposed by Lipschitz[8] offer greater sensitivity for diagnosing underweight and greater specificity for overweight. According to the authors, these cut-off points correspond to the BMI bands within which lower mortality is observed in the older population. Later, the Pan-American Health Organization (PAHO) made their recommendations based on data gathered for older populations of 7 countries of Latin America and the Caribbean, including Brazil, proposing even more sensitive BMI cut-off points for underweight, and more specific values for overweight, while also incorporating obese status as a diagnostic class in older people.

Given the scarcity of studies investigating BMI cutoff points for older Brazilians, the current ack of consensus, and increasing life expectancy and population aging, the objective of the present study was to determine the association between nutritional status according to different BMI cutoff points and the occurrence of chronic NCD in older users adults registered at the Family Health Strategy (ESF) units of the city of Governador Valadares. This study is of fundamental importance for its potential contribution to furthering knowledge in the area of aging and nutritional status assessment, as well as to clinical follow-up and decision-making in treatment and healthcare at all levels.

METHOD

A quantitative exploratory cross-sectional study within the context of the Family Health Strategy in the city of Governador Valadares, Minas Gerais state, was conducted. The city is located in the eastern

region of the state, 324 Km from the state capital city of Belo Horizonte. The city has a population of 263,689 people (11.7% older adults) with a mean income of R$ 678.74 per capita[10]. The main causes of death in this group are cardiovascular diseases, infectious diseases, parasitic diseases and cancers[11].

Data collection was carried out between 2018 and 2019. At the start of data collection, Governador Valadares had 56 Family Health Strategy units and 8 Family Health Support and Primary Health Centers, 37 of which were situated in urban regions with 20,097 registered older (≥ 60 years) users. The urban region of the city was divided geographically into 9 health districts/subregions each containing 2-10 ESF units. The sample was formed by selecting 10 ESF units, at least 1 unit per health district/subregion, so as to ensure coverage of the whole of the urban region and obtain a heterogeneous sample.

The sample comprised older adults aged ≥60 years of both genders. Sample size was calculated based on the number of older users registered at the ESF units within the urban region, an estimated rate of excess weight of 40%, accuracy of 5% and confidence interval of 95%. The calculation, after correcting for final n, based on the total users registered at the ESF units, yielded a sample size of 365 older adults, allowing for 10% losses.

The proportion of the sample by region was based on the total of older users registered at each ESF. This procedure was performed considering that each ESF represents a geographic region of the city. Thus, the chance to participate of older individuals from all the locations was assured. The registration number of each individual at their respective unit was listed and, subsequently, subjects to be approached to take part in the study were randomly selected using the "SORTEIO" (DRAW) app.

Inclusion criteria were: registered at selected ESF; agreed to home visit; aged ≥60 years; and signed the Free and Informed Consent Form. The study exclusion criteria were: failing to answer a question or not performing one of the measurements collected in the study.

Data collection was carried out at participants´ homes by previously trained undergraduates studying Nutrition, Physiotherapy and Physical Education courses and by graduates studying Physical Education, under the supervision of faculty members. A structured questionnaire was applied in the form of an interview collecting information on personal details (name, age and sex), social data (marital status, education, tobacco/alcohol use, and physical activity), economic aspects (source of income, monthly income in minimum wages) and health status (self-rated health, self-reported clinically-diagnosed diseases, medication use and number of medications used). Data collection time was, on average, 60 minutes.

Nutritional status of the participants was measured using BMI. Body weight was measured using portable digital electronic scales (Líder P150M®) with 200kg capacity and accurate to the nearest 50g. Height was determined using a portable stadiometer (Alturaexata®) with a capacity for measuring a maximum of 2 meters with graduations of cm and mm. Both readings were taken according to techniques reported in the literature[12]. In cases where the participant was unable to attain a standing/upright position during the assessment, weight and height were estimated using specific equations for older individuals[13]. The equation employed for females was: [1.83 x knee height] – [0.24 x age] + 84.88; and for males: [2.02 x knee height] – [0.04 x age] + 64.19. BMI was classified using the cut-off points defined by Lipschitz (1994)[8], the WHO[7], and the PAHO[9] (Chart 1).

Chart 1. Cut-off points for classification of body mass index (BMI).

Lipschitz (1994)[8]	
BMI values (kg/m^2)	Classification
<22	Underweight
22-27	Normal weight
>27	Overweight
World Health Organization (WHO, 1998)[7]	
BMI values (kg/m^2)	Classification
<18.5	Underweight
18.5-25	Normal weight
≥25-30	Overweight
≥30	Obese
Pan-American Health Organization (PAHO, 2002)[9]	
BMI values (kg/m^2)	Classification
<23	Underweight
23- 28	Normal weight
>28-30	Overweight
>30	Obese

Data were tabulated using double keyed entry to minimize errors. Normality of the data distribution was determined using the skewness coefficient. Categorical data were expressed as absolute (n) and relative (%) frequency, whereas quantitative data were expressed as either mean and standard deviation or median and minimum and maximum values.

The association of nutritional status according to different cutoff points for BMI and occurrence of chronic NCD was estimated using Odds Ratio (OR) and 95% Confidence Intervals (95%CI), taking normal weight as the reference category and adjusting results for age and sex.

The study was approved by the Ethics Committee for Research in Humans of the Federal University of Juiz de Fora (Permit no. 1.249.770), in compliance with the precepts stipulated in Resolution 466/2012. Data collection took place at participants´ homes, with authorization granted by the Department of Health Care of the city, which furnished details including the names and addresses of older users registered with the ESF units. All participants randomly selected in the sampling process signed the Free and Informed Consent Form prior to data collection. In cases of severe cognitive impairment, preventing the study subject from making an informed decision on participating in the present project, the Free and Informed Consent Form was instead signed by the legal guardian.

RESULTS

Regarding the sample of 365 participants, most (69.0%) individuals were female, median age was 69 (range 60-97) years, and most were living together with a partner. The majority of the sample had ≤8 years of education and received a monthly income via a salary or pension of 1-3 minimum wages (Table 1).

Results revealed that most respondents had never smoked, did not habitually consume alcohol, and had low level of engagement in physical activity. Most respondents had self-rated health of good/fair, whereas the median number of self-reported diseases was 4 and the presence of polypharmacy (use of ≥4 medications|) was observed in 46.1% of participants. The most prevalent disease class was cardiometabolic, followed by osteoarticular and gastrointestinal/renal (Table 2).

Mean BMI of participants was 28.6 ± 5.6 kg/m^2. Nutritional status was classified as adequate in 24.9-32.3% of the population. Excess weight, defined as overweight only or overweight plus obesity, ranged from 57.3% to 73.2%. The rate of underweight varied widely from 1.9% to 15.3% (Table 3).

The distribution of occurrence of chronic NCD and association with classification of nutritional state of participants is presented in Table 4. According to the Lipschitz[8] criteria, the occurrence of underweight was significantly associated with lower occurrence of both osteoarticular diseases (OR=0.38; 95%CI: 0.15-0.93) and cardiometabolic diseases (OR=0.42; 95%CI: 0,19-0,94), whereas overweight was associated with greater occurrence of cardiometabolic diseases (OR=2.26; 95%CI:1.30-3.93).

Table 1. Distribution of frequency of socioeconomic and health characteristics of participants (n=365). Governador Valadares, Minas Gerais state (2018-2019).

VARIABLES	DISTRIBUTION - % (n)
Gender (female) - %(n)	69.0 (252)
Age in years– median (min-max)	69.0 (60 – 97)
Living with partner - % (n)	57.5 (210)
Source of income - %(n)	
No income	13 (47)
Salary/pension	83.7 (302)
Social security benefits	3.3 (12)
Monthly income * - %(n)	
>1 MW	24.0 (79)
1-3 MWs	71.7 (236)
≥ 3 MWs	4.3 (14)
Education - %(n)	
≤ 8 years	58.6 (214)
>8 years	17.0 (62)
Tobacco use - %(n)	
Never smoked	55.4 (201)
Ex-smoker	36.1 (131)
Smoker	8.5 (31)
Alcohol use - %(n)	17.3 (63)
Self-rated health - %(n)	
Very poor	4.4 (16)
Poor	13.3 (48)
Fair	45.3 (164)
Good	31.8 (115)
Very good	5.3 (19)
Engages in physical activity - %(n)	27.1 (99)
Number of diseases – median (min-max)	4 (0-13)
Use of medications - %(n)	89.8 (324)
Number of medications	3 (0- 12)
Weight in Kg - mean (SD)	68.2 (13.6)
Height in m – mean (SD)	1.54 (0.09)

*MW=Minimum wage; MW at time of data collection (R$ 954.00 – R$ 998.00).

Table 2. Distribution of frequency of occurrence of main classes of diseases in participants. Governador Valadares, Minas Gerais state (2018-2019).

Classes of chronic NCD #	DISTRIBUTION - % (n)
Neuropsychological	33.9 (123)
Osteoarticular	42.0 (153)
Cardiometabolic	74.4 (270)
Respiratory	14.0 (51)
Gastrointestinal and/or renal	41.3 (150)

#= more than one reported alternative possible Neuropsychological = Parkinson´s Disease, severe memory problems, depression, chronic convulsions or epilepsy. Osteoarticular= arthrosis, rheumatism, osteoporosis. Cardiometabolic = health problems, diabetes mellitus, arterial hypertension. Respiratory = asthma, bronchitis, respiratory failure. Gastrointestinal and/or renal = urinary and fecal incontinence, gastric or duodenal ulcer, lower urinary tract symptoms, benign prostatic hyperplasia, chronic kidney disease stage IV or lower.

Table 3. Distribution of frequency of classification of nutritional status of participants according to cut-off points for body mass index. Governador Valadares, Minas Gerais state (2018-2019).

CUT-OFF POINTS	CLASSIFICATION - %(n)			
	Normal	Underweight	Overweight	Obese
Lipschitz	32.3 (118)	10.4 (38)	57.3 (209)	-
WHO	24.9 (91)	1.9 (7)	33.7 (123)	39.5 (144)
PAHO	31.8 (116)	15.3 (56)	13.4 (49)	39.5 (144)

WHO= World Health Organization; PAHO= Pan-American Health Organization.

When classified according to the WHO[7] criteria, underweight was significantly associated with lower occurrence of cardiometabolic diseases (OR=0.09; 95%CI: 0.01-0.61), while overweight was associated with lower occurrence of neuropsychological diseases (OR=0.47; 95%CI: 0.26-0.87). Obese classification was significantly associated with greater occurrence of osteoarticular diseases (OR=1.95; 95%CI: 1.08-3.52) and cardiometabolic (OR=3.02; 95%CI: 1.54-5.93) diseases.

Using the PAHO criteria[9], underweight was significantly associated with lower occurrence of cardiometabolic diseases (OR=0.45; 95%CI: 0.22-0.91), whereas obese classification was also associated with greater occurrence of osteoarticular diseases (OR=1.91; 95%CI: 1.16-3.15), cardiometabolic diseases (OR=2.58; 95%CI: 1.36-4.85) and respiratory disease (OR=1.96; 95%CI: 1,16-3,16).

Table 4. Distribution of frequency of occurrence of chronic diseases according to nutritional status classification. Governador Valadares, Minas Gerais state (2018-2019).

Classification	Classes of chronic NCD				
LIPSCHITZ	Neuropsychological	Osteoarticular	Cardiometabolic	Gastrointestinal and/or renal	Respiratory
Normal weight	30.5 (36)	39.8 (47)	67.0 (79)	39.8 (47)	11.0 (13)
Underweight	37.8 (14)	21.6 (8)	54.1 (20)	35.1 (13)	8.1 (3)
OR** (95%CI)	1.39 (0.64-3.0)	0.38 (0.15-0.93)	0.42 (0.19-0.94)	0.82 (0.38-1.77)	0.88 (0.40-1.90)
P	0.407	0.03	0.03	0.609	0.737
Overweight	35.1 (73)	46.9 (98)	82.2 (171)	43.3 (90)	16.8 (35)
OR** (95%CI)	1.08 (0.65-1.77)	1.03 (0.64-1.68)	2.26 (1.30-3.93)	1.15 (0.73-1.82)	1.14 (0.71-1.83)
P	0.777	0.890	0.004	0.546	0.576
WHO	Neuropsychological	Osteoarticular	Cardiometabolic	Gastrointestinal and/or renal	Respiratory
Normal weight	37.8 (34)	28.9 (26)	65.6 (59)	40.0 (36)	10.0 (9)
Underweight	42.9 (3)	42.9 (3)	28.6 (2)	28.6 (2)	28.6 (2)
OR** (95%CI)	1.1 (0.21-5.16)	1.38 (0.27-7.08)	0.09 (0.01-0.61)	0.68 (0.12-3.77)	3.74 (0.61-22.8)
P	0.950	0.693	0.01	0.660	0.152
Overweight	24.4 (30)	39.8 (49)	71.3 (87)	35.8 (44)	9.8 (12)
OR** (95%CI)	0.47 (0.26-0.87)	1.42 (0.77-2.56)	1.39 (0.75-2.56)	0.82 (0.47-1.45)	0.93 (0.37-2.32)
P	0.01	0.263	0.30	0.501	0.869
Obese	39.2 (56)	52.1 (75)	84.7 (122)	47.6 (68)	19.4 (28)
OR (95%CI)	0.85 (0.48-1.51)	1.95 (1.08-3.52)	3.02 (1.54-5.93)	1.35 (0.77-2.37)	2.00 (0.86-4.61)
P	0.582	0.03	0.001	0.296	0.106
PAHO	Neuropsychological	Osteoarticular	Cardiometabolic	Gastrointestinal and/or renal	Respiratory
Normal weight	29.3 (34)	36.2 (42)	69.6 (80)	38.8 (45)	10.3 (12)
Underweight	38.2 (21)	30.9 (17)	54.6 (30)	34.6 (19)	10.9 (6)
OR** (95%CI)	1.58 (0.80-3.14)	0.84 (0.41-1.71)	0.45 (0.22-0.91)	0.85 (0.43-1.67)	1.09 (0.39-3.12)
P	0.191	0.631	0.02	0.637	0.858
Overweight	24.5 (12)	38.8 (19)	77.6 (38)	36.7 (18)	10.2 (5)
OR** (95%CI)	0.71 (0.33-1.55)	0.97 (0.48-1.98)	1.78 (0.79-4.02)	0.88 (0.44-1.78)	0.93 (0.31-2.82)
P	0.393	0.939	0.161	0.730	0.894
Obese	39.2(56)	52.1 (75)	84.7 (122)	47.6 (68)	19.4 (28)
OR (95%CI)	1.33 (0.78-2.29)	1.91 (1.16-3.15)	2.58 (1.36-4.85)	1.43 (0.86-2.39)	1.96 (1.16-3.16)
P	0.290	0.010	0.004	0.172	0.010

WHO= World Health Organization; PAHO= Pan-American Health Organization; OR=Odds Ratio; CI= Confidence Interval, **= Adjusted for participant age and sex, *p*= probability of significance value.

DISCUSSION

The present study determined the association between nutritional status for different BMI cut-off points and occurrence of chronic NCD in older users registered at ESF units. The key findings were: a) all BMI cut-off points were associated with a reduction and/or increase in the occurrence of NCD; b) when applying the WHO criteria[7], underweight was associated with reduced occurrence of cardiometabolic diseases, overweight with reduction in neuropsychological diseases, while obese classification was associated with increased osteoarticular and cardiometabolic diseases; c) using the Lipschitz[8] criteria, underweight was associated with lower occurrence of osteoarticular and cardiometabolic diseases, whereas overweight was associated with greater occurrence of cardiometabolic diseases; d) based on the cut-off points recommended by the PAHO[9], underweight was associated with lower occurrence of cardiometabolic diseases, while obese status was associated with greater occurrence of osteoarticular, cardiometabolic and respiratory diseases.

The profile of the sample proved similar to that of the general older Brazilian population and of older users registered at the ESF units, i.e. predominantly female, low-educated and with low mean monthly income[14-16]. Low income was evident in the population studied, where 13% had no formal source of income and 71.7% lived on a monthly income of 1-3 minimum wages. A previous study of 2,369 older adults from all regions of Brazil found that, although majority had a low income, 95% contributed to the household finances and, of this group, 68% were the heads of household[15]. The present information on health behaviors showed a low level of physical activity and tobacco and alcohol use, mirroring results of the Surveillance System for Chronic Diseases – Telephone survey among older adults (≥ 65 years)[14]. Rates of medication use and polypharmacy in the sample were high at 89.8% and 46.1%, respectively, possibly due to the presence of multiple chronic NCD in this population group[17].

In recent decades, advancements in medical-health practices, chiefly disease prevention and treatment, have promoted an increase in life expectancy and a shift in the profile of typical diseases associated with aging[18]. Multimorbidity leads to disability and high use of health services, requiring the health system and professionals to devise strategies for monitoring and continuous updating toward promoting quality of life and longevity for the population[19]. In the older participants studied, there was a high prevalence of chronic NCD, particularly cardiometabolic diseases, consistent with reports in the literature. A Chinese cohort study involving 5,548 older adults found the most prevalent condition in the study was multimorbidity, affecting 70% of participants, particularly cardiometabolic and osteoarticular diseases[20]. Zhao *et al.*[21] assessed 5,749 in a Chinese city and found that 68.3% had cardiometabolic diseases, predominantly arterial hypertension. In Brazil, according to data from the last National Health Survey, 54.1% of the older respondents reported at least one NCD, 47.1% had two and 33.2% three or more diseases[3].

In addition to this epidemiological scenario, the present study revealed a substantial level of nutritional inadequacy, most notably a high prevalence of excess weight. As expected, the choice of criteria for classifying nutritional state had a major impact on the prevalence of nutritional inadequacy detected. Rates of underweight varied greatly, with only 1.9% of participants classified with this status using the WHO criteria[7] versus 15.3% using the PAHO criteria[9]. Overweight status ranged from 13.4% on the PAHO criteria[9] to 57.3% using the criteria defined by Lipschitz[8]. Overall, rates of obese status were the same, given that both sets of criteria that included this classification adopted the same cut-off point. Notably, irrespective of the cut-off point used, a high occurrence of nutritional inadequacies was observed, particularly excess weight, accounting for over half of the sample, with 1/3 of this group having a BMI >30 kg/m^2.

It is evident that there have been significant changes in the nutritional status of older people over the last few decades, as well as in the profile of diseases affecting this population group, comparing the context of life and health of older individuals today with that at the time the cut-off points were first created, when underweight was more prevalent and a greater concern in routine clinical practice,

along with excess fat as protection against common health outcomes in older people[22].

The results of the present study are similar to those reported in the literature, showing a rising rate of excess weight and obesity among older people over time relative to cases of underweight or malnutrition. A study investigating the agreement between the WHO and Lipschitz methods for classifying nutritional status of older people found that rates of excess weight (overweight/obesity) were high for both sets of cut-off points, at 50.4% and 31.3%, respectively[23]. Palma *et al.*[24], in a study comparing the Lipschitz[8] and PAHO[9] methods for classifying BMI in 424 older residents of a city located in the northern part of Rio Grande do Sul state, found similarly high rates of excess weight for both criteria (51.4% Lipschitz[8] versus 49.1 % PAHO[9]). In 2019, the Surveillance System for Chronic Diseases by Telephone Survey revealed a prevalence of overweight of 59.8% and of obesity of 20.9% in older people (≥ 65 years)[13].

The BMI cut-off points analyzed in the study are widely used for determining the nutritional status of older adults and assessing the risk of potential health problems as a result of being underweight or excess weight. The results clearly show that overweight and obesity were associated with the occurrence of chronic diseases in the population, whereas a diagnosis of underweight, according to some criteria, was associated with lower occurrence of diseases in this group. However, the occurrence of diseases among older individuals classified as underweight or normal weight highlights that, besides identifying the ideal cutoff point, the use of BMI as the sole marker of overweight/obesity is insufficient for predicting chronic diseases in the population or in clinical practice owing to its limitations[6].

As measured using the Lipschitz[8] classification, older individuals diagnosed as underweight had 62% lower odds of having osteoarticular disease and 58% lower chance of cardiometabolic diseases. Individuals classified as overweight had a 2.26 times greater chance of having cardiometabolic diseases. Neumann *et al.*[25] showed that, among a group of 112 older adults from the city of Roca Sales (Rio Grande do Sul state), those classified as overweight using the Lipschitz[8] method had a higher prevalence of arterial hypertension and diabetes. The study by Silveira, Vieira and Souza[2], however, using the same criteria in 418 older adults from the city of Goiânia (Goias state), found a higher likelihood of developing cardiometabolic and osteoarticular diseases in overweight individuals compared to normal weight and underweight subjects.

The results based on the WHO criteria[7] showed that a diagnosis of underweight was associated with a 91% lower chance of the occurrence of cardiometabolic diseases in this population, whereas overweight proved a protective factor for neuropsychological diseases, reducing the probability of occurrence by 53%. A classification of obese status increased the chance of osteoarticular diseases by 1.95 times and of cardiometabolic diseases by 3.02 times. Similarly, a study of 18,687 older individuals from different countries showed that elevated BMI (overweight and obesity) translated to a greater likelihood of diseases, especially cardiometabolic and osteoarticular, for all of the countries investigated[26].

As measured using the PAHO classification, underweight older adults had a 55% lower chance of having cardiometabolic diseases, whereas a diagnosis of obese status increased the chances of having osteoarticular diseases by 1.91 times, cardiometabolic diseases by 2.58 times, and respiratory diseases by 1.96 times. Using the PAHO criteria, Leal Neto, Barbosa and Meneghini[27] found that high BMI was involved in increased occurrence of cardiometabolic, osteoarticular and respiratory diseases in a sample of 477 older people of both sexes from the city of Antônio Carlos (Santa Catarina state). In a study assessing 436 older adults from Sarandi city (Parana state), Sass, Back and Marcon[28] found similar results using the same criteria, showing that individuals classified as obese had a higher likelihood of having cardiometabolic diseases, particularly diabetes and infarction.

Silveira, Kac and Barbosa[29] compared the factors associated with obese status for different sets of cutoffs (Lipschitz[8] and WHO[7] criteria) with the aim of determining which method was the most suitable for anthropometric classification of obesity from a public health perspective. The authors concluded that the most sensitive cut-off point for

diagnosing obese status for older Brazilians was a BMI > 27kg/m^2, i.e. the Lipschitz classification. Chapman[30] stated that the Lipschitz cutoff points are ideal for classifying nutritional status, with a focus on detecting malnutrition, also common in older people and associated with significant adverse health effects.

The use of the WHO cutoff points, developed in 1998[7], in older people requires caution, given that these do not take into account the potential body changes induced by the aging process, particularly at ages older than 70 years[6,28]. Nevertheless, the differential diagnosis between overweight and obese status, and the applicability of the same classification criteria throughout the life course, provide continuity of treatment planning. In a review by Martins, Meneguci and Damião[31] determining the most used cutoff point in surveys and studies involving the older population, found that the WHO criteria was the most widely employed, particularly by international studies of populations in developed countries and comparative studies conducted in Brazil.

Lastly, the cutoff points recommended by the PAHO[9] allow stratification of the diagnosis into overweight and obese classes, providing longitudinal follow-up of the population and continuity of the treatment delivered. Thus, given these reference values are based on a sample that includes older Brazilians, the PAHO cutoff points are recommended as criteria for determining nutritional status in this age group[28].

Evaluating the cutoffs as a whole, osteoarticular and cardiometabolic diseases showed a gradient relationship with nutritional status in older people. BMI values <22 kg/m^2 proved protective against diseases, whereas levels ≥30 kg/m^2 were risk factors for disease occurrence. As expected, cardiometabolic diseases were associated with nutritional status in older individuals and exhibited a greater gradient effect, where a lower prevalence of the disease was seen for a BMI <22 kg/m^2. Conversely, the odds of cardiometabolic disease for a BMI ≥27 kg/m^2 was 2.26 times higher, and 2.58-3.02 times higher for a BMI ≥30 kg/m^2. The results of a previous review showed that, irrespective of race or nationality, older people with a BMI ≥30 kg/m^2 had higher health risks compared with those who had lower BMI[32]. Notably, having a BMIv≤22 kg/m^2 exerted a protective effect against the disease classes assessed in the present study, but represents a risk factor for diseases associated with protein-energy malnutrition in this group[33].

Overall, the study results suggest the importance of diagnostic criteria for nutritional status in older individuals that use both the overweight and obese categories as a means of stratifying the higher risk of chronic NCD in the population with excess weight, given that classification criteria without this stratification, such as the Lipschitz[8] method, fail to detect this increased risk. This stratification provides ongoing clinical follow-up of the population throughout the aging process, allowing continuity of this diagnosis in obese adults that reach late life and definition of priority actions for care and treatment at all levels of health. This definition of care based on nutritional classification can be seen, for example, in the care protocol for the overweight and obese population of the national health system (SUS)[32].

The present study has some limitations, including its cross-sectional design, which precludes the establishing of any causal relationships, the possible presence of memory bias at interview, in addition to the fact that instruments were not used to assess cases deemed to have cognitive deficit potentially impairing judgment and decision to participate in the study. Assessment of these cases was instead carried out subjectively where, of the 356 participants, only 3 (0.84%) were not deemed capable of deciding whether to participate in the present project and therefore had a legal guardian sign the Free and Informed Consent Form on their behalf. Strengths of the investigation include data collection at households involving a representative randomly selected sample of older users registered with the primary health network, allowing the inclusion of different profiles, such as bedridden and frail individuals unable to access ESF units, and the investigation of a topic little explored in the scientific literature.

CONCLUSION

All of the BMI cut-off points were associated with higher or lower occurrence of chronic NCD

in the older participants investigated. Using the criteria proposed by the WHO, the underweight classification was associated with lower prevalence of cardiometabolic diseases; overweight with lower neuropsychological diseases; and obese status with higher osteoarticular and cardiometabolic diseases. Applying criteria specifically for older people showed that underweight was associated with lower occurrence of osteoarticular and cardiometabolic diseases. Excess weight (overweight on Lipschitz and obese on PAHO methods) was associated with higher rate of cardiometabolic disease and (obese on PAHO) osteoarticular and respiratory diseases. A stronger association with greater prevalence of chronic NCD was evident when overweight was differentiated from obesity, demonstrating the importance of the criteria adopting this stratification. These results can help further the knowledge in this area and, from a practical standpoint, improve integration of nutritional status assessment into strategies for monitoring the overall health of older adults and therapeutic decision-making.

AUTHORSHIP

- Arthur F. A. S. Souza - data extraction and tabulation; data analysis and interpretation; writing of manuscript; and approval of final draft.
- Mateus G. Silva – data extraction and tabulation; review of manuscript; and approval of final draft.
- Andreia C. C. Queiroz – conception and design; review of manuscript; and approval of final draft.
- Suely M. Rodrigues - review of manuscript; and approval of final draft.
- Cláudia L. M. Forjaz - review of manuscript; and approval of final draft.
- Clarice L. Á. Silva - conception and design; data analysis and interpretation; writing of manuscript; and approval of final draft.

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Multidimensional geriatric assessment in primary care: a scoping review

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Abstract

Objective: to map the publications on multidimensional geriatric assessment in the primary care setting. *Method:* A scoping review using the Joanna Briggs Institute methodology was carried out on the databases Web of Science, Scopus, Medical Literature Analysis and Retrieval System Online (MEDLINE) and Literatura Latino Americana e do Caribe em Ciencias da Saude (LILACS). The studies addressed the population of older people aged ≥60 years, the concept of multidimensional assessment and the primary care setting. *Results:* a total sample of 19 publications was included for qualitative analysis. The studies selected were of different designs (predominantly cross-sectional) and most were in English. The evaluation comprised three dimensions; instruments developed applicable to primary care; two types of information technologies used to support the evaluation; and the relevant findings about the practice. *Conclusion:* this review identified tools that were based on several existing instruments. Strategies should be tailored for assessing older individuals in a quick feasible manner. Specific domains were commonly present in the instruments, considered important for providing a comprehensive assessment tailored for the older population.

Keywords: Aged. Geriatric Assessment. Primary Care.

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INTRODUCTION

Aging should be a propitious process for developing functional ability and promoting independence and quality of life,[1] rather than one associated with disability and limitations as inevitable consequences[2].Health systems should be geared up to cater for the specific needs of older people through organizational actions and initiatives such as the National Health Policy for Older People (PNSPI)[2] and the decade of healthy aging (2021-2030)[1].

In the context of the growing demands of an aging society and consistent with the PNSPI incentive to rigorous instruments for assessing older people[2], the Multidimensional or Comprehensive Geriatric Assessment (CGA) constitutes a structured multi-dimensional tool that can detect disabilities or abilities from a clinical, psychosocial and functional perspective, allowing a Singular Therapeutic Project to be devised centered principally on recovering and/or maintaining functional ability[3,4].

Although the CGA is considered the gold standard for geriatric assessment[3,4], its effectiveness in the primary care setting remains unclear. Numerous geriatric comprehensive care models have been assessed in recent years, yet convincing evidence of effective integrated care strategies for this population group is lacking[5]. Hence, there is a need to map the available scientific publications in the national and international literature on CGA within the primary care setting. Such an investigation should explore: the dimensions involved; the tools developed for CGA applicable to primary care for each individual dimension and all of them as a whole; the information technology being used to support the CGA; the recommendations on the practice of CGA in primary care; and lastly, the knowledge gaps in the context outlined.

A preliminary search by the authors on the databases MEDLINE, Cochrane Database of Systematic Reviews, Open Science Framework (OSF), JBI Evidence Synthesis, and on the International prospective register of systematic reviews (PROSPERO) platform revealed no existing reviews addressing the following guiding study question: "What scientific evidence is available in the literature on comprehensive geriatric assessment in the primary care setting?" A previous systematic review by Garrard et al., 2020 was found reporting the best strategy for clinical practice, without conflicting with the aim of the present study. Thus, the objective of the present scoping review was to map the publications on comprehensive geriatric assessment in the primary care setting.

METHOD

A scoping review was conducted using the Joanna Briggs Institute (JBI) method[6]. This type of review provides a broader view of the available evidence on a given area, clarifying concepts and, therefore, suitable for the objective of the present study, which a systematic review would be unable to achieve given its main focus of developing practices and policies based on best evidence[7]. An *a priori* protocol was developed, providing a plan for the scoping review and predefining objectives and methods, while allowing for transparency of the process, as outlined in the JBI Manual for Evidence Synthesis"[7]. The resultant protocol was registered with the Open Science Framework platform at https://osf.io/btm7e, DOI: 10.17605/OSF.IO/BTM7E.

The review encompassed the 9 steps defined by the JBI: 1- definition and alignment of objectives and research questions; 2- development and alignment of inclusion criteria with the objectives and questions; 3- description of approach for search of evidence, selection, data extraction and presentation of evidence; 4- search for evidence; 5-selection of evidence; 6-extraction of evidence; 7- analyses of evidence; 8-presentation of results; and 9- summary of evidence with respect to the review objective, conclusion and potential implications of the findings[6].

The studies included were selected based on the PCC (Population, Concept and Context) strategy, whereby the Population was older people (age ≥ 60 years), the Concept was "multidimensional/comprehensive assessment" and the Context "primary care". Studies not meeting the selection criteria, not containing data related to the scenario

investigated or that failed to address the concept and context were excluded.

The population of older people was defined as individuals aged 60 years or older[8], of both genders, and of all races, colors and ethnicities.

The concept of Multidimensional/Comprehensive Assessment was defined as the diagnostic process used to assess the health of older individuals, providing a broad holistic understanding of the person´s health by evaluating multiple dimensions to structure and organize care[3]. This confers a favorable prognosis for the aging process, derived based on the actual needs of the individual and those areas most impaired which may impact functioning[4].

Studies on CGA conducted in primary care, defined as the first level of care in coordinated health systems, the center of liaison between all points of care and where the CGA must initially take place[4].

The search for publications was carried out by the lead author on the databases Web of Science; Scopus; Medical Literature Analysis and Retrieval System Online (MEDLINE) and Literatura Latino-Americana de Informação Bibliografia (LILACS) via the Biblioteca Virtual em Saúde (BVS) – Virtual Health Library. The full search strategy in English, as applied to one of the databases, is shown in Chart 1. The searches were adapted for Spanish and Portuguese and for the other databases used.

Chart 1. Search strategy for databases. Juiz de Fora, Minas Gerais, Brazil, 2022.

Database	Search
Web of Science (English)	(multidimensional assessment) AND (aged) AND (primary health care); (multidimensional assessment) AND (aged) AND (primary care); (multidimensional assessment) AND (elderly) AND (primary health care); (multidimensional assessment) AND (elderly) AND (primary care); (multidimensional assessment) AND (older) AND (primary health care); (multidimensional assessment) AND (older) AND (primary care); (multidimensional assessment) AND ((geriatric)) OR ((gerontology)) AND (primary health care); (multidimensional evaluate) AND ((geriatric)) OR ((gerontology)) AND (primary health care); (multidimensional evaluate) AND (aged) AND (primary health care); (multidimensional evaluate) AND (aged) AND (primary care); (multidimensional evaluate) AND (elderly) AND (primary health care); (multidimensional evaluate) AND (elderly) AND (primary care); (multidimensional evaluate) AND (older) AND (primary health care); (multidimensional evaluate) AND (older) AND (primary care).

Eligible study designs included experimental and quasi-experimental (randomized and non-randomized controlled trials, before-and-after type studies and interrupted time series studies); analytical observational studies (prospective and retrospective cohort studies, case-control and cross-sectional analytical studies); descriptive observational studies (case series, individual case reports and descriptive cross-sectional studies); qualitative studies; documents from national and international governmental bodies and reviews which met the objectives of the present study. Case reports, research projects and protocols, educational materials, academic work (end-of-course reports, dissertations and theses), course materials and presentations at events were not considered in the search. No restrictions regarding language or publication date were imposed. However, for the purposes of data analysis planning, the study selection process took place between 9th August and 25th October 2021.

In this stage, many studies investigating the development/validation/transcultural adaptation of individual scales used in CGA for a specific domain were found. These studies were not selected because they did not address the applicability of the instruments in the practice of CGA within primary care and, hence, made no contribution to the objective of the review. Research protocols and projects were also not included because they did not report consolidated information on the topic of interest.

The references were pooled and transferred to an electronic spreadsheet, where duplicated titles were removed. Titles and abstracts were read in order to select studies that met the inclusion criteria of the study. The selected articles were then read in full by 2 independent reviewers with any differences between them settled by consensus. Using the resultant list of articles for review, the authors extracted the parameters of interest from the publications: study title, journal name, country, study design, publication year, and quality of evidence, categorized as per the recommendations of the Agency for Healthcare Research and Quality (AHRQ)[9].

The process of article selection for inclusion in the review is depicted using the PRISMA-ScR flow diagram, extension for Scoping Review[7] (Figure 1).

RESULTS

The search of the databases led to the retrieval of 11,096 potentially eligible studies (BVS = 10,945; PROSPERO = 4; Scopus = 91; and Web of Science = 56) (Figure 1). The LILACS, BDENF and MEDLINE databases were accessed via the Biblioteca Virtual em Saúde (Virtual Health Library). In total, 9,077 duplicate studies were removed. Of the 2,019 studies eligible for screening of titles and abstracts, 30 were selected for reading in full. Of this group of articles, 11 were subsequently excluded: 1 for being an experience report, 3 due to inability to access the full text, 3 for being a research project or protocol, 1 because the article was an experience report and 3 for being educational materials. The final sample comprised 17 academic articles and 2 documents produced by the Brazilian government.

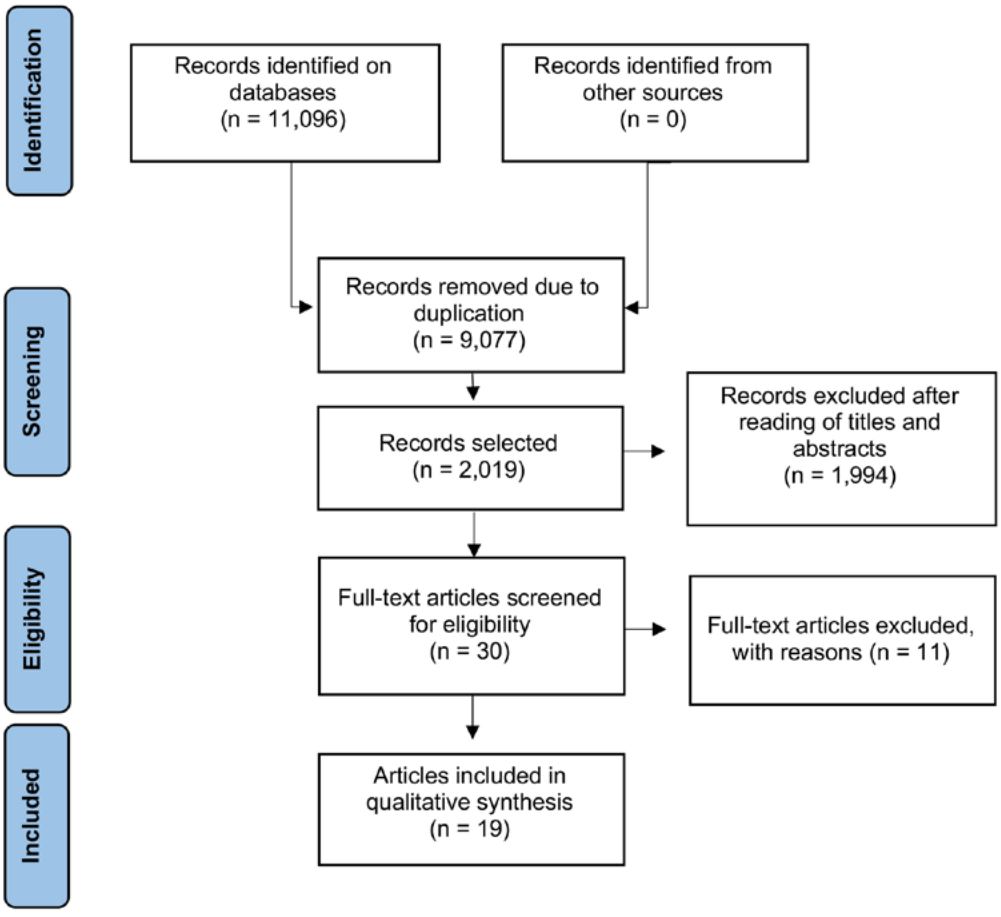

Figure 1. PRISMA-ScR flow diagram of process of article selection for review. Juiz de Fora, Minas Gerais state, Brazil, 2022.

Source: Created by authors (2022).

For language of publication, most of the studies reviewed were in English (n=13), 3 in Spanish and 3 in Portuguese. Regarding methodology design, most studies were cross-sectional (n = 7), followed by reviews (n=4), Brazilian government documents (n=2), longitudinal studies (n=1), case reports (n=1) and a continued medical education article (n=1). The studies reviewed were published between 1991 and 2021. The characteristics of the studies reviewed are outlined in Table 1.

Table 1. Studies reviewed according to title, journal, country, design and year. Juiz de Fora, Minas Gerais state, Brazil, 2022.

Identifier*	Study title	Journal name	Country	Study design	Year	Quality of evidence**
A1 [10]	Comprehensive geriatric assessment in primary care: a systematic review	Aging Clinical and Experimental Research	United Kingdom	Systematic review	2020	Level 1
A2 [11]	Aplicación de un protocolo de valoración geriátrica en atención primaria: comparación con los datos de la historia clínica	Atención Primaria	Spain	Cross-sectional study	2000	Level 4
A3 [12]	Avaliação Multidimensional do Idoso	State Secretariat for Health of Paraná	Brazil	Brazilian government document	2018	Level 5
A4 [13]	Rastreamento de problemas de idosos na atenção primária e proposta de roteiro de triagem com uma abordagem multidimensional	Cadernos de Saúde Pública	Brazil	Cross-sectional study	2016	Level 4
A5 [14]	Multidimensional Geriatric Assessment with MAGIC Questionnaire and Quality of Life in Elderly Primary Care Patients	International Journal of Environmental Research and Public Health	Spain	Cross-sectional study	2020	Level 4
A6 [15]	AMPI-AB validity and reliability: a multidimensional tool in resource-limited primary care settings	BMC Geriatrics	Brazil	Longitudinal study	2020	Level 4
A7 [16]	Avaliação Multidimensional da Pessoa Idosa na Atenção Básica AMPI-AB	Municipal Secretariat for Health of São Paulo	Brazil	Brazilian Government Document	2021	Level 5
A8 [17]	Criterios de valoración geriátrica integral en adultos mayores con dependencia moderada y severa en Centros de Atención Primaria en Chile	Revista Médica de Chile	Chile	Review	2015	Level 5
A9 [18]	Evaluación de la efectividad de un instrumento para identificar problemas sociales y sanitarios en la población anciana adscrita a un centro de atención primaria	Atención Primaria	Spain	Cross-sectional study	2005	Level 4

to be continued

Continuation of Table 1

Identifier*	Study title	Journal name	Country	Study design	Year	Quality of evidence**
A10 [19]	Geriatric Assessment for Primary Care Providers	Primary Care	United States	Review	2017	Level 5
A11 [20]	A Trial Integrating Different Methods to Assess Psychosocial Problems in Primary Care	Psychotherapy and Psychosomatics	Italy	Cross-sectional study	2019	Level 4
A12 [21]	Comprehensive geriatric assessment: comparison of elderly hemodialysis patients and primary care patients	Renal Failure	Bosnia and Herzegovina and Serbia	Cross-sectional study	2015	Level 3
A13 [22]	Population-based multidimensional assessment of older people in UK general practice: a cluster-randomised factorial trial	Lancet	United Kingdom	Clinical trial	2004	Level 2
A14 [23]	Design and pilot results of a single blind randomized controlled trial of systematic demand-led home visits by nurses to frail elderly persons in primary care	BMC Geriatrics	Holland	Clinical trial	2005	Level 2
A15 [24]	Approach to frailty in the elderly in primary care and the community	Singapore Medical Journal	Singapore	Continued Medical Education Article	2018	Level 6
A16 [25]	Development of the Brief Geriatric Assessment for the General Practitioner	The Journal of Nutrition, Health & Aging	Taiwan	Cross-sectional study	2020	Level 4
A17[26]	The Importance of Taking a Patient-Centered, Community-Based Approach to Preventing and Managing Frailty: A Public Health Perspective	Frontiers in Public Health	Italy/Ireland	Review article	2020	Level 5
A18[27]	Functional Assessment: A Holistic Approach to Rehabilitation of the Geriatric Client	Rehabilitation Nursing Journal	United States	Case report	1991	Level 5
A19[28]	Efficacy of a nurse-led multidimensional preventive programme for older people at risk of functional decline. A randomized controlled trial.	BMJ Open	Canada	Clinical trial	2001	Level 2

Source: study authors (2022).

*A: article, followed by sequential number.

** According to Agency for Healthcare Research and Quality (AHRQ) rating.

The results of the thematic analysis of the publications are given in Table 2 and were categorized under dimensions of the CGA, measuring instruments, tools, scales or tests used for each of the dimensions, ways the CGA can be applied in primary care, and relevant findings on the practice of CGA.

Table 2. Thematic categories extracted from publications. Juiz de Fora, Minas Gerais state, Brazil, 2022.

Dimensions of CGA	1. Clinical Dimension 2. Psychosocial Dimension 3. Functional Dimension (A3, A5, A7, A10)
Instruments developed for CGA applicable to primary care by dimension	**Clinical Dimension** Anamnesis – questionnaire on: - Hearing deficits (A2, A4, A5, A7, A12); - Vision deficits (A2, A5, A7, A12, A19); - Urinary or fecal incontinence (A3, A5, A7, A10); - Sleep (A3, A10); - Medications/polypharmacy (A3, A7, A10, A12, A19); - Tobacco use (A3, A10, A16); - Alcohol use (A3, A10, A16); - Sexuality (A3, A10); - Physical activity (A3, A10, A16); - Vehicle steering (A3); - Immunization (A3, A5); - Use of orthoses or prostheses (A3); - Domestic violence (A3, A10); - Self-rated health (A4, A7); - History of Falls (A4, A5, A7, A12); - Age (A7, A11); - Chronic conditions/comorbidities (A7, A12, A16); - History of hospitalization (A7); - Oral health assessment (A3, A7); - Family relationships (A10, A12); - Education (A12); - Living arrangements (A12, A16); - Income (A12, A16); - Gender (A12); - Pain (A12); - Constipation (A12); - Marital status (A16); - Quality of life – Short-Form Health Survey (SF-12) (A11). **Psychosocial Dimension** **MOOD** - Yesavage Geriatric Depression Scale (A2, A3, A10, A16, A19); - Patient Health Questionnaire-9 (PHQ-9) (A10); - Cornell Scale (A10); - Diagnostic and Statistical Manual of Mental Disorders (DSM-5) (A11); - Diagnostic Criteria for Psychosomatic Research (DCPR) –(A11); - Psychosocial Index (PSI) (A11); - Patient Health Questionnaire-2 (PHQ-2) (A4, A10); - Illness Attitude Scales (IAS) (A11).

to be continued

Continuation of Table 2

Instruments developed for CGA applicable to primary care by dimension	**COGNITION** - Mini-Mental State Exam (MMSE) (A2, A3); - Short Portable Mental Status Questionnaire (SPMSQ) (A2, A16); - Brief Mini-mental (A8); - Mini-Cog (A10, A11); - Point Cognitive Screener (10-cs) (A7); - Montreal Cognitive Assessment (MoCA) (A10); - Clock Drawing Test (A3, A5); - Verbal Fluency (A3); - Figure naming (A3); - Word List from CERAD (A3); - Saint Louis University Mental Status (SLUMS) test (A10). **SOCIAL** - Social support scale (Self-complete Scale by California Department of Mental Health) (A2); - Social support (A7); - Social data - social vulnerability questionnaire (A7); - Zarit Caregiver burden scale (A8); - Assessment of caregiver (A3); - Medical Outcomes Study (MOS) (A4); **<u>Functional Dimension</u>** **ACTIVITIES** - Instrumental Activities of Daily Living – IADL (Lawton-Brody scale) (A2, A3, A4, A6, A7, A10, A12, A16, A18); - Activities of daily living - ADL (Katz Index) (A3, A4, A5, A6, A7, A10, A12, A18); - Pfeffer´s Functional Activities Questionnaire (FAQ) (A3); - *Barthel Index(A8, A18);* - Clinical Frailty Scale (CFS) (A15); **MOBILITY** - Timed Up-and-Go Test (A3, A12); - Romberg Test (A3); - Nudge Test (A3); - Single Leg Stance Test (A3); - 6-minute Walk Test (A3); - Get Up-and-Go Test (A2, A3, A10); - 400 m Walk (A7); - Grasp, handgrip and pinch (A3, A4, A7, A16); - 6-meter walk test (6MWT) (A16); - Tinetti test (A19); - Daily micturition test (A3); **COMMUNICATION** - Snellen test (A3, A7, A10, A16); - Whisper Test (A3, A7, A10); - Finger friction (A10); - Newspaper or magazine reading at 25 cm (A3); - Assessment of voice, speech and swallowing (A3); - Hearing Handicap Inventory for the Elderly (A19);

to be continued

Continuation of Table 2

Instruments developed for CGA applicable to primary care by dimension	**NUTRITION** - Mini-assessment of Nutrition (MAN) (A3); - Body Mass Index (BMI) (A4, A10, A12, A16); - Nutritional Health Checklist (A12); **FALLS** - Environmental fall risk assessment (A3); **SLEEP** - Sleep diary (A10).
Multidimensional instruments developed for CGA applicable to primary care	- Vulnerable Elders Survey (VES-13) (A3); - Clinical-Functional Vulnerability Index-20 (IVCF-20) (A3); - Frailty Visual-Analogue Scale (A3); - "Avaliação Multidimensional do Idoso Hierarquizada"-*Hierarchical Multidimensional Geriatric Assessment* (A3); - Moore & Siu (A4); - Avaliação Rápida Multidimensional da Pessoa Idosa (ARMI) *Rapid Multidimensional Geriatric Assessment* (A4); - RAPIDO (Rastreamento de Problemas de Idosos) *Geriatric Problem Screening* (A4); - MAGIC Questionnaire (A5, A16); - EQ-5D-5L Questionnaire (A5); - Avaliação Multidimensional de Pessoas Idosas (AMPI-AB) – *Multidimensional Assessment of Older People* (A6, A7); - Examen de medicina preventiva del adulto mayor (EMPAM) – (A8); - Self-administered Questionnaire (A9); - Self-assessment Questionnaires (A10); - FRAIL (frailty screening) (A15); - Brief Geriatric Assessment (BGA) (A16); - The Functional Autonomy Measurement System (*SMAF*) (A19).
Information Technology used to implement CGA	- Postal-based screening (A9, A19, A14); - Telephone-based approaches (A6, A10).
Relevant findings on practice of CGA in primary care	- Not all older people should undergo comprehensive evaluation using CGA. The assessment should be given to those at higher risk of disability (A3, A4); - Rapid screening and assessment instruments and strategies should be used (A13, A15); tests should be simple and suitable for use in routine practice (A5) - There are difficulties incorporating CGA into the routine of primary care professionals (A10, A12, A16); - Tools and scales can support, but not replace, clinical judgment (A18) - For cognitively impaired older people attending consultations alone, family members or caregivers can take part in some of the interview via telephone conference call (A10).

Source: study authors (2022).

DISCUSSION

This scoping review identified 19 studies addressing CGA in primary care settings. The studies retrieved were heterogeneous, as evidenced by the range of different designs. With regard to quality of evidence, categorized according the AHRQ9 into 6 levels, where 1 indicates high quality and 6 low quality level, one study (systematic review) had a maximum level of evidence, while 3 (clinical trials) had high quality of evidence.

Some studies were observational in nature, entailing application of 1 or more existing instruments to a local population in order to analyze efficacy[11,18,20,23,28], content[13], perform adaptation/validation[14,15], determine the cause-effect relationship[21], and promote development of an instrument[25]. Other studies involved collection and analysis of secondary data, reporting information from literature reviews on the topic and/or employing a technical appoach[10,12,16,17,19,24,26].

The dividing of CGA into 3 dimensions (clinical, psychological and functional) is a framework adopted by national and international bodies[3,4] and seen in several of the studies reviewed[12,14,16,19]. A number of domains comprising each dimension were extensively cited in the studies, namely: screening for hearing and vision deficits, assessment of presence of urinary or fecal incontinence, use of medications or presence of polypharmacy, history of falls, geriatric depression scale, ADL and IADL scales, BMI, grasp, handgrip and pinch tests, considered important components of multidimensional assessment tailored for the older population.

A systematic review study described the CGA models implemented in primary care, the results reported, as well as the acceptability of the intervention compared to the existing care model. The review concluded, based on the 4 articles analyzed, that the potential benefits of implementing CGA included cost effectiveness, greater adherence to medications and lower rates of hospital admission[10]. Another aspect was that CGA has a greater ability to detect geriatric problems compared to other methods of assessment, suggesting its potential use for consultations involving the older population within primary care[11,21].

National and international societies recommend the use of instruments which take into account the multidimensional nature of older people[13]. However, there are reports of difficulties incorporating CGA into routine practice of professionals in primary care[21,25], with issues such as poor cost-benefit, long application times, a lack of qualified Geriatrics and Gerontology specialists, and high service demand at this point of care. Thus, strategies have been adopted to cater for the health demands of older people across multiple dimensions[12,13], such as the use of rapid screening and assessment instruments and strategies[22,24].

In Brazil, studies have been conducted to propose effective models for performing CGA within primary health. One study[13] developed a screening script called RAPIDO - Rastreamento de Problemas de Idosos (Screening of Geriatric Problems), providing an objective assessment based on validated instruments already in use containing a total of 12 elements. The RAPIDO takes, on average, 16 minutes for any trained team member to apply.

From the international literature, the MAGIC questionnaire was identified. This instrument was developed by clinicians in English and is designed to provide a brief viable assessment for use in primary care practice. One study reported the translation and adaptation of the tool into Spanish[14].

Four studies were found on the deployment of information technology as support for application of CGA and management of data gathered. Of these articles, 3 described the use of postal-based screening to identify more frail older individuals indicated for geriatric assessment. These measures produced positive results, albeit with greater data loss[18] and incomplete responses[23]. In addition, the manual for use of the AMPI-AB primary care CGA instructs professionals to register the data on the information system in place for later export to the Brazilian National Health System Ambulatory Information System (SIASUS) under the registered code[16].

Identifying gaps in the literature, one of the objectives of this scoping review, indicates the needs for futures studies and identifies fertile areas for furthering research on the topic. Most of the studies failed to specify whether information technology or available resources were used to support the

application of CGA in primary care and management of information. The studies centered on assessment instruments, without exploring integration with information systems, and there is a dearth of scientific publications in the literature on the management of care of this population group using comprehensive assessment.

The present study has some limitations, such as the fact that most publications were cross-sectional, involving experiences with CGA over predefined time periods as opposed to long-term follow-up.

CONCLUSION

Mapping the scientific output on the topic revealed that the available studies were heterogeneous, predominantly observational, and investigated the local application of multidimensional instruments to the older population. This review found tools which were devised based on several existing instruments. Strategies to cater for older people in a rapid feasible manner are needed, given that incorporation of CGA into routine practice within primary care proved difficult. Specific domains were commonly present in the instruments, considered important for providing a comprehensive assessment tailored for the older population.

Further studies elucidating CGA in primary care should be conducted to allow programs to be executed in a more rapid effective manner and data managed in an integrated fashion by systems for monitoring the health of older people from a given region, thereby facilitating the devising of strategies to meet emerging demands. To this end, information technology can be useful in supporting the implementation of CGA.

AUTHORSHIP

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Associations between anxiety and functional disability in older adults: a cross-sectional study

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Abstract

Objective: to estimate the prevalence of anxiety in older adults and its association with different levels of functional disability in a small town in the state of Paraiba, Brazil. *Method: a* cross-sectional analytical study was carried out of 233 randomly-selected older users of the Family Health Strategy program. Data were collected using the World Health Organization Disability Assessment Schedule 2.0 and the Geriatric Anxiety Inventory. Results were analyzed using descriptive and bivariate statistics adopting a significance level of $p < 0.05$. *Results*: Overall, 48.1% of the participants had some degree of self-reported anxiety, with significantly higher levels among women (mean rank = 128.11; $p = 0.002$). An association was also found between severe anxiety level and severe disability level ($p < 0.001$). *Conclusion*: the high prevalence of different degrees of geriatric anxiety and its association with severe functional disability indicates the coexistence of psycho-emotional and motor alterations. These findings suggest the need to break the chain of underdiagnosis and strengthen the implementation of specialized interventions in the field of gerontology and geriatrics.

Keywords: Aging. Aged. Anxiety Disorders. International Classification of Functioning, Disability and Health.

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INTRODUCTION

Geriatric Anxiety is emerging as one of the most important health issues in aging, with a prevalence of 15-52% worldwide[1]. Although anxiety occurs across virtually all stages of life, anxiety disorders tend to be more severe in late life and are commonly associated with a disability outcome in older adults[2]. Anxiety is one of the leading causes of work-related and social absence[2] and constitutes a risk factor predisposing individuals to limitations comparable to or more severe than well-established chronic diseases[2,3].

The aging process is accompanied by a gradual natural decline in function among older individuals, reducing their capacity for adaptation and rendering them less able to carry out activities of daily living involving self-care, acquiring new skills and interaction in society[1,4]. However, when aging is associated with psycho-emotional disorders and pre-existing comorbidity, there is a greater degree of frailty and impairment of autonomy and independence, making older individuals more susceptible to dysfunction and disability[4,5].

Thus, functioning can be defined as a dynamic relationship which encompasses all structures of the body, activities performed, health status, environmental factors, and the people around the individual, while disability denotes difficulty or limitation in performing everyday activities in some domain of life within the expected timeframe for humans[6].

Hence, maintaining psycho-emotional wellbeing and functional capacity in late life represents a core concern in the field of aging, given its implications can have a direct impact on the older individual, their family and the community. Moreover, these disorders increase the risk of death in the older population, and lead to higher rates of hospitalization and burden for the public health system.

This scenario reveals the need to identify scientific evidence elucidating the existence of a relationship between aging, anxiety and functional capacity. This knowledge can help support the provision of quality specialized care to the older population, especially by conceptualizing the coexistence of anxiety-related symptoms with functional (dis)ability.

A search of the main national and international literature databases (Literatura Latino-Americana e do Caribe em Ciências da Saúde - LILACS, Scientific Electronic Library Online (SciELO); and Cumulative Index to Nursing and Allied Health Literature – CINAHL) revealed the availability of a greater volume of studies on other common mental disorders than for anxiety in the older population, and a dearth of evidence on anxiety disorders in this group and their implications for life and health, particularly within smaller towns in the Northeast region of Brazil[7,8].

Therefore, the objective of the present study was to estimate the prevalence of anxiety in older people and its association with different levels of functional disability in a small town located in the state of Paraíba, Brazil.

METHOD

A cross-sectional analytical study was conducted of a representative sample of older users of 5 Primary Health Units in the urban zone of Cuité, a small town located in Western Curimataú, Paraíba state, Brazil.

The sample size was determined using the public domain software OpenEpi version 3.0. The parameters were: the universe of the older population of the urban zone of the town (N= 2,486)[9]; mean estimated prevalence of anxiety-related disorders in the older population, P = 22.0% (0.22)[10]; a 95% level of confidence; and a sample error of 5%, giving an estimated sample size "n" of 233 participants, allowing for 6 losses and refusals. Participants were selected randomly in a systematic proportional fashion for each Primary Health Unit. The 3 criteria for participant inclusion were: age ≥60 years; living in the catchment area of the Primary Health Units at which they were registered users; attaining the cognitive performance cut-off of 10 points on the Mini-Mental State Exam (MMSE) for the items orientation for time (date of interview) and for place (address of residence), irrespective of educational level[11]. Individuals that had communication deficits precluding data collection, or who could not be found at home after 2 visits, were excluded from the study.

The data collection process took place between April and May 2021, following study approval by

the Research Ethics Committee of the University Hospital Alcides Carneiro (Permit no. 4.487.662), in compliance with the ethics and scientific precepts set forth in Resolutions 466/2012 and 510/2016 of the National Board of Health. Participant identification and recruitment entailed compiling a list of home addresses of all older users registered at each Primary Health Unit from medical records. The data collection was carried out by the lead researcher, the assistant researcher and 3 previously-trained students enrolled at the Center for Studies and Research in Aging and Quality of Life (NEPEQ) of the Federal University of Campina Grande (UFCG). In view of the COVID-19 pandemic, all health and biosafety rules prevailing in Brazil were adopted, with distancing of 1.5 meters and use of personal protective equipment by researchers.

Data were gathered using the following instruments: I) Sociodemographic questionnaire collecting information on the variables sex, skin color/race, marital status, religion, family income, living arrangement, functional literacy and occupational status; II) Geriatric Anxiety Inventory (GAI) to assess symptoms indicative of anxiety in the older population[12] and comprising 20 dichotomous items, with scores tallied and categorized as follows: 0-10 indicates absence of anxiety; 11-15, mild/moderate anxiety; and 16-20, severe anxiety, as per its translation and transcultural adaptation in the Brazilian version[13]; and III) World Health Organization Disability Assessment Schedule (WHODAS 2.0) comprising a generic assessment instrument for health and disability applicable in both general population and clinical settings covering 6 life domains of functioning: Domain 1: Cognition (understanding & communicating); Domain 2: Mobility (moving & getting around); Domain 3: Self-care (hygiene, dressing, eating & staying alone); Domain 4: Getting along (interacting with other people); Domain 5: Life activities (domestic responsibilities, leisure, work & school); and Domain 6: Participation (joining in community activities). The 12-item version of the scale used in the present study yields a score of 0-48 points, where 0-1 points indicates "none", 2-5 "mild", 6-11 "moderate"; and ≥12 points "severe" disability[14].

The data were analyzed and statistics expressed descriptively and in bivariate fashion as simple measures of absolute and relative frequency, with mean as the measure of central tendency. Subsequently, analysis of inferential statistics was performed to correlate the outcome variable (anxiety level) and exposure variables (sociodemographic characteristics and functioning level). For treatment of the bivariate statistic, Fisher´s Exact test was applied to determine the association between categorical variables, while the Mann-Whitney U test and Kruskal-Wallis test were used for group comparisons with the outcome variable. Non-parametric tests were used for skewed normal distribution of data, as measured by the Kolmogorov-Smirnov test. Associations were deemed statistically significant for $p < 0.05$.

RESULTS

Of the 233 participants, there was a predominance of individuals that were young older adults aged 60-74 years (59,7%), female (60.5%), married (54.1%), brown (56,2%), Catholic (70.4%), retired (89.7%), illiterate (57.9%), receiving a monthly income of 2-3 minimum wages (51.1%) and living with spouse only (28.3%). Comparison of total score on the GAI against groups of socioeconomic variables showed statistical significance only for the sex variable ($p = 0.002$), whose mean rank indicated that anxiety was more prevalent in women (mean rank = 128.11) (Table 1).

The findings regarding the anxiety level self-reported by the participants are presented in Table 2. According to the stratified total GAI scores, 51.9% of the participants had no anxiety, 18.9% mild/moderate, and 29.2% severe anxiety. Thus, at least 48.1% of the study sample had some degree of anxiety.

Correlating the occurrence of anxiety levels with functioning classification revealed a statistically significant association ($p < 0.001$) between anxiety and disability, with severe level of anxiety associated with severe level of disability (Table 3). Levels of disability reported were 9.87% (none), 33.05% (mild), 22.75% (moderate) and 34.33 (severe).

Table 1. Comparison of total score on GAI according to sociodemographic variables among older users of Primary Health Units. Cuité, Paraíba state, Brazil, 2021 (n=233).

Variables	Total score on GAI		
	n (%)	Mean rank	Sig. p-value
Age group[B]			
60-74 years (youngest-old)	139 (59.7)	115.08	0.851
75-89 years (middle-old)	82 (35.2)	120.37	
≥90 years (oldest-old)	12 (5.2)	116.17	
Sex[A]			
Male	92 (39.5)	99.98	**0.002***
Female	141 (60.5)	128.11	
Skin color/Race[B]			
White	70 (30.0)	107.79	0.233
Brown	131 (56.2)	122.77	
Yellow	02 (0.9)	31.25	
Black	29 (12.4)	119.12	
Indigenous	01 (0.4)	115.50	
Marital status[B]			
Single	36 (15.5)	101.78	0.059
Married	126 (54.1)	111.65	
Divorced/separated	16 (6.9)	128.59	
Widowed	55 (23.6)	135.84	
Religion[B]			
None	18 (2.6)	101.28	0.710
Catholic	164 (70.4)	118.22	
Protestant/Evangelical	43 (18.5)	119.57	
Judaism	01 (0.4)	58.50	
Other	06 (2.6)	102.75	
Functional literacy[A]			
Yes	98 (42.1)	119.10	0.684
No	135 (57.9)	115.47	
Family income[B]			
1 m.w.	112 (48.1)	116.85	0.932
2-3 m.w.	119 (51.1)	116.84	
≥4 m.w.	02 (0.8)	134.75	
Living arrangements[B]			
Spouse and children	39 (16.7)	108.32	0.230
Children only	23 (9.9)	129.04	
Trigenerational	21 (9.0)	134.95	
Intragenerational	11 (4.7)	141.09	
Spouse only	66 (28.3)	104.24	
Grandchildren only	05 (2.1)	174.90	
Alone	50 (21.5)	114.96	
Spouse, children, son/daughter-in-law	10 (4.3)	120.10	
Other	08 (3.4)	122.38	

to be continued

Continuation of Table 1

Variables	Total score on GAI		
	n (%)	Mean rank	Sig. p-value
Occupational status[B]			
Retired	209 (89.7)	117.12	
Farmer	19 (8.2)	119.34	0.399
Civil servant	03 (1.3)	143.50	
Other	02 (0.9)	42.50	

[A] - Mann-Whitney U test. [B] - Kruskal-Wallis test* - Statistical significance (p-value < 0.05); m.w - minimum wage.

Table 2. Classification of anxiety level on GAI among older users of Primary Health Units. Cuité, Paraíba state, Brazil, 2021 (n=233).

Variables	Participants	
	n (%)	
No anxiety	121 (51.9)	
Mild/moderate anxiety	44 (18.9)	
Severe anxiety	68 (29.2)	
Total	**233**	**100.0%**

Table 3. Association between categories of anxiety and disability levels among older users of Primary Health Units. Cuité, Paraíba state, Brazil, 2021 (n=233).

Disability level (WHODAS)	Anxiety Level (GAI)			Sig.
	None	Mild/Moderate	Severe	*p-value*[A]
None	17	05	01	< 0.001*
Mild	49	16	12	
Moderate	28	09	16	
Severe	27	14	39	

[A] – Fisher´s Exact Test * - Statistical significance (p-value < 0.05)

DISCUSSION

The present study sought to estimate the occurrence of anxiety in older individuals and its association with different levels of functional disability in a small town located in the interior of Paraíba state. The first hypothesis was that there is a high prevalence of anxiety in older people, given the underdiagnosis of the condition, especially in the primary care setting. The second hypothesis was that there is an association among anxiety, functional disability and socioeconomic status of older people. Thus, the study findings confirmed both these hypotheses upon showing that 48.1% of participants had some degree of self-reported anxiety and that a severe level of the disorder was significantly associated with severe level of functional disability.

Anxiety can be characterized as a condition that is deleterious for the health of older individuals, reducing their quality of life and promoting a decline in health[15]. Multiple conditions associated with the aging process can directly contribute to the development of the disorder. Consequently, these conditions present signs and biases for assessment of anxiety in aging, including a loss or reduction of self-esteem, limitations in activities of daily living,

loss of friends and relatives, decreased physical independence, increase in chronic diseases, and lack of social support[16]. The prevalence of anxiety in this age group can vary by as much as 52%, with rates gradually increasing with age[10,15].

Despite the high prevalence widely reported in the scientific literature, obstacles to the diagnosis and screening of anxiety in the older population remain. Effective detection of anxiety disorders in older individuals is hampered by its pathological aspects that are easily confounded with natural conditions of biopsychosocial aging, common emotional disorder, cognitive decline, or comorbidities induced by the aging process. Thus, when symptoms are not differentiated, the assessment, diagnostic conclusion and therapeutic management of this condition are neglected[16].

Neglect by the individual has also been reported in the scientific literature in health care. A study of older people in 5 general practices in the United Kingdom showed that those with higher levels of severity of anxiety normalized their symptoms as part of their health issues and functional difficulties associated with late life. These individuals also proved reluctant to seek health services, further hampering their diagnosis and treatment[17].-

In the present investigation, the assessment of level of severity found that 29.2% of participants had severe anxiety, exceeding the 16.28% rate reported by a study conducted in Maceió, Brazil[18]. Consistent with the data cited, symptoms such as restlessness, muscle tension, poor concentration and sleep disturbances, commonly associated with the more severe clinical form of anxiety, greatly increase the risk of limitations in physical functioning, social participation, and in activities of daily living of older people. These symptoms are regarded as independent risk factors for the onset of disabilities in this age group[2]. -

Numerous conditions can lead to the high prevalence of severe anxiety in the older population, principally related to factors such as increased burden of diseases and hospitalizations, low level of physical work, substance use (e.g. alcohol or tobacco), late diagnosis of anxious disorder, or poor therapeutic treatment[5].

It is important to mention the epidemiological scenario in which study participants were assessed, amid the pandemic caused by COVID-19. The evidence shows that the COVID-19 pandemic, and resultant physical distancing, can act as potential stressors for the development and exacerbation of psychoemotional issues in older people, whereby factors such as loneliness due to lockdowns, fear of catching the disease, prevention of saying goodbye to those who died, economic strain and uncertainty over future, led to an increase in anxiety symptoms of up to 20% in this population[19,20].

When examined in terms of gender, geriatric anxiety was more prevalent and severe in women than in men. This finding corroborates the results of a multi-center study conducted in Germany, Italy, the United Kingdom, Spain and Israel showing that women had significantly higher levels of anxiety, being 3 times more likely to develop an anxiety disorder[21].

Overall, the literature reports a higher prevalence of health issues and psychoemotional disorders in females[22]. This gender difference might be explained by factors historically associated with females, who had lower access to education, fewer formal work opportunities, lower levels of income, greater social pressure and household burden, contributing to less protection, security and well-being in late life[21].

Moreover, symptoms indicative of anxiety in older women may manifest as symptoms associated with underlying problems in their lives, including hormone syndromes, post-traumatic stress disorder, sexual aggression, domestic violence or other adverse experiences, commonly related to gender and older age group[22]. This strata of the population should, therefore, receive special care and attention from professionals and be extensively evaluated and treated at the different levels of the healthcare network.

Consistent with the results reported, the aging process, together with the myriad of physiological and pathological changes experienced by the older population across the life span, culminate in a growing level of dependence, functional impairment and declines in physical, cognitive and psychological capacity, directly influencing the development of common mental disorders such as anxiety[23,24].

Furthermore, this implies that anxiety acts as a driver of frailty and vulnerability in the older population, and can be regarded as a strong determinant for increased level of disability in late life[1].

In this respect, the study results confirm the association between level of self-reported anxiety and level of disability among the older adults assessed, where severe level of anxiety was associated with severe level of disability. These findings corroborate a study performed in a small town located in the interior of the Brazilian state of Bahia, in which older people with anxiety or depression had a higher prevalence of impairment in carrying out activities of daily living, greater clinical-functional vulnerability, low social engagement and greater disability processes[25].

The presence of functional deficits or disabilities are often reported in studies investigating geriatric anxiety, characterized as a form of symptom or consequence of the impairments secondary to the disorder[15]. The authors emphasize that anxiety-related changes contribute to lower social participation, impaired autonomy and a worsening of limitations for performing activities of daily living, factors which may debilitate older individuals in everyday life[22]. In addition, symptoms of the disorder can interact with other pre-existing diseases, exacerbating cognitive and functional deficits that accompany the aging process, becoming more severe and debilitating over time[2].

Another factor impacting level of disability in older individuals with anxiety is the increase or onset of comorbidities resulting from the disorder[24]. The literature shows that anxious older patients are more predisposed to physical disturbances, including visual deficits, falls, hypertension, gastrointestinal problems, besides cardiovascular changes, factors which may contribute to increased levels of disability and vulnerability. Moreover, older people with anxiety tend to have inadequate treatment and impaired self-care, factors which further impact the functioning and quality of life of this group[26]..

Although no statistically significant association was found between age group and total GAI score in the present study, severe anxiety appears to be a precursor of cognitive decline and of severe disability in older adults[27]. This relationship can be explained by the neurobiological changes promoted by the disorder, compounded by long-term use of benzodiazepines for treatment of the condition, which can render patients more susceptible to developing neurodegenerative conditions such as Alzheimer´s disease or vascular dementia. Early evidence of these risk factors has been reported by other meta-analyses performed in the last 5 years[28-30].

It is also noteworthy that anxiety disorders are associated with avoidance behaviors which, in turn, can result in a higher degree of social isolation and substantially lower levels of physical activity, both representing risk factors for the development of disability conditions in this age group[27].

However, it should be pointed out that, although some authors hold there is complex interaction between anxiety and clinical-functional decline among older individuals, the cause-effect relationship has not yet been fully elucidated. Thus, both emotional disorders and pathological anxiety may be consequences of physical diseases and, conversely, chronic anxiety may lead to a decline in health and increase in morbimortality, resulting in a greater degree of disability[31].

The present study has some limitations which should be taken into account when interpreting the results, including its cross-sectional design which, besides precluding any conclusions regarding cause and effect relationships between variables, introduces the risk of reverse causality bias among the outcomes and exposure elements. Another noteworthy point is the scarcity of national output on the topic. Perhaps, owing to the underdiagnosis of the disorder, there is consequent under-reporting of data in the national literature. This lack of previous reports hampers meaningful comparisons against the results of the present study that encompass the diverse range of cultural, social and demographic aspects in Brazil.

Notwithstanding the limitations outlined, a major strength of the study lies in the relevance of the topic amid a dearth of studies addressing this issue in the national literature. Lastly, the results found can help inform public policy-making and

enhance the multiprofessional care delivered to the older population, aiding screening, identification, diagnosis and early therapeutic management of geriatric anxiety.

CONCLUSION

Valuable evidence was found confirming the relationship between sociodemographic profile, levels of geriatric anxiety and different degrees of functional disability of the older adults assessed. Overall, 48.1% of the sample were shown to have some level of geriatric anxiety, with greater severity identified among women. Comparison of performance on the WHODAS and the GAI revealed a significant association between severe level of disability and severe level of anxiety.

Taken together, these results indicate the need for planning and implementation of specialized interventions in the field of geriatrics and gerontology, along with the devising of public policies that incorporate the practice of routine assessment of biopsychosocial aspects concerning the health of older people, given that both anxiety and disability are largely preventable conditions.

The negative impacts of anxiety and disability can be attenuated by screening and early detection, allowing effective individualized care, a reduction in complications and promotion in the quality of life of the older population. To this end, primary care professionals should be trained so as to develop their competencies and skills in the identification, management and proper treatment planning for these health conditions, besides broadening the scope of actions addressing psychoemotional and motor dimensions, with subsequent referral to specialist services when necessary.

Finally, further trials exploring the complexity of the relationship between geriatric anxiety and clinical-functional disability are warranted to maximize the empirical contribution of studies in this area and support the underpinnings, integrality and longitudinality of health care for the older population.

AUTHORSHIP

- Patrício A. Costa – conception and design or data analysis and interpretation; article writing or critical review; approval of the draft to be published; and responsible for all aspects of the study, ensuring issues involving accuracy or completeness of any part of the work.
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- Matheus F. Nogueira – conception and design or data analysis and interpretation; article writing or critical review; approval of the draft to be published; and responsible for all aspects of the study, ensuring issues involving accuracy or completeness of any part of the work.

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Association of self-perceived depressive feelings and cognitive performance with prevalence of depression among quilombola elderly people

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Abstract

Objective: To analyze the association of self-perceived depressive feelings and cognitive performance with prevalence of depressive symptoms among quilombola elderly people. *Methods:* Cross-sectional study conducted with elderly people from 11 communities in Bequimão-MA. Socioeconomic and health conditions, self-perception of depressive feelings, cognitive performance by the Mini-Mental State Examination (MMSE) and prevalence of depressive symptoms by the *Geriatric Depression Scale* (GDS-30) were investigated. Crude and adjusted prevalence ratios were calculated with a confidence interval of 95% by Poisson regression with robust variance. *Results:* A total of 59.5% of the elderly people were females, 50.6% were up to 69 years old and 83.7% were classified in socioeconomic status E. Moreover, 45.7% reported feeling "down" or "without perspective"; 12.1% had altered cognitive performance and 46.4% were screened as depressed by the GDS-30. Based on the GDS-30, 65.0% of the elderly people reported perception of depressive feelings associated depression, as well as 70% of them showed altered cognitive performance. In the adjusted analysis, depression evaluated by the GDS-30 was associated with self-perceived depressive feelings (PR= 2.02; 95% CI: 1.26-3.26), but not with the MMSE (PR= 1.64; 95% CI: 0.90-3.01). *Conclusion:* There was a high prevalence of self-perceived depressive feelings and depressive symptoms identified by the GDS-30. The association between these variables points to the importance of monitoring the mental health of quilombola elderly people.

Keywords: Depression. Mental Status and Dementia Tests. Aged. Health of Ethnic Minorities.

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The authors declare that there is no conflict in the conception of this work.

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INTRODUCTION

Population aging is a global trend and reinforces the importance of understanding themes related to old age in different areas of knowledge and socioeconomic contexts[1-3]. In Brazil, until 2060, the Brazilian population aged 65 or older will correspond to 26.7% (58.4 million) of individuals, and life expectancy in the country will approach 81 years[4].

However, this gradual aging process is marked by dilemmas, challenges and paradoxes, since elderly people still remain under strong vulnerabilities and deprivations that often increase their risks for physical and psychiatric disorders like dementia and depression. Thus, negative mental health outcomes are prevalent among elderly citizens, but remain the least evaluated among those living in rural and peripheral areas of the country[5].

Socioeconomic factors, in turn, make the aging process in Brazil heterogeneous and marked by inequalities. Racial inequities establish disparities between whites and blacks or browns – which contribute to the maintenance of material misery, restriction of political participation and spatial and social isolation of this population group[6,7]. These inequalities negatively impact the aging of the black population in the country: elderly citizens with black or brown skin color/race, when compared to white ones, predominate in the younger age groups (65-69 years), have high exclusive dependence on public health services, lower education, lower income levels and live in areas with the worst social and health indicators in the country[8].

In Brazil, there are rural communities that have particular characteristics, which are the quilombola communities. They are part of this historical context of social exclusion suffered by blacks in Brazil as expressions of resistance. These are rural groups formed by descendants of people who were enslaved and who organized themselves in spaces that allow the expression of traditional values and practices, based on African ancestry. In these communities, racial inequities translate into social determinants that materialize elements intensifying vulnerabilities, putting longevity in check and favoring the emotional and psychological distress of this population[9,10].

The adaptation of the individual to this stage of life, marked by functional decline and stressful life events – such as mourning following the loss of relatives, friends and spouses – may be associated with processes of physical, emotional and/or social vulnerability that cause or precipitate the manifestation of depressive symptoms[11].

Depression is characterized by depressed mood, loss of interest in activities once considered pleasurable and changes in biological functioning, such as changes in sleep patterns and appetite. In elderly people, depressive symptoms can also manifest themselves through irritability, apathy, guilt, helplessness, desire to be isolated at home, sleep disorders, loss of energy, constant thoughts about the past and negative evaluation of oneself, the future and life[2,12,13]. Depressive disorders have a multifactorial etiology and, among older people, biological, psychological and social factors compete, interact and determine the high prevalence of depressive symptoms at this stage of life[14-16]. Globally, the prevalence of depression among the elderly population is high, and there is a set of variables associated with it. One systematic review and meta-analysis provided an estimate of the prevalence of depression during old age[17]. The average expected prevalence of depression during old age was 31.7% (95% CI 27.9, 35.6). In the sub-group analysis, the pooled prevalence was higher among low- and middle-income countries (40.8%) than among high-income countries (17.1%)[17].

Unsatisfactory self-perception of emotional state and presence of depressive symptoms can also indicate levels of emotional distress and can be used as markers in the evaluation of emotional health using a screening test. Thus, poor emotional self-perception and the presence of depressive symptoms can be predictors of the clinical presentation of depressive symptoms in elderly people. In this way, the screening and, later, the treatment of depressive symptoms constitute protection for the independence and autonomy of older adults[18].

Loneliness, changed roles, lack of social and family support, prior depression and cognitive decline are psychological factors that are associated with depression in the elderly population[3,15]. The term depressive *pseudodementia* was created as a result of the high frequency of cognitive complaints in

depressive elderly people, where it was observed, accompanying the depressive symptoms, difficulties in concentration, attention and lack of memory, similar to the cognitive changes observed in dementia conditions. Nonetheless, recent investigations indicate that depressive disorders act as a strong indicator of the development of dementia processes and should therefore motivate the screening and evaluation of cognitive symptoms in older adults with depressed mood and anhedonia[16,19,20]. Based on these findings, the term *pseudodementia* is now considered inappropriate and misleading[16,19,20].

Within this panorama, this study has the objective of analyzing the association of self-perceived depressive feelings and impaired cognitive performance with prevalence of depression measured by the *Geriatric Depression Scale* (GDS-30) among elderly citizens in quilombola populations.

METHODOLOGY

This is a cross-sectional and household-based study that used data from the project "Population Survey on Living Conditions and Health of Elderly People from the Quilombola Population in a City in the Baixada of the Maranhão State" (IQUIBEQ Project). Data collection took place between July 2019 and March 2020 in the municipality of Bequimão – MA, where 11 Quilombola Communities participating in the study were located, namely: Ariquipá, Conceição, Juraraitá, Mafra, Marajá, Pericumã, Santa Rita, Sibéria, Suassuí, Ramal do Quindíua and Rio Grande. These communities are officially recognized as remnants of quilombola people by the Palmares Cultural Foundation and by the Brazilian Ministry of Culture (Figure 1).

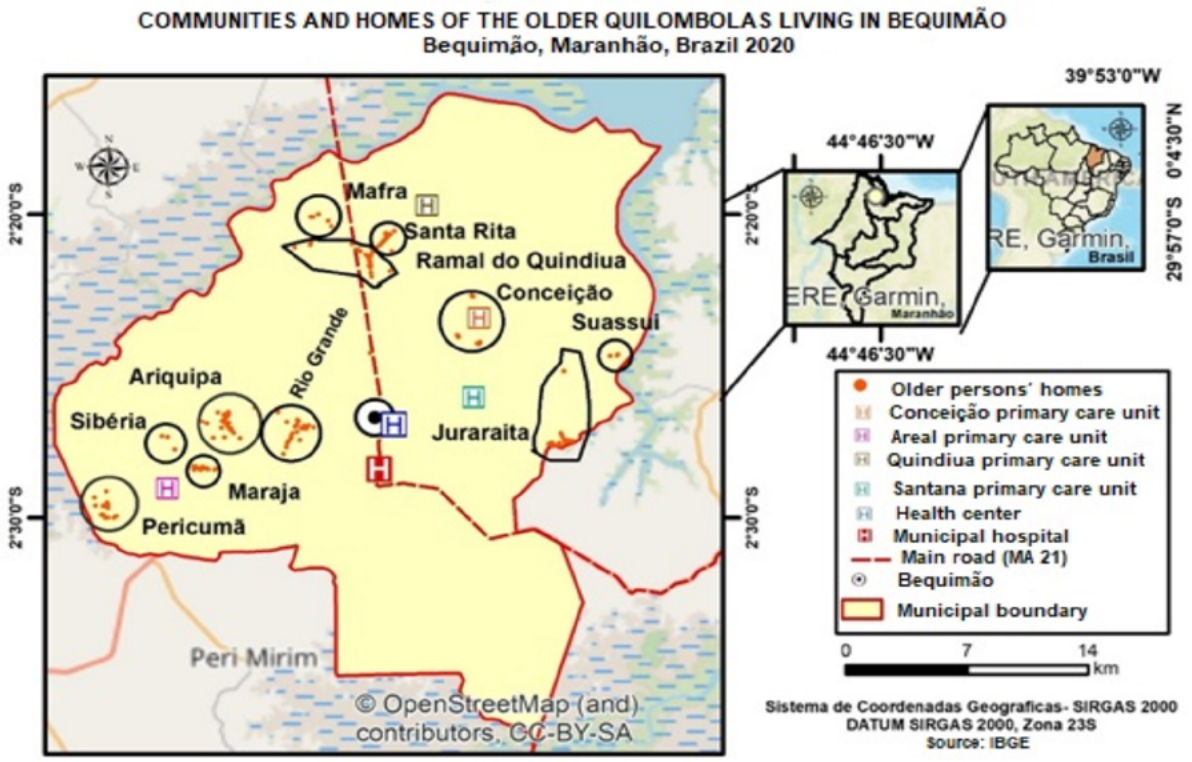

Figure 1. Geographic location of quilombola communities in Bequimão, Maranhão, Brazil, 2020.

The municipality of Bequimão is located in the northern mesoregion and in the microregion of Baixada Ocidental of the Maranhão State. In geographic terms, its location is on the side of the MA-211 road, at an equidistant point from the capital, São Luís, and the campus of the Federal University of Maranhão, Pinheiro – MA Campus. In 2010, the total area of the municipality of Bequimão was 761.49 km² and the census population was 20,344 inhabitants (67.5% in rural areas and 12.3% of the elderly citizens). The Human Development Index (HDI) was 0.601 and the Gross Domestic Product per capita was R$2,754.37[21,22].

The study population consisted of elderly people residing in quilombola communities and older than 60 years. The selection of these citizens took place through the articulation between the Municipal Department of Social Welfare and the Community Health Workers (CHW) of each community. From a survey carried out by CHW, a total of 245 elderly people were identified. For this study, a sample was calculated. Sample calculation was performed using Epi Info, version 7. With an estimated prevalence and error margin of 50% and 4.0%, respectively, for a confidence level of 95%, the calculated sample consisted of 168 subjects (68.6 %). The elderly people were selected through simple random sampling.

The inclusion criteria used to select the studied population were: individuals aged ≥60 years, who met the definition of an elderly person by Brazilian legislation[23], males and females, able to communicate with the researcher and residents in communities certified by the Palmares Foundation in Bequimão. The exclusion criteria were: elderly people unable to communicate with the researcher, who were not interviewed after several attempts or refused to participate in the research.

Questionnaires were applied to analyze the socioeconomic and health aspects: self-perceived depressive feelings, impaired cognitive performance and depressive symptoms. For socioeconomic conditions, the questionnaires were adapted from the 2013 National Health Survey (NHS) and can be verified on the website https://www.pns.icict.fiocruz.br. The evaluated variables were: gender (male or female); age group (in years: 60 to 69, 70 to 79 and ≥ 80), race/skin color (white, brown, black or other), marital status (with or without a spouse), number of residents per household (in categories: 1, 2 and ≥3 people), literate/education in years (illiterate, low and medium [1 to 8 years of incomplete schooling] and high education [8 or more years of complete schooling], family income in Brazilian reais [<1 and 1 to 3 minimum wages), socioeconomic status according to Social Class indicated by *Novo Critério Brasil*[24], number of rooms (≤3, 4 to 7 and ≥8), water treatment at home (yes or no), disposal of sewage from the bathrooms/toilets existing in the household (Septic tank, rudimentary *septic tank* and open-air) and households with the simultaneously adequate floor, roof and wall conditions. As for the variables related to self-perception of depressive feelings, the following questions were used: *"Has any health professional ever given you a diagnosis of depression?"* and *"In the past two weeks, how often have you felt depressed, 'down' or 'without perspective'?"*.

The Mini-Mental State Examination (MMSE) was also applied to evaluate the mental status among elderly citizens[7,25]. This instrument was applied and analyzed according to the recommendations of Bertolucci et al. 1994[25], who adjusted cut-off points suggestive of cognitive impairment to intervals determined on the basis of formal education: for illiterates (cannot read or write): 13 points; for individuals with low (1 to 4 years of incomplete schooling) or medium education (4 to 8 years of incomplete study): 18 points; and high education (8 or more years of schooling): 26 points. The Geriatric Depression Scale (GDS-30) was applied for depression screening specifically in the elderly population[6]. The cut-off point set at 10 was adopted to evaluate depressive symptoms; individuals with scores below 10 were considered normal and values above or equal to 10 were considered indicative of depressive symptoms[12,26].

The absolute and relative frequencies of the variables under study and their association with prevalence of depression measured by the GDS-30 were estimated. Pearson's Chi-square tests were estimated with a significance level of 5%. Crude and adjusted Poisson's analyses with robust variance were performed to test the associations of *impaired cognitive performance* and self-perceived depressive symptoms

with prevalence of depression measured by the GDS-30. In the adjusted model, gender, socioeconomic status and age were considered as confounding variables. These variables were selected based on theoretical criteria or statistical significance ($p<0.05$) in relation to impaired cognitive performance and presence of depression according to the GDS-30. Residual analysis was performed using graphical analysis and significance test.

The Prevalence Ratio (PR) and Confidence Intervals (95% CI) were estimated. All data analyses will be performed using Stata®, version 14 *(StataCorp LP, College Station, Texas, USA).*

The research was approved by the *Research Ethics Committee of the University Hospital – UFMA*, which evaluated the research project in accordance with Resolution nº 466/2012 of the National Health Council. The number of the substantiated and favorable order is 2.476.488/2018, and all participants signed the Free and Informed Consent Form before the collection.

RESULTS

Among the 168 elderly citizens (born between 1914 and 1958), 59.5% were females. The average age was 69 (64-77) years, 50.6% of them were aged up to 69 years old and 16% were long-lived (≥80 years old). It was found a higher percentage of elderly people with black color/race (59.0%), where most lived with three or more people in the household (57.1%), had a family income of 1 to 3 minimum wages (64.8%) and were classified in status E in relation to socioeconomic class (83.7%). Most were illiterate (54.2%). As for the household conditions, most lived in homes with 4 to 7 rooms (68.0%), and it is common to find households that did not have adequate floor, roof and wall conditions at the same time (71%). For 68% of the elderly people, treatment for water consumption at home was not carried out and only about 59% of the households had a septic tank, while 13% disposed of waste in the open-air environment (Table 1).

Concerning emotional health, of the 166 elderly people who underwent cognitive function evaluation through the MMSE, 12.1% had impaired cognitive performance. About 99.0% of the elderly citizens reported that they had never received a previous diagnosis of depression from a health professional. Nonetheless, the prevalence of those who reported feeling depressed, "down" or "without perspective" was 45.7%. When screening for depression using the GDS-30, this outcome is prevalent in 46.4% of the sample (Table 2).

This prevalence of depression according to the GDS-30 was statistically significant and higher among women (53%; p-value = 0.038), elderly citizens in the worst socioeconomic statuses (class D: 25.0% and class E: 50.3%; p-value=0.019), with *impaired cognitive performance* (70.0%; p-value=0.017) and greater self-perception of depressive symptoms (64.5%; p-value=0.001). Although the prevalence of depression according to the GDS-30 increased with age, this association was not statistically significant (p-value=0.810). (Table 3).

When testing the association of impaired cognitive performance and self-perceived depressive symptoms with depression by the GDS-30, it was found that only self-perceived depressive symptoms was associated with prevalence of depression by the GDS-30 in the crude and adjusted analysis. In the crude analysis, elderly people who self-reported these symptoms were more likely to be rated as having depression by the GDS-30 (PR = 2.15; 95% CI: 1.34-3.44). After adjustment for confounding factors, the prevalence ratio was attenuated, but the positive association remained. Elderly people who self-perceived depressive symptoms were twice as likely to be screened for depression by the GDS-30 (PR= 2.02; 95% CI: 1.26-3.26). The final model showed good goodness of fit and p-value (>0.05). (Table 4).

Table 1. Socioeconomic and demographic characteristics of elderly people in quilombola populations ≥ 60 years old (n=168), Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2020.

Variables	n (%)
Gender	
Male	68 (40.4)
Female	100 (59.5)
Age group (years)	
60 to 69	85 (50.6)
70 to 79	56 (33.3)
≥80	27 (16.0)
Color/race	
Black	98 (59.0)
Brown	52 (31.3)
Other	16 (9.6)
Marital status	
Married/stable relationship	58 (34.5)
Separated/divorced/widowed	110 (65.5)
Literate/Education (in years)**	
Illiterate	90 (54.2)
Low and medium	76 (45.8)
High	0 (0.0)
Number of members per household	
Living alone	26 (15.4)
Two	46 (27.3)
Three or more	96 (57.1)
Family income considering the minimum wage (R$954.00)	
< 1 Minimum wage	59 (35.1)
1 to 2 minimum wages	109 (64.8)
Socioeconomic status*	
C	3 (1.8)
D	24 (14.4)
E	139 (83.7)
Number of rooms per household	
≤ 3	2 (1.2)
4 to 7	113 (68.0)
≥ 8	51 (30.7)
Treatment of drinking water	
Adequate	113 (68.0)
Inadequate	53 (31.9)
Use of adequate construction material for walls, roof and floor **	
Yes	48 (28.9)
No	118 (71.1)
Sewage disposal	
Septic tank	98 (59.0)
Rudimentary septic tank	46 (27.7)
Open-air	22 (13.2)

Notes: *There were no elderly people in social statuses A and B; ** missings n=2.

Table 2. Evaluation of mental health status and depressive symptoms in quilombola elderly people ≥60 years old (n=168), Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2020.

Variables	n (%)
Impaired cognitive performance (MMSE)[1]	
Yes	20 (12.1)
No	146 (87.9)
Have you ever received a diagnosis of depression from a healthcare professional?	
Yes	2 (1.2)
No	164 (98.8)
Self-perceived depressive symptoms[2]	
Yes	76 (45.7)
No	90 (54.2)
Prevalence of depression according to the *GDS-30*[3]	
No depression	90 (53.6)
Depression	78 (46.4)

Notes: 1- Mini-Mental State Examination; 2- Self-perception of depression and feeling down and without perspective for more than half the day in the last two weeks; 3- Geriatric Depressive Scale-30

Table 3. Socioeconomic, demographic and mental health characteristics of elderly people in quilombola populations aged ≥60 years (n=168) with diagnosis of depressive symptoms according to the Geriatric Depression Scale (GDS-30), Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2020.

Variables	Depression		*p-valor*
	Yes	No	
	n (%)	n (%)	
Gender			
Male	25 (36.7)	43 (63.2)	*0.038*
Female	53 (53.0)	47 (47.0)	
Age group (years)			
60 to 69	38 (44.7)	47 (55.2)	0.810
70 to 79	26 (46.4)	30 (53.7)	
≥80	14 (51.8)	13 (48.1)	
Color/race			
Black	40 (40.8)	58 (59.1)	0.112
Brown	30 (57.6)	22 (42.3)	
Other	6 (37.5)	10 (62.5)	
Marital status			0.530
Married/stable relationship	25 (43.1)	33 (56.9)	
Separated/divorced/widowed	53 (48.2)	57 (51.8)	
Literate/Education (in years)**			0.956
Illiterate	42 (46.7)	48 (52.3)	
Low and medium	34 (44.7)	42 (55.3)	
High	0 (0)	0 (0)	

to be continued

Continuation of Table 3

Variables	Depression		*p-valor*
	Yes	No	
	n (%)	n (%)	
Number of members per household			
Living alone	11 (42.3)	15 (57.6)	0.872
Two	21 (45.6)	25 (54.3)	
Three or more	46 (47.9)	50 (52.0)	
Family income considering the minimum wage (R$954.00)			
< 1 Minimum wage	26 (44.0)	33 (55.3)	0.652
1 to 2 minimum wages	52 (47.7)	57 (52.2)	
Socioeconomic status*			
C	0 (0)	3 (100)	*0.019*
D	6 (25.0)	18 (75.0)	
E	70 (50.3)	69 (49.6)	
Number of rooms per household			
≤ 3	0 (0)	2 (100)	0.422
4 to 7	52 (46.0)	61 (53.9)	
≥ 8	24 (47.0)	27 (52.9)	
Treatment of drinking water			
Adequate	46 (40.7)	67 (59.2)	0.055
Inadequate	30 (56.6)	23 (43.4)	
Use of adequate construction material for walls, roof and floor **			0.080
Yes	27 (56.3)	21 (43.7)	
No	49 (41.5)	69 (58.5)	
Sewage disposal			
Septic tank	42 (42.8)	56 (57.1)	0.578
Rudimentary septic tank	22 (47.8)	24 (52.1)	
Open-air	12 (54.5)	10 (45.4)	
Impaired cognitive performance (MMSE)[1]			
Yes	14 (70.0)	6 (30.0)	*0.017*
No	62 (42.5)	84 (57.5)	
Self-perceived depressive symptoms[2]			
Yes	49 (64.5)	27 (35.5)	*0.001*
No	27 (30.0)	63 (70.0)	

Notes: * Pearson Chi-square test; **** missings n=2; **1-** Mini-Mental State Examination; **2-** Self-perception of depression and feeling down and without perspective for more than half the day in the last two weeks; **3-** *Geriatric Depressive Scale.*

Table 4. Crude and adjusted association of impaired cognitive performance and self-perceived depressive symptoms with diagnosis of depression according to the Geriatric Depression Scale (GDS-30) of elderly people in quilombola populations ≥60 years old (n=168), Bequimão (IQUIBEQ Project), Maranhão, Brazil, 2020.

Variables	Depression			
	Crude Analysis		Adjusted Analysis[3]	
	PR	95% CI	PR	95% CI
Impaired cognitive performance (MMSE)[1]				
Yes	1.65	0.93-2.94	1.64	0.90-3.01[4]
No	---	---	---	---
Self-perceived depressive symptoms[2]				
Yes	2.15	1.34-3.44	2.02	1.26-3.26[5]
No	---	---	---	---

Notes: 1- Mini-Mental State Examination; 2- Self-perception of depression and feeling down and without perspective for more than half the day in the last two weeks; 3- Adjusted for variables: gender, socioeconomic status and age; 4- Deviance goodness of fit: 106.101 and Prob > chi2 = 0.98; 5- Deviance goodness of fit: 102.531 and Prob > chi2 = 0.98.

DISCUSSION

The results show a high prevalence of self-perceived depression feelings and depression identified by the GDS-30. The association between these variables points to the importance of regularly monitoring the mental health of elderly people in quilombola populations, since, although negative mental health outcomes are prevalent in the elderly population, they remain the least evaluated among older adults from remote areas, such as rural or quilombola communities.

Between and within countries, there are important variations in the prevalence of depression[17,20]. Part of these differences can also be attributed to the different cut-off points employed in the use of the GDS-30. Nonetheless, socioeconomic and demographic determinants remain the most evaluated, and studies that verify the self-perception of depression feelings as a predictor of depression tracked through an adequate instrument, such as the GDS-30[17,20], are still scarce. Thus, this would be an important contribution of this work.

The World Health Organization (WHO) estimates that, worldwide, more than 322 million people, of all ages, suffer from depressive disorders. T*he total estimated number of people living with depression increased by 18.4% between 2005 and 2015.* This number makes depression the leading cause of disability around the world, generating inestimable costs for the global health system[26,27]. In Brazil, population-based studies indicate prevalence rates ranging between 13% and 38% of depressive disorders in the elderly population living in communities[28] – it is estimated that, among those institutionalized, the prevalence may be higher than 53%[3].

The high prevalence of depression among elderly people in quilombola populations in Bequimão-MA may be related to the precariousness of living conditions and overlapping vulnerabilities, characterized by worse socioeconomic status and inadequate sanitary conditions in households and communities[28,29]. It is worth noting that the prevalence of depression in the studied population proved to be higher than the prevalence of depression in other quilombola communities, under analogous living conditions[30]. Nonetheless, the depression screening instrument used in this analysis (GDS-30) was different from that used in the comparison study (PHQ-9)[30]. On the other hand, they were higher than those observed among elderly citizens in other low- and middle-income countries[17,20].

Despite its significant prevalence, it is believed that depression is one of the most under-identified and under-reported chronic diseases by health professionals[31]. Regarding the elderly population, this under-diagnosis is mainly attributed to four factors: 1) the widespread belief that depressive symptoms are

normal manifestations of the aging process; 2) the social stigma surrounding mental disorders, which generally makes the patient and/or family reluctant to accept the existence of mental illness and seek help; 3) failure to train primary health care teams in terms of recognizing and diagnosing mental disorders; 4) evident scarcity of mental health care services in the primary health system. Added to these factors, it is important to emphasize that, in elderly people, the typical manifestations of depression can be distorted by the presence of other comorbidities, contributing to diagnostic failure, inadequate management of the disease, thus resulting in a worse prognosis[2,32]. In the research undertaken with the quilombola citizens, the negligible number of individuals diagnosed with depression previously signaled by a health professional contrasted with the high number of individuals who signaled self-perception of depressive symptoms, suggesting a failure in terms of screening and diagnosis. In addition to the previously listed factors, it is questioned whether the attention and management given to mental health complaints in the population with black or brown color does not differ negatively from the attention given to mental health complaints in the white population, contributing to under-diagnosis and negatively impacting the prognosis[7,33].

In the studied population, the self-evaluation of depressive feelings was able to predict the presence of depressive symptoms screened by the GDS-30. The verification of the perception of elderly people in relation to their self-health status has significant relevance in terms of screening for depression because a poor evaluation of their health status can eventually be understood as a depressive symptom[34]. Due to its subjective nature, self-perception of health has a multidimensional character, involves lifestyles, in addition to psychological, demographic and socioeconomic aspects of the perception of the individual in relation to his/her health status, being widely evidenced as an important aspect of individual and collective well-being in national and international studies. It is a reliable indicator that can be applied effectively, quickly, and at a low cost in the evaluation of the health conditions of population groups[35,36]. Although the results indicate a low prevalence of cognitive impairment in the elderly citizens from the studied quilombola communities, it was observed that the levels of cognition among those with positive screening for depression differed from the standard levels of cognition. Considering the association between depression and cognitive decline, it is worth noting that depressed mood and anhedonia can be confounding factors for performance on cognitive tests[13]. The prevalence of impaired cognitive performance in this study was higher than observed in an isolated rural community, descendent of slaves, in the Midwest Region of Brazil *(2.6%, according to the MMSE cut-off point proposed by Bertolucci et al[35])*[37]. It was also higher than that observed among urban elderly citizens living in São Paulo, but lower than for black elderly citizens in that city[7].

The high prevalence of depressive symptoms among women in the studied population can be associated with the performance of gender roles in patriarchal societies: while men develop work activities outside the home and have the opportunity to engage in collective recreational activities (sports, bars, etc), women are reserved for domestic work and care for the family group, restricting their socialization outside this environment and their engagement in recreational activities other than individual ones. In rural communities, marked by low education, intense work routine and lack of leisure facilities, women are even more oppressed by their submissive relationship to men, which would lead them to establish a family early with older men, thus evading school activities and compromising their autonomy and economic independence when older[4,36,38,39].

Despite these results, it is worth highlighting some of its limitations. Survival bias could have impacted the results in two ways: since elderly citizens with worse health conditions tend to survive for a shorter time, the elderly people who participated in the study may represent a healthier portion of the studied population, and therefore have a lower estimate of cognitive impairment than the expected margin. Nonetheless, when selecting elderly people who lived for a longer time with precarious living conditions in their communities, accumulating losses and experiencing the accumulation of overlapping risks, it is possible to believe that these older adults also represent a portion more susceptible to the manifestation of depressive symptoms.

As this is a cross-sectional study, the simultaneous measurements of risk factors, protection and outcomes may limit the understanding of the directionality of some associations. The low prevalence of cognitive impairment in question in this study may be related to the sample size or even to the limitation of applying only a single type of cognitive screening test, since other tools could evaluate other dimensions of cognition, thus increasing the accuracy of the cognitive performance evaluation.

CONCLUSIONS

This study identified a high prevalence of self-perceived depressive feelings and depression according to the GDS-30, as well as an association between these two outcomes. This study can be considered as an early warning and advice for health professionals, health policymakers and other pertinent stakeholders to take effective control measures and periodic evaluation for the elderly population, since depressive disorders in older adults are associated with tragic outcomes on cognitive and functional decline, loss of maintenance of the social network and self-care, which can contribute to the emergence or worsening of diseases and even culminate in self-extermination. Depression is related to emotional and social factors, and a context of socioeconomic vulnerability and restricted access to health services may imply its higher prevalence and worse prognosis.

The quilombola population in Brazil lives in rural territories marked by poverty, geographic isolation and restricted social participation. Precarious sanitary and community infrastructure, high illiteracy rates and extreme dependence on social programs for income transmission mark a context of socioeconomic vulnerability and restricted access to health services that constitute a favorable scenario for greater involvement of infectious and parasitic diseases, worse prognosis of chronic non-communicable diseases, worse prenatal care, worse oral health and greater exposure to situations of sexual, physical and psychological violence.

Therefore, given this context, it is necessary to recognize that this scenario of discrimination and social exclusion makes this population need more attention and sensitivity from the health systems in relation to its psychological and emotional complaints, especially in old age. It is hoped that, when estimating the prevalence of depressive symptoms in the population of older adults among quilombola citizens, this work can serve as a subsidy for the strengthening of effective local actions and strategies that act in the prevention, diagnosis and adequate management of depressive disorders in this population.

AUTHORSHIP

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Use of potentially inappropriate medications by older adults in Primary Health Care: cross-sectional study

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Abstract

Objective: To verify the prevalence of potentially inappropriate medications (PIM) in use and possible associated factors in older adults and the agreement between two assessment tool in Primary Health Care (PHC) context. *Methods:* Cross-sectional study. The prevalence of older adults in use of PIM and associated factors were estimated. First of all was calculated the frequency of drugs, among those used, considered PIM. Classification as PIM was based on the 2019 Beers Criteria and the 2016 Brazilian Consensus on Potentially Inappropriate Medications 2016 (BCPIM) for the older adults. The agreement between the two classifications was also evaluated. Multivariate logistic regression models were estimated. Association was evaluated by Odds Ratio (OR). Kappa was calculated for agreement between both classifications. *Results:* The prevalence of older adults using MPI was 32.9%, according to Beers Criteria and 27.6% according to the BCPIM. The reports of diabetes (OR=1.96), depression (OR=2.25) and polypharmacy (OR=4.11) were associated (p<0.001) with the use of inappropriate medication, according to the Beers Criteria. Older adults who were very satisfied with their own health were less likely to use inappropriate medication both according to the Beers Criteria (OR=0.02) and the BCPIM (OR=0.09). Agreement between classifications was considered good (k=0.75, p<0.001). *Conclusion:* Reports of diabetes and depression, polypharmacy and negative self-rated health and satisfaction were associated with PIM's use. The associations were similar between the two classifications, indicating that both are relevant in identifying PIM use in older adults in the context of PHC.

Keywords: Older Adults. Medication Prescription. Primary Health Care.

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INTRODUCTION

The significant increase in the use of medicines in the older population is a worrying situation, which involves complex aspects, due to the morbidity and mortality associated with the use of some medicines for the treatment of common diseases in older adults[1]. This age group is particularly vulnerable to the use of several medications, being susceptible to the manifestation of problems in drug therapy, such as undesirable effects, drug interactions and use of potentially inappropriate medications (PIM)[2].

PIMs are medications that present a high risk of adverse effects, or those used for an inappropriate period of time or without indication, in addition to drugs that are ineffective in treating older patients and those that should not be prescribed for older adults[3]. There is evidence that the use of PIM is associated with the occurrence of adverse events such as falls, fractures, hospitalizations, constipation, heart failure, depression, cognitive deficit and renal dysfunction[4,5]. Some current studies, national and international, report that the prevalence of PIM use by older adults reaches percentages above 50% in most of the studied groups[4-7].

In order to reduce the negative outcomes related to the consumption of PIM by older adults, instruments were developed to identify these drugs, capable of helping professionals at the time of prescription[8]. The Beers Criteria are the most used tool in clinical practice since its first version, in 1991, until the most recent update, published in 2019[9].

The Beers Criteria are guidelines formulated for greater safety at the time of prescription, based on a list of drugs that should be avoided for use in older adults, such as oral decongestants, theobromines, stimulants, benzodiazepines, anticholinergics and anticonvulsants. Such criteria help health professionals to make the best choice of medication by considering and strongly weighing the existence of better alternatives when prescribing new medications, in addition to identifying PIM. The criteria also adopt flowcharts for when it is necessary to interrupt or reduce the dose of PIM in occasional use[9,10].

Due to differences in drug availability and different prescription methods used, these instruments have been adapted in many countries. In 2016, the Brazilian Society of Geriatrics and Gerontology (SBGG) published the Brazilian Consensus on Potentially Inappropriate Medications for Older People (BCPIM), which aims to validate the content of the Beers Criteria (2012) and the Screening Tool of Older Person's Prescriptions (STOPP) (2006), to obtain national classification criteria for PIM[11]. STOPP is a different tool from the Beers Criteria and depends on the user's clinical information for its complete use[11].

Based on the use of criteria for identifying PIM, epidemiological studies found a high prevalence of PIM use in different health care contexts: 84.5% in acute/intensive care, 70% in institutionalized older adults and 62.4% in older adults with non-institutionalized polypharmacy[12].

Primary Health Care (PHC) is the preferred gateway to the public health system. Research on the use of PIM in PHC is of great interest, as it is the scenario in which most drug prescriptions occur, in addition to coordinating and integrating the care provided to older adults in the Health Care Network. Therefore, in addition to prevalence studies and associated factors, there is a growing interest in intervention studies, which seek to recognize strategies to reduce the use of PIM in PHC[13].

The use of medication in the older population is considered an important practice and should be investigated at all levels of health care. Due to its serious adverse events, research is essential to estimate the prevalence of older adults using PIM and factors associated with this use, according to the Beers Criteria (2019)[9] and the BCPIM (2016)[11]. It is also relevant to assess whether the BCPIM still reflects the 2019 Beers Criteria updates for the Brazilian population. Thus, the present study had two objectives: (1) to verify the prevalence of PIM use and its associated factors according to the Beers Criteria 2019 and BCPIM 2016; and (2) observe the agreement between the two evaluation criteria for the use of PIM among older adults in PHC.

METHOD

Population-based exploratory cross-sectional observational study with older adults covered by the Family Health Strategy (FHS) in the city of Alfenas/MG. At the time of data collection (between 2014 and 2016), this population was 4,005 individuals, which represented approximately 70% of the older population residing in the municipality. The number of older adults to be evaluated was defined based on a sample calculation based on a pilot study that considered α=0.05 and power of 80%. To calculate the sample, the proportion of the older population of each of the 14 Basic Health Units (BHU) in the municipality was taken into account, in order to maintain the representativeness of the distribution of this population, based on the proportions and means of the variables of interest collected in a pilot study, with 10 seniors from each BHU. Thus, a minimum sample of 350 older adults was estimated. However, to ensure representativeness, especially in cases of exclusion or loss of information, a total of 571 older adults were initially selected to compose the sample. Participants were selected by drawing lots from a list that contained all older adults registered in each unit and their address. If the winner met the exclusion criteria or refused to participate, a new replacement draw was made.

Users aged 60 years or older and residing in areas covered by PHC in the city were included. Exclusion criteria were: bedridden older adults; with positive screening for cognitive impairment assessed by scores of less than 13 (illiterate or low schooling), 18 (medium schooling) and 26 (high schooling) on the Mini Mental State Examination (MMSE)[14]. For the analysis of this study, older adults with incomplete information for some variable of interest were excluded. Data collection was carried out at the home of the older adults drawn and included, by trained evaluators, at a time available to respond to the interview.

The following sociodemographic variables were considered as independent variables in this study: age, sex, color/race, marital status, education, family income, number of residents in the household, ability to read and write and own residence; health conditions: self-report of the presence of comorbidities (hypertension, stroke, diabetes, Parkinson's disease, seizures, depression, vertigo, urinary and fecal incontinence, osteoporosis, arthritis, osteoarthritis and heart disease), functional capacity (how many activities they report being able to perform out of a maximum of eight: leaving home using transport, walking short distances, preparing meals, cleaning the house, getting dressed, going up and down stairs, getting in and out of bed, taking a shower), occurrence of falls in the last year, life habits (cigarette and alcohol consumption), self-assessment and health satisfaction (own and compared to other older adults). Regarding the use of medications, polypharmacy was evaluated based on recording the number of medications used, considering as polypharmacy the use of five or more medications[15]. The use of some classes considered more common was evaluated: benzodiazepines, diuretics, antiarrhythmics and psychotropics[15]. The checking of medications, their dosage and class was carried out by checking medical prescriptions and packaging during the interview.

The use of PIM was operationalized by classifying each participant as "uses at least one PIM" or "does not use PIM", having as reference the "Beers Criteria", version 2019[9] and the BCPIM, from 2016[11]. The classification was made considering the PIM in any situation, regardless of clinical conditions that the individual could present. Thus, it was possible to assess the prevalence of older adults using PIM or not.

The classification of the drugs whose use was identified at least once by the older adults participating in the study was carried out. Each drug was classified as PIM ("yes" or "no") also by Beers 2019[9] and BCPIM 2016[11]. In this classification, drugs that appeared at least once as used were classified, regardless of the older adult who reported use.

The sample was described by mean and standard deviation values for continuous and discrete independent variables, and absolute and relative frequencies for categorical ones. The prevalences of older adults using PIM according to classifications were calculated by the proportion of the number of older adults using PIM and the total sample.

To verify the associations between the independent variables and the use of PIM, Logistic Regression models were built and the measures of association adopted were Odds Ratio (OR) with a

95% Confidence Interval (95%CI). In all models, the dependent variable was the use of PIM, with the older adult using the referred medication being considered as a reference. Each sociodemographic, clinical or medication-related characteristic was first inserted into a crude logistic regression model as an independent variable. Those that showed association in the crude models were included in the final adjusted regression model. The Hosmer-Lameshow test was used to verify the fit of the models, being considered a good fit when $p>0.05$. The evaluation of the significance of all models was verified using the F test, which was considered significant at $p<0.05$.

To assess the agreement between the classifications of the older adults who used or not PIM according to the Beers Criteria and the BCPIM, the Kappa test was performed, considering values above 0.80 = excellent; between 0.79 and 0.60 = very good; between 0.59 and 0.40 = moderate, below 0.39 = poor16. The significance of the Kappa test was verified by the X^2 test.

Considering the medication as the unit of analysis, the prevalence of PIM, according to the Beers and BCPIM Criteria, was calculated by the proportion of the total number of PIM registered according to each classification criterion and the total number of drugs in use reported at least once.

Analyzes were performed considering a significance level of 0.05.

The study was approved by the Research Ethics Committee of UNIFAL-MG (Opinion number 1,209,721). All participants signed the Free and Informed Consent Term (FICT).

RESULTS

Of the 571 older adults initially contacted, 29 were excluded for not scoring the minimum on the MMSE and 5 for being bedridden. Of the 537 included in the sample, 41 were not part of the present study because they did not have complete information about the medications used. The final sample consisted of 496 older adults, 62.3% women, mean age of 70.80 (±6.71) years, most aged between 60-75 years (77.6%) and married (66.4%) (Table 1).

The most prevalent morbidity was arterial hypertension (77.2%). The mean number of morbidities was 3.81 (±2.40) and the number of medications used was 3.96 (±2.68). Regarding polypharmacy, 36.9% of older adults reported using more than five medications, with diuretics being the most used class (41.6%) (Table 2).

When classified by the Beers Criteria, 163 (32.9%) older adults used PIM, while 137 (27.6%) used PIM by BCPIM. Comparison of classifications by the Beers Criteria and BCPIM showed very good agreement (k=0.75, $p<0.001$) (Table 3).

Table 1. Description of the sample according to sociodemographic characteristics, lifestyle and self-rated health, Alfenas (MG), 2016 (n=496 older adults)

Variable	Mean (±standard-deviation)	Frequency n(%)*
Sociodemographic Variables		
Age	70.80 (± 6.71)	
Age Group		
60 – 75 years / >75 years		385 (77.6%) / 111 (22.4%)
Sex		
Female/Male		309 (62.3%) / 187 (37.7%)
Education (Years)	3.67 (± 3.32)	
Abilty to read and write		
Yes/No		330 (66.5%) / 166 (33.5%)

to be continued

Continuação da Tabela 1

Variable	Mean (±standard-deviation)	Frequency n(%)*
Marital Status		
Married/Unmarried**		327 (66.4%)/169 (33.6%)
Color/Race		
White/ Non-White***		315 (63.5%)/154 (36.5%)
Paid Work		
No/Yes		405 (81.7%)/91 (18.3%)
Own Income		
Yes/No		266 (53.6%)/230 (46.4%)
Retired		
Yes/No		355 (71.6%)/141 (28.4%)
Pensioner		
No/Yes		391 (78.8%)/105 (21.2%)
Money enought for expanses		
Yes/No		274 (55.3%)/222 (44.7%)
Family Income (salaries)	2.24 (± 1.44)	
Own Residence		
Yes/No		444 (89.5%)/52 (10.5%)
Number of people living home	2.74 (± 1.27)	
Life Habits/Clinical Conditions		
Cigarettes		
Does not Smoke/Smoke****		415 (88.4%)/54 (11.6%)
Alcohol Consumption		
Does not drink/Drink*****		392 (79.0%)/104 (21.0%)
Occurrence of falls		
No/Yes		362 (73.1%)/135 (26.9%)
Functional Capacity	7.59 (± 1.14)	
Health self – assessment		
General Health Self-assessment		
Good/More or less/Bad		265(53.5%)/213(42.9%)/18(3.6%)
Compared Health Self-assessment		
Good/More or less/Bad		374(75.4%)/100(20.2%)/22(4.4%)
Own Health Satisfaction		
Very/More or less/Little		381(76.8%)/103(20.8%)/12(2.4%)
Compared Health Satisfaction		
Very/More or less/Little		405(81.7%)/80(16.1%)/11(2.2%)

* Frequencies presented from the most frequent category followed by the least frequent in the sample;

** unmarried: single/divorced/widowed; *** non-white: black/brown/other;**** Does not smoke: never smoked/stopped smoking; ***** does not drink: never drank/stopped drinking

Table 2. Sample description according to multimorbidities and medications, Alfenas (MG), 2016 (n=496 older adults)

Variable	Mean (±standard-deviation)	Frequency n(%)*
Morbidities		
Arterial Hypertension		
Yes/No		383 (77.2%)/113 (22.8%)
Stroke		
No/Yes		466 (94.0%)/30 (6.0%)
Diabetes		
No/Yes		302 (60.9%)/194 (39.1%)
Parkinson's Disease		
No/Yes		486 (98.0%)/10 (2.0%)
Seizures		
No/Yes		480 (96.8%)/ 16 (3.2%)
Depression		
No/Yes		393 (79.2%)/ 103 (20.8%)
Vertigo		
No/Yes		316 (63.7%)/ 180 (36.3%)
Urinary Incontinence		
No/Yes		389 (78.4%)/ 107 (21.6%)
Fecal Incontinence		
No/Yes		489 (98.6%)/ 7(1.4%)
Osteoporosis		
No/Yes		404 (81.5%)/ 92 (18.5%)
Arthritis		
No/Yes		402 (81.0%)/ 94 (19.0%)
Osteoarthritis		
No/Yes		395 (79.6%)/ 101 (20.4%)
Heart Disease		
No/Yes		365 (73.6%)/ 131 (26.4%)
Number of Comorbidities	3.81 (± 2.40)	
Medication		
Number of Medication Used	3.96 (± 2.68)	
Polypharmacy		
No/Yes		313 (63.1%)/183 (36.9%)
Benzodiazepines		
No/Yes		450 (88.9%)/ 46 (11.1%)
Diuretics		
No/Yes		289 (58.4%) /207 (41.6%)
Antiarrhythmics		
No/Yes		445 (89.9%)/ 51(10.1%)
Psychotropics		
No/Yes		445 (89.9%)/ 51 (10.1%)

* Frequencies presented from the most frequent category followed by the least frequent in the sample;

Table 3. Kappa reliability index through comparisons Beers Criteria and the Brazilian Consensus on Potentially Inappropriate Medications for Older People (BCPIM) on the use of inappropriate medications by older adults, Alfenas (MG), 2016.

Use of PIM for older adults	Beers Critetia (2019)	BCPIM (2016)	Kappa
No	333 (67.1%)	359 (72.4%)	k = 0.75 (0.68-0.81) $p < 0.001$ Very Good*
Yes	163 (32.9%)	137 (27.6%)	

***** Classification according to Portney and Watkins[16]: above 0.80 = excellent; between 0.79 and 0.60 = very good; between 0.59 and 0.40 = moderate, below 0.39 = poor; p value determined by X^2 test for Kappa significance.

Table 4 presents the results of the crude and adjusted regression models used to evaluate the factors associated with the use of PIM, classified according to the Beers Criteria and BCPIM. All models were significant (F test $p < 0.05$). When considering the classification by the Beers Criteria, older adults who reported diabetes (OR=1.96, 95% CI 1.24 - 3.09), depression (OR=2.25, 95% CI 1.30 - 3.92) and polypharmacy (OR=4.11, 95% CI 2.50 - 6.85) were more likely to use PIM. The older adults were more or less satisfied (OR=0.06, 95% CI 0.01 - 0.43) and very satisfied (OR=0.02, 95% CI 0.01 - 0.19) with their own health compared to other seniors were less likely to use PIM.

When classifying the use of PIM according to CBMPI, it was evidenced that older aduts who reported depression (OR=1.83, 95% CI 1.04 - 3.20) and polypharmacy (OR=4.23, 95% CI 2.52 - 7.21) were more likely to use PIM. Regarding self-rated health, older adults who considered their health to be more or less (OR=0.22, 95% CI 0.04 – 0.93) and good (OR=0.21, 95% CI 0.03 – 0.97), in addition to older adults who were very satisfied with their own health compared to other older adults (OR=0.09 95% CI 0.01 - 0.50), were less likely to use PIM (Table 4).

Regarding the prevalence of PIM among the drugs reported by the older adults as used by the two classifications, 15.2% of the drugs were PIM according to the Beers Criteria and 16.6% according to the BCPIM. There was 94.3% agreement between classifications. (Table 5).

Table 4. Crude Regression Models and Adjusted Regression Model for Use of Inappropriate Medications by the Beers Criteria and Brazilian Consensus on Potentially Inappropriate Medications for Older People (BCPIM), Alfenas (MG), 2016.

Independent Variables	Crude Models				Ajusted Models**			
	Beers Criteria		BCPIM		Beers Criteria		BCPIM	
	Odds Ratio	IC95%	Odds Ratio	IC95%	Odds Ratio	IC95%	Odds Ratio	IC95%
Age >75 years	0.87	0.55 – 1.37	1.08	0.67 – 1.71				
Sex Male	0.60	0.40 – 0.90*	0.78	0.51 – 1.17	0.99	0.58 – 1.12		
Arterial Hypertension Yes	1.65	1.03 – 2.69*	2.04	1.22 – 3.55*	0.88	0.50 – 1.54	1.17	0.65 – 2.16
Stroke Yes	1.02	0.44 – 2.19	1.31	0.48 – 2.46				
Diabetes Yes	2.93	1,99 – 4,33*	1.89	1.27 – 2.83*	1.96	1.24 – 3.09*	1.83	0.68 – 1.80
Parkinson's Disease Yes	0.87	0.18 – 3.18	1.76	0.44 – 6.29				
Seizures Yes	2.72	0.99 – 7.74	2.09	0.73 – 5.73				
Depression Yes	2.87	1.84 – 4.49*	2.53	1.60 – 3.99*	2.25	1.30 – 3.92*	1.83	1.04 – 3.20*
Vertigo Yes	1.25	0.85 – 1.84	1.61	1.08 – 2.42*			0.95	0.56 – 1.58
Urinary Incontinence Yes	1.29	0.82 – 2.01	1.29	0.80 – 2.04				
Fecal Incontinence Yes	0.81	0.11 – 3.82	0.43	0.02 – 2.56				
Osteoporosis Yes	1.11	0.68 – 1.78	1.18	0.71 – 1.92				
Arthritis Yes	1.19	0.74 – 1.90	1.37	0.83 – 2.21				
Osteoarthritis Yes	1.11	0.68 – 1.78	1.18	0.71 – 1.92				
Heart Disease Yes	2.05	1.36 – 3.10*	2.38	1.55 – 3.64*	1.24	0.72 – 2.10	1.29	0.75 – 2.19
Morbidities >5	2.21	1.49 – 3.26*	2.28	1.52 – 3.42*	0.71	0.40 – 1.24	0.91	0.50 – 1.63
Polypharmacy Yes	4.58	3.08 – 6.87*	4.55	3.03 – 6.95*	4.11	2.50 – 6.85*	4.23	2.52 – 7.21*
Functional Capacity 7/8 ADL	1.04	0.56 – 1.99	0.87	0.47 – 1.70				
Occurrence of Falls Yes	1.73	1.14 – 2.61*	1.65	1.07 – 2.52*	1.41	0.87 – 2.28	1.23	0.74 – 2.02
Own Health Self-assessment More or less	0.38	0.13 – 1.10	0.15	0.04 – 0.43*	0.86	0.25 – 2.89	0.22	0.04 – 0.93*

to be continued

Continuation of Table 4

Independent Variables	Crude Models				Ajusted Models**			
	Beers Criteria		BCPIM		Beers Criteria		BCPIM	
	Odds Ratio	IC95%	Odds Ratio	IC95%	Odds Ratio	IC95%	Odds Ratio	IC95%
Own Health Self-assessment Good	0.23	0.08 – 0.62*	0.11	0.03 - 0.32*	0.77	0.21 – 2.70	0.21	0.03 – 0.97*
ComparedHealth Self-assessment More or less	0.58	0.22 – 1.49	0.40	0.15 – 1.05			1.22	0.33 – 5.07
Compared Health Self-assessment Goof	0.44	0.44 – 1.06	0.35	0.14 – 0.84*			2.02	0.55 – 8.53
Mais ou menos satisfeito com a saúde	0.17	0.03 – 0.64*	0.15	0.03 – 0.56*	0.44	0.07 – 2.36	0.32	0.05 – 1.75
Very satisfied with own health	0.14	0.03 – 0.51*	0.11	0.02 – 0.37*	1.00	0.16 – 5.69	0.56	0.08 – 3.26
More or less satisfied with compared health	0.06	0.01 – 0.37*	0.22	0.04 – 0.84*	0.06	0.01 – 0.43*	0.22	0.03 – 1.19
Very satisfied with compared health	0.04	0.01 – 0.22*	0.12	0.02 – 0.42*	0.02	0.01 – 0.19*	0.09	0.01 – 0.50*
Hosmer-Lamashow					p = 0.690		p = 0.260	

* significant $p<0,001$; ** considering the associated variables in the crude models

Table 5. Kappa reliability index through comparisons Beers Criteria and the BCPIM on the use of inappropriate medications, Alfenas (MG), 2016.

Criteria	Number of Medication
Beers Criteria	No: 245 (84.8%)
	Yes: 44 (15.2%)
BCPIM	No: 241 (83.4%)
	Yes: 48 (16.6%)
Classification Agreement	No: 16 (5.5%)
	Yes: 273 (94.5%)

DISCUSSION

Given the importance of medication use in the daily lives of older adults, this study used two criteria, one international (Beers Criteria) and the other national (BCPIM), to assess the use of PIM in PHC. The use of a criterion that includes the drugs available in the country provides greater understanding to measure the use of PIM and develop educational strategies on appropriate and safe prescription of drugs[17].

In this study, a prevalence of 32.9% (Beers Criteria) and 27.6% (BCPIM) of older adults using PIM in PHC was observed. Studies carried out in the PHC identified percentages of 50%, 44.8% and 20% of use of at least one PIM for at least one criterion[7,18,19].

When analyzing the reported drug use, 15.5% according to the Beers Criteria, and 16.6%, according to the BCPIM, were considered PIM. It can be inferred that a higher frequency of PIM according to the BCPIM may reflect adaptation to the drugs available in Brazil. These results indicate that the two criteria, applied together, are complementary and help the process of minimizing PIM prescription.

Based on the Nominal List of Essential Medicines (RENAME, in portuguese), a national study identified several drugs considered PIM according to the Beers Criteria and available in PHC pharmacies[20]. However, many of them present safer options in RENAME itself[20].

Among older adults treated at a Reference Center for Health Care for Older People in the Midwest region of Brazil, a strong agreement was also observed between the Beers Criteria (2015), where 56.9% of the older adults used PIM, and the BCPIM, in which the frequency of PIM use was 66.8%[21]. In the work by Almeida[13], the agreement between the classifications of at least one PIM between the Beers Criteria (2015) and the BCPIM (2016) was also considered high. The classification of excellent agreement between the frequency of use of PIM in relation to the two classification criteria is due to the fact that the BCPIM was developed based on the previous version of the Beers Criteria[22], and it has undergone few changes in its update[9], the inclusion of Proton Pump Inhibitors >8 weeks being the most significant[13,22]. However, this therapeutic class was already part of another classification also used as a basis for the BCPIM (2016), the STOPP version (2006)[11].

The prevalence of PIM use by older adults may vary according to different observation sites, characteristics of prescribers and individuals studied, in addition to the criteria employed[13]. A systematic review study with meta-analysis found heterogeneity between the results of cross-sectional studies that analyzed PIM, regarding sample selection and stratification, practice scenarios, data collection and validation of PIM instruments and criteria[23].

Among hospitalized older adults in the United States, with a median age of 77 years, PIM use, based on the Beers Criteria, exceeded 50%[6]. On the other hand, among older adults in the community in Rio Branco (AC), according to the BCPIM, the prevalence of use of at least one PIM was 25.9%[24]. In China, 32.16% of the studied community-dwelling older adults used PIM according to the Beers Criteria (2019)[25].

A study carried out by Almeida[26] analyzed the data collected in two Basic Health Units (BHU) located in the East Region of Belo Horizonte and showed a frequency of PIM use of 53.7%, considering the Criteria of Beers (2015) and 55 .9% for the BCPIM. In the study by Santos-García[18], carried out in the PHC linked to a teaching hospital in Porto Alegre (RS), the use of at least one PIM was observed in 55.1% of the sample, according to the Beers Criteria, and 51.3% according to the BCPIM.

The positive report of diabetes was associated with the use of PIM only according to the Beers Criteria, and not when the classification was made by the BCPIM. The non-association with BCPIM can be explained by the non-inclusion of some medications used by older adults with diabetes as PIM, unlike what happens in the Beers criteria. Martins[27] identified a prevalence of PIM use of 48.3% using the Beers Criteria, with 21.3% of these drugs having a potential associated negative clinical result, and 14% of these outcomes corresponding to hypoglycemia, a common condition in patients with Type 1 diabetes. Parrela[7], in a study with groups of older adults using PHC in Campo Grande (MT), found that the main PIM used was glibenclamide, an oral hypoglycemic agent with a high potential risk of severe prolonged hypoglycemia. For diabetes mellitus and hypertriglyceridemia there is an increased cardiovascular risk, which must be properly treated, without the use of PIM [27,28].

Positive self-assessment of health and satisfaction with one's own health compared were associated with a lower chance of using PIM in older adults, according to the Beers and BCPIM criteria. The regular use of medicines provides a less esteemed self-image and negative self-perception of health, indicating to the older adults that something is wrong, due to the daily use and purchase of drugs[29]. Therefore, the present study confirms that a negative self-perception of health, often associated with the disease and the search for more health services, increases the chance of PIM prescription. This association is worrisome, since older adults with negative self-rated health probably have a significant health problem and are more exposed to PIM use, collaborating to worsen morbidity and mortality[30].

Positive reports of depression and polypharmacy were also associated with the use of PIM, considering the Beers and BCPIM Criteria. Analyzes based on the BCPIM, in hospital discharge prescriptions in a public hospital in Minas Gerais, found that the use of PIM at hospital discharge was associated with depression and polypharmacy[17]. In the work by Farias[19], in PHC, the author observed, as well as in the present study, that the factors associated with the use of PIM were self-reported diagnosis of depression and polypharmacy, according to BCPIM (2016).

A statistically significant association between polypharmacy and PIM was also identified in the study by Passos[31] with older adults assisted at the PHC in Rio de Janeiro, where 35.6% of the sample reported polypharmacy and, among the medications used, 19.2% were PIM, according to the Beers Criteria (2015). In Portugal, Castilho[32] identified the prevalence of polypharmacy and the prescription of PIM. Polypharmacy was present in 62.3% of the sample, and 40.7% had at least one PIM prescribed. The association between polypharmacy and PIM is not surprising, as the occurrence of polypharmacy triggers a cascade of prescriptions, and several drugs included are considered PIM[9].

Regarding the significant association between reports of depression and PIM use, it is known that depression is the fourth main disabling reason for social functions and activities of daily living in older adults, and can lead to the worsening of preexisting pathologies, due to consumption from PIM[5]. Bandeira[33] showed that more than half of the older women studied were using at least one PIM according to the 2019 Beers Criteria, associated with reports of insomnia and depressive symptoms. In that same study, a prevalence of selective serotonin reuptake inhibitors was observed, which represent the main class used in the treatment of depression. The consumption of this PIM can accentuate the symptoms of the syndrome of inappropriate secretion of antidiuretic hormone and favor falls and fractures, by producing ataxia and impairment of psychomotor function[33]. The frequent use of antidepressants, antipsychotics or anticonvulsants in older patients contributes to this association, in addition to classes of drugs that act on the central nervous system, such as benzodiazepines and tricyclic antidepressants,

also frequently observed in the criteria for PIMs, and widely used by older adults in the treatment for depression[18].

Negative self-assessment of health is consistent with depressive patterns, in which the older adults begin to identify themselves as inadequate, unwanted and incapable, with frequent frustrations and adversities[34], which results in greater consumption of drugs, increasing the chance of using PIM. In the present study, positive self-assessment and health satisfaction were associated with lower PIM use.

The study has limitations. The cross-sectional design may have underestimated the prevalence of PIM, as some drugs are considered PIM when used for a long period of time. The self-report of the clinical condition also does not allow detailing of the drug-disease interaction, which would result in a better judgment of the use as PIM by the Beers and BCPIM Criteria and its association with the investigated comorbidities. The exclusion of older adults with cognitive alterations may have left a potential group for the use of PIM out of the sample, but the fact that the information was collected by self-report limited their participation, prioritizing the quality of the data. As positive points, the research analyzed data collected in a representative way from older adults in the context of PHC and promoted valuable results for the improvement of treatment and prescription of medicines. The PHC stands out as a privileged field for the care of older adults, since it is the preferential gateway to the system, having direct contact with the profile of the older population in the territory, allowing the necessary subsidies to promote the integral health of this population group.

The use of PIM from PHC is relevant and can become a relevant public health problem. Studies carried out identify that the use of PIM prescribed in PHC is associated with admission to emergencies, adverse drug events, poor quality of life and hospitalizations[35]. Therefore, it is essential that there are actions that contribute to a better safety in the prescription of drugs for the older population from the first level of care. The data found in this study may make health managers aware of the importance of reviewing medication prescriptions for the older population, seeking adjustments that allow for a more rational prescription and a reduction in the risk of adverse effects caused by the administration of PIM.

CONCLUSION

The prevalence of older adults using potentially inappropriate medications was 32.9% according to the Beers Criteria and 27.6% according to the Brazilian Consensus. Self-reports of diabetes and depression, polypharmacy and negative self-assessment and dissatisfaction with health were associated with the use of these medications. The two classifications showed concordant results, proving to be adequate and complementary. However, it is important to highlight the need for constant updating of the BCPIM version, after all, new drugs are being incorporated with gains in effectiveness in pathological interventions, especially for the older population. PIM classification tools such as the Beers Criteria (2019) and BCPIM (2016) should be taken into account for a more rational and safe prescribing practice for older adults, especially in primary care, a level of care that promotes the monitoring of injuries and where such population is prevalent in the demands.

AUTHORSHIP

- Claudia O. Coelho – conception and design of the study; article writing; approval of the version to be published, responsible for all aspects of the work.
- Silvia Lanziotti A. da Silva – conception and design of the study; data analysis and interpretation, critical review of the article; approval of the version to be published, responsible for all aspects of the work
- Daniele S. Pereira – conception and design of the study; critical review of the article; approval of the version and be published.
- Estela Márcia S. Campos – conception and design of the study; critical review of the article; approval of the version to be published, responsible for all aspects of the work.

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Analysis of the components for classifying Metabolic Syndrome used in older people: an integrative review

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Abstract

Objective: To analyze the components of Metabolic Syndrome (MetS) and the rationale for adopting the criteria used for its classification in older individuals through an integrative review. *Method*: an integrative review of the literature in Portuguese, English, Spanish and Bulgarian involving older people (age ≥60 years) on the electronic databases MEDLINE - via PubMed, Embase, Web of Science and Scopus, without restriction on publication date or study design, was conducted from August 2022 to January 2023. The Medical Subject Headings (MeSH) and Health Sciences Descriptors (DEcS) controlled descriptors "elderly", "elderly 80 or older", "metabolic syndrome", "prevalence", "component" and "criterion" were used. Studies that were off-topic, unavailable in full and that failed to answer the guiding question were excluded. *Results*: Application of the eligibility criteria led to the retrieval of 1340 studies, of which 14 were included in the integrative review. Seven sets of criteria were identified for evaluating MetS in the older population were identified and most studies used two of these criteria. The IDF criterion was cited 7 times and the NCEP - ATP III criterion 8 times in the 14 article reviewed. *Conclusions*: Although the searches retrieved different studies on the subject, the results suggest the criteria for MetS should be revised, with cut-off points defined according to the population studied.

Keywords: Older people. Older people 80 and over. Metabolic Syndrome. Prevalence. Component. Criteria.

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INTRODUCTION

The growth in the older population, promoted by increased life expectancy and shifts in demographic, epidemiological and population transitions, is associated with significant consequences for society[1,2]. Aging favors greater vulnerability, giving rise to functional and physiological changes in the body that lead to the development of chronic non-communicable diseases (NCD), which often cooccur in this age group[3,4]. Chronic conditions, such as diabetes mellitus (DM) and systemic arterial hypertension (SAH), affect a large contingent of the older population. These conditions, when co-occurring with high triglyceride (TG) levels, low high density cholesterol (HDL-c) values and abdominal obesity, define metabolic syndrome (MetS), a highly prevalent NCD in the older population[5-8].

The spatial distribution of MetS is widespread, although some studies show major disparities in different parts of the world. In Brazil, the rate of MetS is around 22.7%, compared with 24.3% in European countries and 34.2% in North America. The contrast in these estimates might be explained by regional differences, disparities in sample characteristics (age, sex, race/ethnicity and economic status), besides differences in diagnostic criteria used to define the syndrome[9-13].

Several sets of criteria, based on different definitions and cut-offs, have been suggested by the leading world health organizations for diagnosing MetS. This definition has been the focus of studies and consensus conducted by important organizations in the field of health. In 1999, the World Health Organization (WHO), with the aim of standardizing the criteria, proposed a first diagnostic criterion, modified shortly after by the EGIR (European Group for the Study of Insulin Resistance), which proposed a new definition[14].

One of the most widely used criteria to date was devised in 2001 in the USA, namely, the National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III), defining the presence of the syndrome when 3 or more of the following criteria/components are abnormal: waist circumference, TG, blood pressure and plasma fasting glucose. In 2015, the Brazilian Society of Cardiology deemed the NCEPATP III satisfactory for diagnosing MetS[15-17].

In 2005, another framework widely accepted in the literature, the International Diabetes Federation (IDF) criteria, recommended waist circumference, together with the presence of 2 or more of the following for diagnosing MetS: raised fasting plasma glucose or diagnosed DM, raised HDL-cholesterol or specific treatment, raised triglycerides or specific treatment, and raised blood pressure or specific treatment. In 2017, the Brazilian Diabetes Society endorsed the use of the IDF criteria for diagnosing MetS, including adaptations for diagnosing individuals aged under 18 years given the lack of consensus on reference values[18].

The third National Surveillance of Risk Factors of Non-Communicable Diseases in Iran, conducted in 2007, drew on the definition of MetS according to the criteria established by the NCEP - ATP III and the IDF, adapting the cut-off point for waist circumference for the local population. The Iranian National Obesity Committee adopted this cut-off point, along with the following criteria for MetS, with 3 out of 5 components: Iranian-specific waist circumference ≥ 95cm, fasting plasma glucose or previously diagnosed DM, reduced HDL-cholesterol or specific treatment, raised triglycerides or specific treatment, raised blood pressure or specific treatment[19,20].

Generally, the diagnostic criteria for MetS take into account the presence of dyslipidemia (hypertriglyceridemia, low-HDL), systemic arterial hypertension, obesity and hyperglycemia. However, no solid consensus exists on whether DM2 (glycemia > 126 mg/dL in population-based studies without clinical diagnosis) or obesity should be obligatory criteria for MetS, and different reference values have been proposed for systemic arterial hypertension and other biochemical analyses[14].

Given the lack of a consensus definition on the combination of risk factors that should be considered for diagnosing MetS, together with the dearth of articles in the literature on the best criteria for assessing MetS in the older population, the objective of the present study was to analyze

the components of the Metabolic Syndrome (MetS) and the rationale for adopting the criteria used for classifying the syndrome in older adults through an integrative review.

METHOD

An integrative review was carried out in 6 stages: 1- identification of the topic and selection of the guiding question; 2- establishing of criteria for study inclusion/exclusion; 3- definition of the information to be extracted from the studies selected and their classification; 4- methodological assessment of the studies included; 5- interpretation of results; 6- presentation of the review and synthesis of knowledge.

The search was performed between August 2022 and January 2023 based on the guiding question: "*what components are used for diagnosing Metabolic Syndrome in older people available in the literature?"* The PICo framework was used to devise the question, where P denotes the population (older people), I the aspect of interest (components used) and Co the context (Metabolic Syndrome)[21].

The search for studies was conducted on the databases MEDLINE (Medical Literature Analysis and Retrieval System Online)) – via Pubmed (U.S. National Library of Medicine), Web of Science, Scopus and Embase. The last 3 databases, with restricted access, were accessed free of charge via the Federal Academic Community (CAFe) of the National Teaching and Research Network (RNP), using the CAPES Periodicals website portal.

The following controlled descriptors from Medical Subject Headings (MeSH) and Descritores em Ciências da Saúde – Health Science Descriptors (DEcS) were employed*: aged, aged 80 and over, metabolic syndrome, prevalence, component and criteria*, together with the Boolean logic operators AND and OR, as per the search strategy outlined in Chart 1.

The present integrative review was registered on the OSF Registry platform under protocol code no. 10.17605/OSF.IO/V7YJH. Inclusion criteria for studies were primary original articles (cross-sectional, cohort study and case-control studies), addressing the different components of MetS in older adults (age ≥60 years), available in Portuguese, English, Spanish and Bulgarian. No restrictions for study design or publication date were applied. Studies were selected independently by 2 reviewers using the Rayyan selection platform by QCRI (Qatar Computing Research Institute) and all duplicate records removed. The articles were first screened by reading titles and abstracts. Articles that met the eligibility criteria and were selected by both reviewers (agreement) were read in full for inclusion or exclusion in the review. Disagreements at the full reading stage were settled by consensus by recruiting a third reviewer.

Exclusion criteria were studies that addressed other diseases besides MetS, animal studies and review articles.

The Critical Appraisal Skills Programme (CASP) tool was used to appraise the methodological rigor of the articles included (Chart 2). The original CASP contained 8 specific tools for appraising different study designs, such as reviews, cohort studies, cross-sectional studies, clinical trials, among others. An adapted 10-item version of the CASP was scored in the present review: 1) clear statement of aim; 2) appropriate method; 3) presentation and discussion of theoretical and methodological procedures; 4) appropriate sample recruitment; 5) clear data collection; 6) relationship between researcher and participants; 7) ethical standards maintained; 8) rigorous data analysis; 9) clear statement and discussion of findings; and 10) contributions, limitations and identification of new areas of research. Each item was attributed a value of 0 (zero) or 1 (one), where the final result is a tally of the scores, for a maximum of 10 points. The articles selected were classified according to final scores into level A – 6-10 points (good methodological quality and reduced bias) or level B – at least 5 points (satisfactory methodological quality, but with increased risk of bias)[22].

Chart 1. Search strategies for databases. Recife, Pernambuco state, Brazil, 2023

DATABASE	SEARCH STRATEGY	RESULTS
MEDLINE / PUBMED	((((aged[MeSH Terms]) OR (aged, 80 and over[MeSH Terms]) AND (y_5[Filter])) AND ((metabolic syndrome x[MeSH Terms]) OR (prevalence[MeSH Terms])) AND ((component) AND (y_5[Filter])) AND (criteria AND (y_5[Filter]))	229
EMBASE	('aged'/exp OR aged OR 'very elderly'/exp OR 'very elderly') AND ('metabolic syndrome x'/exp OR 'metabolic syndrome x' OR 'prevalence'/exp OR prevalence) AND component AND criteria	958
SCOPUS	((KEY (aged) OR KEY (aged, 80 AND over))) AND ((KEY (metabolic AND syndrome) OR KEY (prevalence))) AND ((KEY (component) AND KEY (criteria)))	9
WEB OF SCIENCE	(TS=(aged)) OR TS=(aged, 80 and over) AND (TS=(Metabolic Syndrome x)) OR TS=(prevalence) AND (TS=(component)) OR TS=(criteria)	144
TOTAL		1340

Source: created by author.

Chart 2. Appraisal of methodological rigor of the 17 articles reviewed. Recife, Pernambuco state, Brazil, 2023

QUESTION	YES	CAN´T TELL	NO
1. Was there a clear statement of the aims of the research?	14	0	0
2. Is a qualitative methodology appropriate?	14	0	0
3. Was the research design appropriate to address the aims of the research?	13	1	0
4. Was the recruitment strategy appropriate to the aims of the research?	14	0	0
5 Was the data collected in a way that addressed the research issue?	14	0	0
6. Has the relationship between researcher and participants been adequately considered?	14	0	0
7 Have ethical issues been taken into consideration?	14	0	0
8. Was the data analysis sufficiently rigorous?	14	0	0
9. Is there a clear statement of findings?	14	0	0
10. How valuable is the research?	14	0	0

Source: created by author.

The level of evidence of the studies was categorized using the Agency for Health Care Research and Quality (AHRQ) system. Quality of evidence is classified into 6 levels, namely: (1) systematic review or meta-analysis; (2) randomized clinical trials; (3) non-randomized clinical trials; (4) cohort and case-control studies; (5) systematic review of descriptive and qualitative studies; and (6) original descriptive or qualitative study[23].

RESULTS

A total of 1340 articles were identified on the databases. After removal of duplicate articles (n=79), 1261 remained for analysis. After screening of titles and abstract, articles eligible for full reading were selected, with the exclusion of 1166 studies for being off-topic or meeting other exclusion criteria. Subsequently, a further 81 articles were excluded for not being available in the literature or because, after full reading, the methods and results failed to meet the eligibility criteria. A total sample of 14 articles met the inclusion criteria and were included in the review (Figure 1).

The articles reviewed were published in English (n=11), Spanish (n=1), Portuguese (n=1) and Bulgarian (n=1) in international journals, between 2012 and 2023. Studies were conducted in 11 countries,

comprising 5 European (Bulgaria, Spain, Finland, Croatia and Ireland), 3 Asian (Iran, India, China) and 3 Latin American (Mexico, Brazil and Cuba) countries. The objectives of the studies addressed the research question and the methodologies used were quantitative.

All studies were rated as Level A for methodological quality by the adapted CASP. Assessment using the AHRQ revealed 2 case-control type studies (Level 4 evidence), 2 prospective cohort studies (Level 4 evidence) and 10 cross-sectional observational studies (Level 6 evidence). None of the studies adopted a qualitative approach. The main information extracted from the articles is presented in Chart 3, providing a range of characteristics of the studies included covering the parameters: author, publication year, country, study design, objective, MetS assessment instruments, sample and key results.

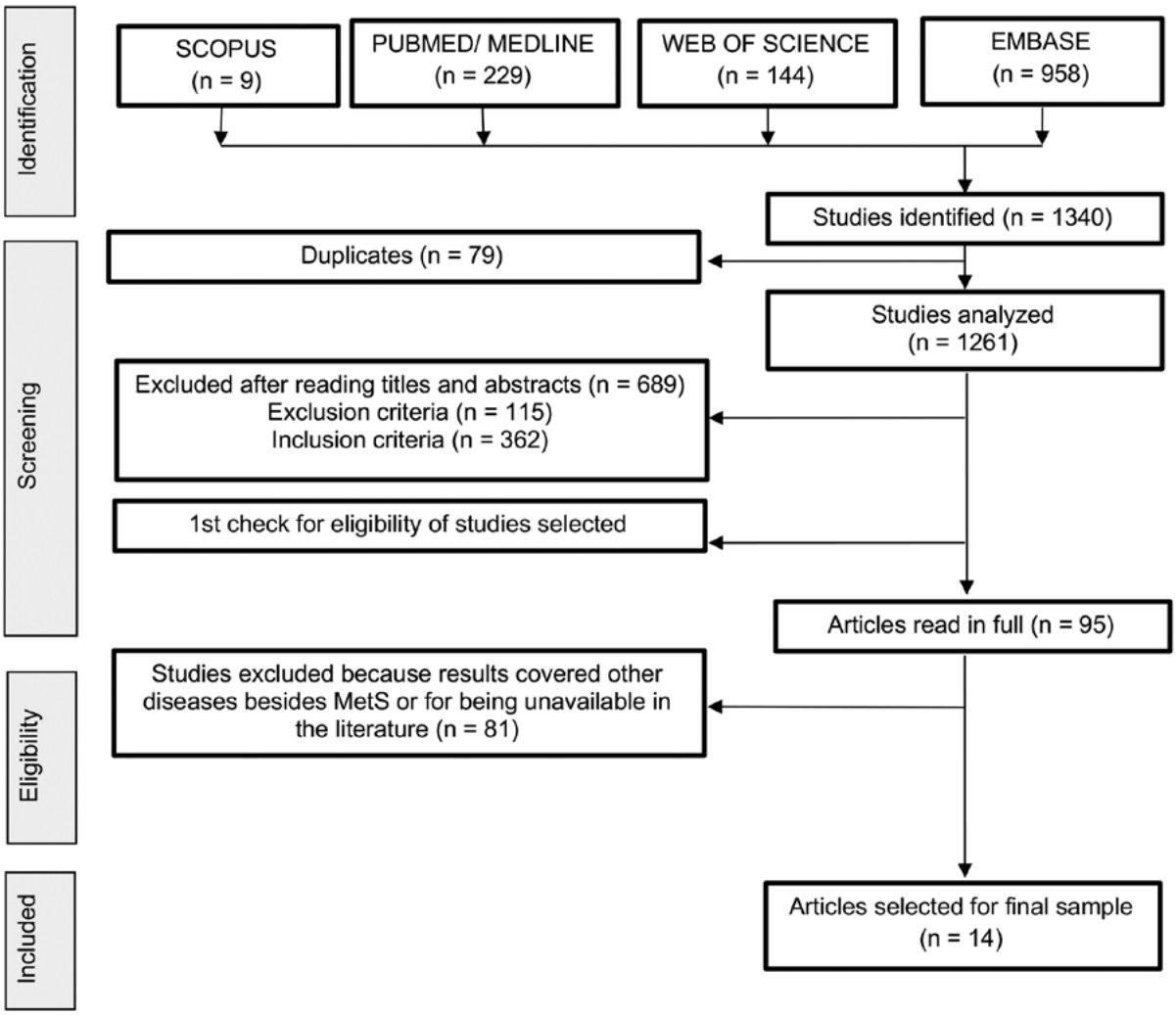

Figure 1. Flow diagram of search and selection process and reasons for exclusion of studies selected for integrative review**.** Recife, Pernambuco state, 2023.

Source: created by author.

Chart 3. Characteristics of studies included in integrative review. Recife, Pernambuco state, 2023.

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Vilela et al,[24] 2013, Spain	Descriptive, prospective study. Objective: to determine MetS prevalence.	Criteria: National Cholesterol Education Program-Adult Treatment Panel III (NCEP-ATP III) and International Diabetes Federation (IDF) definitions of MetS and its relation to cardiovascular disease (CVD) in hospitalized older patients.	200 older hospitalized patients	Prevalence of MetS was 65% (NCEP-ATP III) and 67.5% (IDF), proving greater in women (NCEP-ATP III= 72.8%, IDF=73.6%) than men (NCEP-ATP III=50.7%; IDF=56.3%).
Nevajda et al,[25] 2013, Croatia	Cross-sectional study. Objective: To investigate the prevalence of MetS in an older population in Croatia.	Criteria: WHO.	561 older nursing home residents in Zagreb, Croatia. There were 160 men (28.5%) and 401 women (71.5%).	The prevalence of MetS in the older residents was around 20.8%. The most common MetS component was hypertension, being significantly more frequent in women than in men.
Vieira et al,[26] 2014, Brazil	Cross-sectional study. Objective: to evaluate the prevalence and factors associated with metabolic syndrome in older adults.	Criterion: Harmonized criteria proposed by the WHO.	A total 133 individuals were randomly selected from users of primary health services of the Unified Health System.	The overall prevalence of metabolic syndrome was 58.65%, with 60.5% for females and 55.7% for males. Hypertension was the most prevalent component of the syndrome in both men (80.8%) and women (85.2%).
Borissova et al,[27] 2015, Bulgaria	Cross-sectional study. Objective: to explore the prevalence of MetS in the Bulgarian population and the role of some major factors such as age, gender and place of residence.	Criteria: IDF (2005), WHO (2000) and the newer harmonized MetS definition (2009).	1050 women (53.4%) and 917 males (46.6%), of which 538 were older adults (60-80 years).	Increased waist circumference was found in all older subjects with MetS (as an obligatory component). Most often MetS was diagnosed with three components (in 49.6%). MetS was found in 35.7% and was more prevalent in males (40.9%) than in females (31.1%). MetS prevalence increased with age reaching 53% in older individuals. MetS prevalence in Bulgaria was similar to that in other countries.

to be continued

Continuation of Chart 3

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Gholamreza Yousefzadeh; Mehrdad Sheikhvata,[28] 2015, Iran	Retrospective cohort study. Objective: to estimate the prevalence of the different MetS combinations in younger and older men and women in Iran.	Criteria: Adult Treatment Panel III (ATPIII) and International Diabetes Foundation (IDF).	6000 individuals, aged 15-75 years, resident in the city of Kerman, of which 874 were aged >60 years.	The prevalence of MetS increased with age for both genders in the older population. MetS was significantly more prevalent in females for both criteria used.
DM O'Connor, S. Leahy et al[29], 2016, Ireland	Retrospective cohort study. Objective: to determine the national prevalence of MetS in older adults using data from the first wave of the Irish Longitudinal Study on Aging (TILDA).	Criteria: Adult Treatment Panel III (ATPIII) and International Diabetes Foundation (IDF).	5026 participants, of which 1811 were older adults.	The ATPIII-defined prevalence of MetS in the population was 41·6 %, while the IDF criteria identified 47·3 % as having MetS. For both methods, MetS was more prevalent in men than women and increased with age in both sexes.
Rodríguez et al, [30] 2017, Cuba	Descriptive cross-sectional study. Objective: To determine the manifestations of MetS in people over 60 years of age in three elderly homes in Boyeros municipality.	Criterion: Adult Treatment Panel III (NCEF- ATP)	103 older people	33.01% of patients had MetS, with predominance (44.12%) in those aged 60-64 years and in female patients (64.71%).
Xianghua He et al,[31] 2017, China	Cross-sectional with a control group Objective: to estimate the prevalence of MetS in longevity in the Guangxi Zhuang Autonomous Region, China.	Criteria: revised National Cholesterol Education Program's Adult Treatment Panel III (NCEP ATPIII)	226 women and 81 men (mean age: 95.06 ± 4.91 years and 94.60 ± 4.09 years old for women and men, respectively; range: 90–111 years old). The control group comprised 185 women and 301 men (mean age: 47.98 ± 4.07 and 47.24 ± 3.70 years old for women and men, respectively; range: 35–68 years old).	The overall prevalence estimates of MetS among longevity group were 28.0% based on NCEP ATPIII criteria. The most common metabolic component was elevated blood pressure (61.1%), In the control group, the overall prevalence of MetS was 5.1%, irrespective of the criteria used, while triglycerides was the most common component.

to be continued

Continuation of Chart 3

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Sales, et al,[32] 2018, Brazil	Analytical and cross-sectional. Objective: to determine the frequency of metabolic syndrome and associated. factors in older individuals living in nursing homes.	Criterion: National Cholesterol Education Program – Adult Treatment Panel III.	202 older participants of both sexes.	The frequency of MetS was 29.2%. The most frequent MetS components were low HDLc (63.9%) and abdominal obesity (42.7%).
James et al,[33] 2020, India	Cross-sectional study. Objective: to identify the occurrence of MetS and to evaluate the gender-associated difference in each component of MetS	Criteria: International Diabetic Federation (IDF) and National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III).	350 patients, of which 144 were aged >60 years.	MetS increased with age, peaking at 51-60 years followed by 61-70 years. MetS prevalence was found to be significantly associated with age for both criteria.
Jesús D. Meléndez-Flores, et al,[34] 2021, Mexico	Cross-sectional study. Objective: To determine the prevalence and clinical features of MetS and its components in patients with Parkinson Disease (PD).	Criterion: World Health Organization.	99 patients with median age of 66 years, with most patients male.	Among components of MetS, arterial hypertension showed the greatest prevalence among patients with PD with 30%. MetS was reported in 8% of the PD population.
SAUKKONEN et al,[35] 2021, Finland	Cross-sectional study. Objective: to investigate the prevalence of MetS and its components in an aging population by using different definitions.	Criteria: National Cholesterol Education Panel (NCEP), the modified NCEP (NCEPm), and the International Diabetes Federation (IDF).	539 participants comprising 320 women and 219 men	Overall, the prevalence of MetS was 24.7%, 35.2%, and 37.2% in men, by NCEP, modified NCEP, and IDF-definitions, respectively. In women the corresponding figures were 20.9%, 33.1%, and 47.8%.
Zoghi et al,[20] 2021, Iran	Prospective cohort study. Objective: to determine the prevalence of MetS, its components, and related factors in the southern coastal area of Iran, Bandare-Kong Non-Communicable Diseases (BKNCD).	Criteria: National Cholesterol Education Program (NCEP) and the Iranian-specific cut-off for waist circumference (95 cm), the IDF and Iranian-specific cut-off point for Iran.	Of 3,927 participants included in this study, 598 were aged ≥60 years.	Females, the widowed/ divorced, the illiterate, rural residents, the unemployed, and non-smokers showed a higher number of MetS components compared to their counterparts. 54.6% of the older population met the Iranian definition of MetS.

to be continued

Continuation of Chart 3

Authors, year and country	Study design and objective	Instruments used	Sample	Key results
Sinha, et al,[36] 2023, India	Cross-sectional study. Objective: to determine the prevalence of MetS and its correlates among the residents of care homes for the elderly in Hyderabad city, India.	Criteria: International Diabetes Federation.	114 older residents (aged ≥60 years) from 2 care homes.	The overall prevalence of MetS was 42.1% (48/114) among the study population. A higher prevalence (50.9%; 27/53) was found among women. High blood pressure or taking antihypertensive medication was the most common (95.8%; 46/48) cardiometabolic component. The risk of metabolic syndrome did not differ significantly by age group or sex.

Source: created by author.

The articles selected addressed the main criteria and components used for assessing MetS older populations worldwide. Seven sets of criteria for assessing MetS in the older population were identified in the 14 articles reviewed. The data extracted from the studies were analyzed and compiled to assess for possible differences in classification among the criteria used for diagnosing MetS (Chart4). The results showed that most studies used 2 out of the 7 criteria. The IDF criteria was used in 7 of the 14 articles reviewed, while the NCEP - ATP III and modified NCEP III were used by 8 and 1 study, respectively. The Iranian-specific criteria (both IDF and NCEP III) were used once only in the articles reviewed. The WHO criteria was cited in 3 of the articles reviewed, whereas the Harmonized Criteria for MetS was used once only in the 14 articles reviewed.

Chart 4. Criteria/components used for diagnosing metabolic syndrome in older adults: WHO, IDF, NCEP-ATP III, modified NCEP-ATP III, IDF with cut-off point for Iran, NCEP - ATP III with cut-off point for Iran and Harmonized MetS. Recife, Pernambuco state, Brazil,2023.

COMPONENTS	CRITERIA						
	WHO	IDF	NCEP - ATPIII	NCEP-ATPIII(m)	IRANIAN-SPECIFIC CRITERIA – IDF	IRANIAN-SPECIFIC CRITERIA - NCEP	HARMONIZED CRITERIA for MetS (2009)
SAH (mmHg)	>140/90	>130/85					
Obesity	BMI >30 kg/m²	WC > 80 cm (F) WC > 94 cm (M)	> 102 cm (M) WC > 88 cm (F)		WC>95 cm		Population and country-specific definitions
TG (mg/dL)	Triglycerides > 150 or specific treatment for this lipid abnormality		Triglycerides > 150	Triglycerides > 150 or specific treatment for this lipid abnormality	>150		Triglycerides > 150 or specific treatment for this lipid abnormality
HDL-c (mg/dL)	<35 (M) <39 (F)	<40 (M) <50 (F)	<40 (M) <50 (F)	<40 (M) <50 (F) or specific treatment for this lipid abnormality	<40 M <50 F		<40 (M) <50 (F)
Glycemia (mg/dL)	>126	>100 or DM	>100	Raised fasting plasma glucose > 100 or specific treatment for high glucose is alternative indicator	>100		Raised fasting plasma glucose > 100 or specific treatment for high glucose is alternative indicator
Diagnostic criteria	DM2+ two factors	Obesity + 2 factors	Presence of 3 factors				

WHO: World Health Organization; NCEP-ATP III: National Cholesterol Education Program Adult Treatment Panel III; IDF: International Federation of Diabetes; NCEP-ATP III (m): modified National Cholesterol Education Program Adult Treatment Panel III; SAH: Systemic Arterial Hypertension; WC: Waist Circumference; TG: triglycerides; HDL-c: High-density lipoprotein cholesterol; BMI: body mass index; DM2: type 2 diabetes mellitus; M: male; F: female

Source: created by author.

DISCUSSION

Metabolic syndrome is a condition affecting a large contingent of the population, with a high prevalence in older people[3]. No specific criteria for classifying MetS in this older group was found, with all available criteria used for adults and adolescents, extending to the older population.

A 2021 study was conducted in Finland investigating 539 older individuals, comprising 320 women and 219 men. For diagnosing MetS, 3 comparative instruments were applied: the IDF, NCEP ATP III and the modified NCEP ATP III. Overall, the prevalence of MetS was 24.7%, 35.2%, and 37.2% in men, according to the NCEP, modified NCEP, and IDF definitions, respectively.

In women, the corresponding figures were 20.9%, 33.1%, and 47.8%[35].

According to the 2016 study by O'CONNOR et al. performed in Ireland, the prevalence of MetS in the population was 41.6% when defined using the NCEP ATP III criteria versus 47.3% according to the IDF criteria. For both methods, MetS was more prevalent in men than in women and increased with age[29].

Consistent with results of the Irish study, in a 2015 study by YOUSEFZADEH et al. in Iran of 874 individuals aged >60 using the same IDF and NCEP ATP III criteria, increased age was directly associated with the development of MetS and its prevalence was high in females for both criteria[28].

In India, a 2023 study of 114 older adults comparing both the IDF and NCEP ATP III criteria was published. The prevalence of MetS in the diabetic population was 42.3% and 28.9% according to the IDF and NCEP ATP III, respectively. A higher prevalence was found in women than men using both criteria[33,36].

The same two criteria were used to classify MetS in 200 older hospitalized patients in a Spanish study determining MetS prevalence with the IDF and NCEP ATP III criteria. The prevalence of MetS was 65% (NCEP-ATP III) and 67.5% (IDF), proving greater in women (NCEP-ATP III=72.8%; IDF=73.6%) than in men (NCEP-ATP III=50.7%; IDF=56.3%)[24].

In Brazil, 2 studies assessing MetS in older adults were conducted, In the first, a group of 202 institutionalized older adults diagnosed with MetS using the NCEP ATP III revealed a MetS rate of 29.2%[32]. In the second investigation, 113 older adults were randomly selected from among users of the primary care service of the Brazilian national health system (SUS) and MetS assessed using the WHO harmonized criteria. The overall prevalence of MetS was 58.65%. The rate among females was 60.5% versus 55.7% for men, with no statistically significant gender difference ($p = 0.589$)[26].

The NCEP ATP III was one of the most widely used frameworks in China and Cuba for assessing MetS in older individuals. A study investigating MetS prevalence in longevity in the Guangxi Zhuang Autonomous Region, China, recruited 307 oldest-old to assess the presence of MetS. Overall, 28% of the participants had MetS diagnosed using the NCEP ATP III criteria[31]. In Cuba, 103 older residents of 3 nursing homes were assessed using the same criteria, revealing that 33% of patients had MetS, with predominance in in females[30].

A study in Iran including 598 participants aged ≥60 years found that females, the widowed/divorced, the illiterate, rural residents, the unemployed, and non-smokers showed a higher number of MetS components compared to their counterparts. The results also found that, of the sample of participants, 15.3% had no MetS components, 23.7% only one, 24.5% two, 20.3% three, 12.2% four, while 4.1% exhibited all of the components of MetS. Thus, 84.7% of the subjects had at least one MetS component[20,37].

In another Iranian study investigating MetS components, the IDF criteria showed a higher prevalence of raised systolic blood pressure and reduced HDL cholesterol levels, while central obesity was more frequent in men. Using the NCEP ATP III definition, the study results showed that systolic and diastolic blood pressure, mean levels of plasma triglycerides and fasting glucose and reduced HDL were lower in women than in men[28].

Similar findings were reported by a study in Finland when comparing the component of elevated blood pressure using the NCEP and modified NCEP ATP III or IDF criteria (91.8% in men versus 89.0% in women). In men, the second most commonly component detected by the 3 definitions was glucose abnormality, with rates of 53.2% by NCEP and 78.4% by the modified NCEP and/or IDF criteria. In women, the second most prevalent single component was also glucose abnormality, with rates of 33.1% and 59.7% measured by the NCEP and modified NCEP, respectively[35].

In Brazil, a study of institutionalized older individuals using the NCEP ATP III criteria showed that the most frequent MetS components were low HDLc (63.9%) and abdominal obesity (42.7%)[32]. According to Vieira et al., in another Brazilian study, of older individuals selected from users of the Unified Health System and assessed using the WHO harmonized criteria, hypertension was the

most prevalent component of the syndrome in both men (80.8%) and women (85.2%)[26].

In Bulgaria, 1050 women, comprising 538 older adults, were explored to determine the prevalence of MetS using the IDF criteria and new WHO harmonized definition. Results showed that the 41.7% (527/1265) of participants with increased waist circumference had no data on MetS because at least 2 of the total 5 components for MetS were missing. The SAH component proved a strong predictor and was second only to obligatory waist circumference in the Bulgarian population[27].

Give the growing prevalence of MetS in the older population, mechanisms linking MetS with neurodegenerative diseases have been investigated[38]. In 2021, FLORES Jesús et al. performed a study in Mexico of a population of 99 patients, predominantly males, with median age of 66 years that had Parkinson Disease, using the World Health Organization (WHO) criteria for diagnosing MetS. MetS was reported in 8% of the population with Parkinson Disease. Of the different components of MetS, arterial hypertension had the greatest prevalence among PD patients, with a rate of 30%. Results also showed that patients who had both PD and MetS exhibited greater motor impairments than those without MetS[34].

In 2013, NEVAJDA used the WHO criteria to investigate the prevalence of MetS in an older population in Croatia. A total of 561 older nursing home residents in Zagreb were studied. The prevalence of MetS in the older residents was 20.8% and the most common component was hypertension, being significantly more frequent in women[25].

The present review has some limitations, such as the small number of studies addressing MetS criteria in older people and also the dearth of studies on the Brazilian population included in the review. The weakness of the criteria regarding the cut-off point for assessing waist circumference in the population studied may hamper or introduce bias in the true diagnosis of MetS, leading to a possible overestimation of the prevalence of the syndrome in women.

CONCLUSION

This integrative review showed that different organizations have developed specific criteria for assessing MetS, which were applied in different parts of the world, according to the choice of study authors. The NCEP ATP III and IDF criteria were the most used by the studies, proving more rigorous than other criteria.

The WHO criteria appears to be less commonly used given its disparate results compared to other criteria, possibly due to its use of the type 2 diabetes as an obligatory factor for MetS. The Harmonized MetS criteria was less cited in the literature, although it uses abdominal obesity as an assessment component based on country-specific cut-off points, rendering the criteria more flexible.

Overall, the NCEP ATP III set of criteria was the most cited by the articles reviewed, proving more workable in that data on the components measured are more easily collected in original studies.

Although the search retrieved different studies on the subject, the results suggest the components of MetS criteria should be investigated in more depth, with specific cut-off points defined according to the population studied.

AUTHORSHIP

- Áurea J. B.Costa – data analysis and interpretation, writing of article, approval of article to be published and oversight of all aspects of the study
- Gessica C. de Medeiros - writing of article
- Ilma K. G. de Arruda - critical review
- Alcides S. Diniz – critical review
- Maria das Graças W. S. Coriolano – conceptualization and design, data interpretation

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Sarcopenia and associated factors in older people living in rural riverside areas of the Amazon

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Abstract

Objective: To estimate the prevalence of signs suggestive of sarcopenia and its associated factors in an older rural riverside population of the Amazon. *Method:* A cross-sectional household-based study was carried out from April to June 2021 involving the universe of older people (age ≥60 years) living in nine rural communities on the banks of the Rio Negro, Manaus city, Amazonas state, Brazil. Signs suggestive of sarcopenia were identified using the Sarcopenia Formulary combined with calf circumference. Sociodemographic aspects, physical performance (static standing balance, gait speed at usual pace, and chair sit and stand), handgrip strength and self-reported health conditions (hypertension, diabetes, stroke, chronic low-back pain and multimorbidity) represented the explanatory variables. Poisson regression with robust variance was used to assess factors associated with signs suggestive of sarcopenia. *Results*: Data from 98 older individuals (55.1% male) with a mean age of 69.6±7.4 years were analyzed. Results revealed that 50.5% had low handgrip strength, 52.6% disability/low physical performance and 43.0% multimorbidity. Sarcopenia was identified in 28.9% of participants and associated with higher age (PR=1.1; 95%CI=1.1-1.1) and greater number of residents in the household (PR=1.2; 95%CI=1.0-1.3). *Conclusion:* The findings of the study showed a high prevalence of signs suggestive of sarcopenia (28.9%) among the population of older people in rural riverside areas of the Amazon, where higher mean age and greater number of residents in the household increased the probability of occurrence of this clinical condition.

Keywords: Sarcopenia. Aging. Rural Population.

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INTRODUCTION

In Brazil, the population aging process has occurred at a rapid pace and, while the guarantees provided for in law 10.741/2003 ruling on the Statute of the Older Person[1] have met with barriers precluding full implementation, the National Health Policy for Older People contains in its recommendations the conditions necessary to improve this scenario[2]. On a global scale, the demographic transitions have imposed a new epidemiological demand profile for society. The physiological changes accompanying advancing age can impact physical performance, nutritional status and risk of chronic diseases[3,4].

Sarcopenia, the term used to define progressive age-related loss of peripheral muscle mass and strength, is common in older people owing to the physiological process of ageing and conditions in this population group[5]. The etiology of this skeletal muscle disorder is multifactorial, involving a complex interaction between age, health conditions, and genetic, social and behavioral factors[6]. The condition is also associated with adverse health outcomes, including musculoskeletal, endocrine, psychiatric and cardiovascular problems[7]. Globally, the prevalence of sarcopenia in the older population ranges from 10% to 27%[8]. In Brazil, a systematic review and meta-analysis reported an overall sarcopenia prevalence of 17% in older people, with higher rates seen in women (20%) than men (12%)[9]. Therefore, monitoring and controlling this condition is critical to public health.

Sarcopenia can also affect the functioning of older individuals. Physical performance, besides constituting a predictor of independence and quality of life, is necessary for carrying out self-care[3]. Thus, assessments of physical performance are also fundamental in primary care to help devise strategies for maintaining health, autonomy and independence, and also to promote the health of these populations,

It is important to recognize the heterogeneity of characteristics of groups of older people in different regions of the country. Amid this diversity, evidence shows that health care of rural populations from the Amazon still replicates the urban logic, overlooking local specificities and providing only limited actions by health professional at riverside settlements[10]. In general, despite the dearth of epidemiological information pertaining to this group, they are considered a vulnerable population, with poorer health status that faces numerous barriers to accessing goods and services, and possesses inadequate basic health infrastructure[11].

Despite the growing body of knowledge about sarcopenia, related epidemiological studies involving traditional Brazilian populations, such as rural amazon riverside dwellers, remain scarce. The literature suggests that older individuals living in rural areas may experience a decline in physical activity level during the aging process and cumulative exposures throughout the life course[12]. Against this backdrop, the objective of the present study was to estimate the prevalence of signs suggestive of sarcopenia, and assess associated factors, in older people from rural Amazon riverside communities.

METHOD

A cross-sectional household-based study was conducted at 9 riverside settlements situated on the left bank of the river Negro, a rural area of the city of Manaus, Amazonas state, Brazil. The communities selected are part of 4 different subareas defined by the Municipal Health Secretariat covered by a single Fluvial Family Health Team (Floating Mobile Units) which serves the communities on an itinerant basis[10]. The only health professionals that reside in the area are Community Health Workers (CHW). The 9 locations with the highest population density were chosen for this study: Nova Jerusalém, Nova Canaã and São Francisco (subarea Mipindiaú); São Sebastião do Cuieras and Nova Canaã (subarea Cueiras); Santa Maria, Pagodão and Chita (subarea Santa Maria); and Bela Vista do Jaraqui (subarea Costa do Arara). The geographic locations of the communities selected, all covered by the fluvial primary health unit, are depicted in Figure 1.

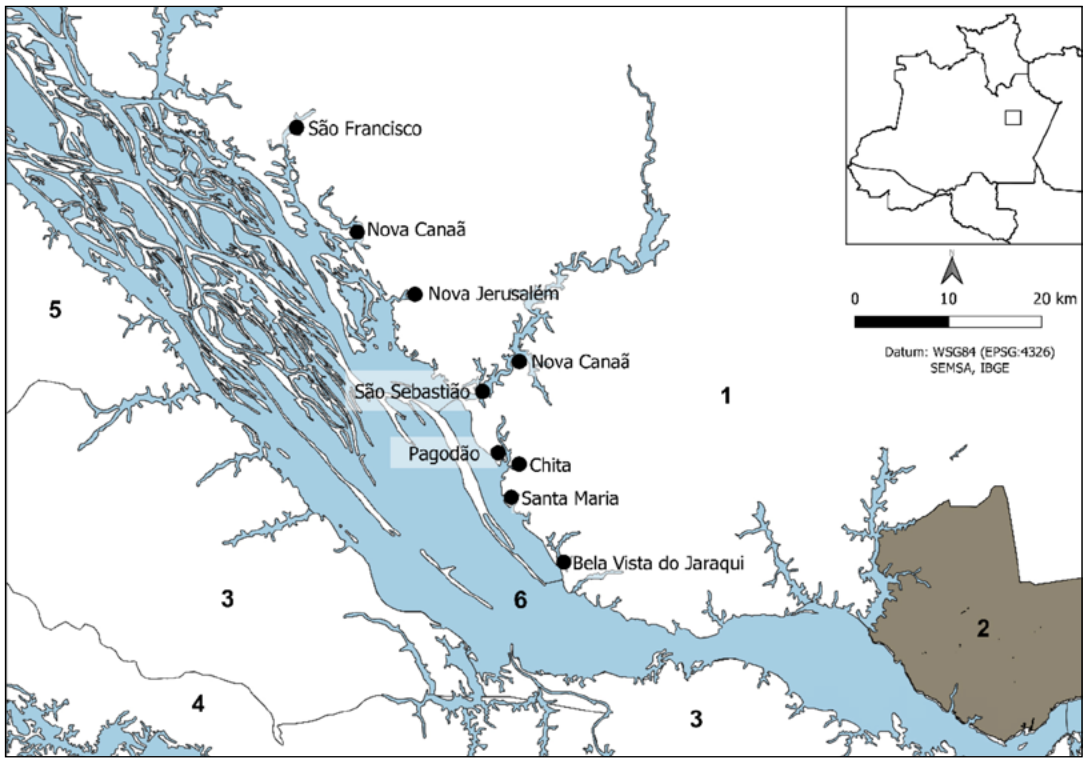

Figure 1. Rural riverside communities included in the study, Manaus, Amazonas, Brazil.

Source: SEMSA, IBGE. Datum: WGS84 (EPSG: 4326).

Notes: (1) Manaus, rural area; (2) Manaus, urban area; (3) Iranduba; (4) Manacapuru; (5) Novo Airão; and (6) Waterway/Hydrography.

All older individuals (≥60 years) of both genders and living at the selected study sites were included. For cognitive screening, the Verbal Fluency Test by semantic category (animals) was applied[13]. Individuals scoring less than 6 points were not included. The estimated sample of participants, based on the registration data for the year of collection provided by the CHWs, was 100 older individuals, representing 80% power in estimating regression coefficients of 0.3 in a model with 5 covariables at a significance level of 0.05, allowing for up to 10% losses. Older individuals who were bedridden or had a temporary or permanent disability precluding proper performance of the physical tests in the study were excluded (n=2).

Data were gathered from April to June 2021 by applying a questionnaire collecting data on sociodemographics and self-reported health status, as well as performing physical tests. The data collected were registered on smartphones using the Research Electronic Data Capture (REDCap) app designed to create and manage studies and databases, enabling field collection without the internet, while also recording the geolocation of each household. Prior to the main study, theoretical and practical training was carried out, besides a pilot study to train the interviewers in a controlled environment (within the institution), including 19 older respondents. The assessment of reproducibility of scores for the scales applied using intraclass correlation coefficient showed good reliability of the measurements on calibration (>0.75). Subsequently, a pilot study was conducted in a rural riverside community close to the urban area of Manaus to replicate the collection conditions in the field.

The interview entailed collection of sociodemographic data (age, sex, self-declared race/color, employment status, education, family income, receipt of welfare benefit, number of dwellers in household), household characteristics (main material for floors, wall enclosures and roof;

water/electricity supply; waste disposal) and variables related to health status (self-rated general health; self-reported clinical diagnosis of chronic diseases [arterial hypertension, diabetes, stroke, chronic lower-back pain], multimorbidity [≥2 self-reported chronic diseases in the same individual]; medical consultation in past 12 months; and limitations in activities of daily living due to health issues).

Physical performance was assessed using the Short Physical Performance Battery (SPPB) translated and adapted for use in the Brazilian population[14]. The SPPB comprises 3 timed physical tests which measure, in sequence, static standing balance, gait speed walking at usual pace, measured twice for a set course and, indirectly, lower limb muscle strength by repeated chair stand and sit 5 times without the assistance of upper limbs. Score on each test ranges from 0 (worst) to 4 (best).

Balance testing was performed in 3 stages with increasing degree of difficulty. The participant must hold each of the following 3 positions for 10 seconds: standing with feet together, side by side; standing with feet one foot placed slightly forwards of the other (semi-tandem position), and standing with one foot in front of the other, toe to heel (tandem position). For each position, the interviewer first demonstrated the task, offering arm support while the participant positioned their feet, and asks whether they are ready, withdrawing support and then beginning timing. The stop watch was stopped when the participant moved their feet, grasped the interviewer for support, or when 10 seconds had elapsed. A score of 1 was awarded when the participant performed the first position for 10 seconds and failed on the second position; 2 points when the participant held the second position for 10 seconds but failed to hold the 3rd position for more than 3 seconds; 3 points when the 3rd position was held for 3-9 seconds; and 4 points when holding the 3rd position for 10 seconds. If the participant scores 0 on either of the 2 first positions then the balance test should be stopped[14].

For the gait speed test, the participant walked a distance of 4 meters, marked out using tapes affixed to the floor. The participant was asked to walk from the start line until crossing the finish line at their usual walking pace. A score of 0 was given if the participant was unable to do the walk. A score of 1-4 was attributed according to the time taken to perform the test (1 point for time >8.70 seconds; 2 points for 6.21-8.70 seconds; 3 points for 4.82-6.20 seconds; and 4 points when time <4.82 seconds)[14].

The chair stand and sit test was then carried out, during which the participant was asked to repeat the movement 5 times, unassisted by upper limbs. A score of 0 was given if the participant was unable to do the test. A score of 1-4 points was given according to the time taken to complete the test (1 point: ≥16.70 seconds; 2 points: 13.70-16.69 seconds; 3 points: 11.20-13.69 seconds; and 4 points: ≤11.19 seconds)[14].

Total score on the SPPB was calculated by summing the points on each of the 3 tests, and ranged from 0 (worst performance) to 12 (best performance) points. Total score was subsequently categorized as follows: 0-6 points = disability/low physical performance; and 7-12 points = moderate/good physical performance[15].

For the assessment of isometric hand-grip strength, a Saehan® (Saehan Corporation, Masan, Korea) dynamometer was used. The device has two handles, one fixed and the other sliding, adjustable to 5 grip positions, accommodating the patient´s hand size. The individual sat in a chair with the arm in adduction, neutral rotation and elbow flexed to 90º. The needle was first set to zero. The participant was asked to apply grip pressure to the device using maximum possible force. In response to prompts from the interviewer, the subject must exert maximum force to bring the handles of the device together. The verbal commands were standardized to prevent influence of encouragement given. Three measurements were collected for each hand with 1-minute rest intervals between sets, where the highest value obtained was used for analysis. The reference values adopted for low hand-grip strength were <33.4 kg for men and <18.6 kg for women[16].

The Sarcopenia Formulary (SARC-F) scale was applied, using the version adapted for Portuguese[17], which consists of a questionnaire with objective questions probing the individual´s perceived level of difficulty for 5 components: strength, ambulation (walking independence), rising from chair, climbing stairs and falls. Each of the 5 components was scored

on a scale of 0-2 points (0 = no difficulty or no falls in past year; 1 = some difficulty or 1-3 falls in past year; and 2 = major difficulty/disability or ≥4 falls in past year). Calf circumference was measured using an inelastic metric measuring tape (accurate to nearest 1mm) at the largest volume of the two legs with the individual sitting in a chair with leg flexed to 90°[18]. In the absence of information on the dominant leg, the largest measurement was used. Low muscle mass was defined as ≤34 cm for men and ≤33 cm for women[19]. Calf circumference was given a score of 0 for adequate muscle mass and 10 for low muscle mass. Sarcopenia was assessed using the SARC-CalF (SARC-F + calf circumference) which includes the 5 items of the SARC-F plus calf circumference. A total score (SARC-CalF) ≥11 points (maximum 20 points) was considered suggestive of sarcoepenia[20].

The data collected by REDCap, following critical analysis and correction of inconsistencies, were exported to the software package Stata SE, version 15 (StataCorp, College Station, TX). A descriptive analysis of the data was first performed. Bivariate analyses were then carried out to assess the differences between independent variables (sociodemographic and health characteristics) according to the presence or otherwise of signs suggestive of sarcopenia. To check for differences between proportions and means, the chi-square/Fisher exact tests and Student´s *t*-test for independent samples were applied, respectively. Variables with a p-value ≤0.20 on bivariate analyses were included in the multiple analysis, using Poisson regression with robust variance to estimate prevalence ratios (PR) and respective 95% confidence intervals (95%CI). Variables with p-value ≤ 0.10 were retained in the final model. The goodness-of-fit of the model was assessed by the Hosmer-Lemeshow model. A 5% level of significance was adopted for the analyses.

The study complied with the recommendations of Resolution nos. 466/12 and 510/2016 of the National Board of Health of the Ministry of Health. The study was approved by the Ethics Committee for Research involving Humans of the University of Amazonas State (CAAE permit no. 34514220.1.0000.5016). All study participants received and signed a Free and Informed Consent Form after receiving explanations about the study objectives, risks and benefits when approached to take part.

RESULTS

Of the 100 older adults visited, 98 dwellers aged ≥60 years were included in the study. Of this total, 28 presented signs suggestive of sarcopenia (prevalence 28.9%). Participant age ranged from 60-96 years and mean age was 69.6 (±7.4) years. The study participants were predominantly male (55.1%), self-declared as black or brown (93.8%), retired (71.6%), and received social welfare benefit (54.6%). Mean monthly income was R$ 1,661.8 (R$ ±1,088.8) and mean number of dwellers in the household was 3.2 (±1.9).

Regarding physical characteristics of the houses, most were built with wood or mud floors, wood enclosing walls, and zinc metal or cement fiber sheet roofing. Almost 12% of the household had no electric lighting, 60% of families drew drinking water from artesian wells, and 87% reported burning or burying domestic waste in the community (data not shown in tables). Sociodemographic characteristics of the older participants according to presence of sarcopenia are presented in Table 1. The individuals exhibiting signs suggestive of sarcopenia tended to be older (p<0.001).

The prevalence of multimorbidity was 43%. Regarding physical performance assessed using the physical tests (balance, gait speed and sit-and-stand) on the SPPB, 52.6% (n=51) had low functional performance or disability/very poor performance. Results shows that 50.5% (n=49) of participants had low hand-grip strength. The association between health characteristics and sarcopenia is presented in Table 2. A higher occurrence of stroke (p=0.023) and worse physical performance (p=0.018) was evident among individuals with signs suggestive of sarcopenia.

The multiple logistic regression analysis (Table 3) revealed that, on the adjusted model, older age (PR=1.1; 95%CI=1.1-1.1) and higher number of dwellers in household (PR=1.2; 95%CI=1.0-1.3) were associated with a greater occurrence of signs suggestive of sarcopenia.

Table 1. Sociodemographic characteristics according to presence of signs suggestive of sarcopenia in older individuals from rural riverside areas (n=98). Manaus, Amazonas, 2021.

Variable	Total n (%)	Sarcopenia*		*p*-value
		Without suggestive signs (n=69)	With suggestive signs (n=28)	
Sex				0.474
Female	44 (44.9)	29 (42)	14 (50)	
Male	54 (55.1)	40 (58)	14 (50)	
Skin color/race				0.611
White	2 (2.1)	2 (2.9)	0 (0)	
Brown and Black	91 (93.8)	65 (94.2)	26 (92.9)	
Indigenous	4 (4.1)	2 (2.9)	2 (7.1)	
Age (years) (Mean ± SD)	69.6 ± 7.4	67.3 ± 5.7	74.9 ± 8.2	<0.001
Monthly income per capita (Reais) (Mean ± SD)	1,661.8 ± 1,088.8	1,677.1 ± 1,238.6	1,644.3 ± 618.8	0.894
No, of dwellers in household (Mean ± SD)	3.2 ± 1.9	3.0 ± 1.8	3.6 ± 2.0	0.155
Education[#]				0.543
Never attended school	21 (21.9)	13 (19.2)	8 (28.6)	
Primary	64 (66.7)	46 (67.6)	18 (64.3)	
Secondary/Higher/Postgraduate	11 (11.5)	9 (13.2)	2 (7.1)	
Employment status[&]				0.072
Employed**/self-employed**/civil servant	16 (16.7)	15 (22.4)	1 (3.6)	
Homemaker/student/unemployed	11 (11.5)	7 (10.4)	4 (14.3)	
Retired	68 (71.6)	45 (67.2)	23 (82.1)	
Social welfare benefits received by a member of household				0.224
No	44 (45.4)	34 (49.3)	10 (35.7)	
Yes	53 (54.6)	35 (50.7)	18 (64.3)	

Chi-square or Fisher Exact test (expected counts < 5) for comparison of proportions. Student´s *t*-test for comparison of means. **Activities related to agriculture, fish farming, extractivism, tourism, business and general services. *n=97; [#]n=96; [&]n=95.

Table 2. Health characteristics according to presence of signs suggestive of sarcopenia in older individuals from rural riverside areas (n=98). Manaus, Amazonas, 2021.

Variable	Total n (%)	Sarcopenia*		*p*-value
		Without suggestive signs (n=69)	With suggestive signs (n=28)	
Arterial hypertension				0.524
No	43 (44.3)	32 (46.4)	11 (39.3)	
Yes	54 (55.7)	37 (53.6)	17 (60.7)	
Diabetes mellitus				0.563
No	76 (78.4)	53 (76.8)	23 (82.1)	
Yes	21 (21.6)	16 (23.2)	5 (17.9)	
Stroke				0.023
No	85 (87.6)	64 (92.8)	21 (75.0)	
Yes	12 (12.4)	5 (7.2)	7 (25.0)	
Chronic lower-back pain*				0.487
No	43 (46.2)	29 (43.9)	14 (51.9)	
Yes	50 (53.8)	37 (56.1)	13 (48.1)	
Multimorbidity				0.522
No	53 (57.0)	39 (59.1)	14 (51.9)	
Yes	40 (43.0)	27 (40.9)	13 (48.1)	
Medical consultation in past 12 months				0.317
No	24 (24.7)	19 (27.5)	5 (17.9)	
Yes	73 (75.3)	50 (72.5)	23 (82.1)	
Limitation in daily activities due to health problem				0.470
No	75 (77.3)	52 (75.4)	23 (82.1)	
Yes	22 (22.7)	17 (24.6)	5 (17.9)	
Self-rated health status				0.955
Very good/good	42 (43.3)	30 (43.5)	12 (42.9)	
Fair/poor/very poor	55 (56.7)	39 (56.5)	16 (57.1)	
Hand-grip strength				0.200
Low	49 (50.5)	32 (46.4)	17 (60.7)	
Adequate	48 (49.5)	37 (53.6)	11 (39.3)	
Physical performance				0.018
Disability/low	51 (52.6)	31 (44.9)	20 (71.4)	
Moderate/good	46 (47.4)	38 (55.1)	8 (28.6)	

Chi-square or Fisher Exact test (expected counts < 5) for comparison of proportions *n=93.

Table 3. Association of sociodemographic and health characteristics with signs suggestive of sarcopenia in older individuals from rural riverside areas (n=98). Manaus, Amazonas, 2021.

Variables	PR (95%CI)	*p*-value	Adjusted PR (95%CI)	*p*-value
Age (years)	1.1 (1.0-1.1)	<0.001	1.1 (1.1-1.1)	<0.001
No. of dwellers in household	1.1 (1.0-1.3)	0.152	1.2 (1.0-1.3)	0.033
Employment status				
Employed/self-employed/civil servant	ref.			
Homemaker/student/unemployed	5.8 (0.7-45.8)	0.094		
Retired	5.4 (0.8-37.5)	0.088		
Stroke				
No	ref.			
Yes	2.4 (1.3-4.3)	0.006		
Hand-grip strength				
Low	1.5 (0.8-2.8)	0.210		
Adequate	ref.			
Physical performance				
Disability/low	2.3 (1.1-4.6)	0.027		
Moderate/good	ref.			

PR= prevalence ratio. 95%CI= 95% confidence interval. Ref.= reference category. Final model = Nagelkerke R^2: 0.1190; Hosmer-Lemeshow: 0.9947.

DISCUSSION

The occurrence of signs suggestive of sarcopenia was found in 28.9% of the older population living in rural riverside settlements of the Amazon. Older age and greater number of dwellers in the household were associated with the occurrence of signs suggestive of sarcopenia.

The study results revealed that 52.6% of the participants were classified into the 2 poorest physical performance categories (disability and low performance). A population-based study of older users of the Family Health Strategy in a city lo located in the south of Minas Gerais state (n=406) found that over half of the sample (57,6%) had low functional performance, scoring less than 6 points on the SPPB scale[21], results corroborated by the findings of the current study. Examination of the biomechanical and motor control aspects on an analysis of the ability to perform the sit-to-stand and stand-to-walk actions showed that, amid the age-related compensatory mechanisms with regard to the quality and execution of movement, there is an influence of a physical energy saving strategy, manifested by slow speed during the execution of the movement, together with emphasis on the aspect of body stability, characterized by the lack of fluidity between standing and walking positions in these individuals[22]. This theory explains the poorer results for physical performance in older people.

The present study showed that 50.5% of older participants had low hand-grip strength. This rate proved higher than that reported (30.6%) in the SABE (Health, Well-being and Aging) study, a cross-sectional population-based investigation involving 1,168 older individuals in the city of São Paulo[23]. The application of the hand-grip strength test represents a simple, objective alternative that is low cost and non-invasive. However, few Brazilian studies assess this outcome, possibly due to lack of consensus on the reference values for older people. This indicator is considered a good predictor of functional capacity and physical performance in these populaitons[24]. Thus, the literature shows that age-related loss of muscle mass, strength and resistance are determinants of functioning in older people[6,25]. In this respect, pursuing a physically active life style through healthy aging can favor the preservation of muscle strength in

this population and, consequently, the maintenance of good gait and balance[25]. It should be emphasized that physical strength is at the core of the normal riverside routine due to the long journeys via waterways and on foot, together with work to support the family involving fishing, hunting and extractivism in the forest. In general, factors such as work overload, low education, limited access to healthcare services, as well as older age, have negative repercussions during aging which can promote the occurrence of chronic diseases and reduce both functioning and autonomy. Notably, all these issues outlined regarding life style and aging are perceived empirically by older dwellers of riverside areas in the Amazon region[26].

In the present study, the prevalence of chronic diseases was high, particularly for arterial hypertension (55.7%), chronic lower-back pain (53.8%), and multimorbidity (43%). A cross-sectional study of older people from the rural area of the Uberaba city, Minas Gerais state, also reported high rates of chronic diseases, with highest prevalences seen for arterial hypertension (55.7%) and back problems (57.7%)[27]. Amaral et al. (2018)[28], in study assessing older people treated under the Family Health Strategy of the urban area of Acre city detected multimorbidity in 66.3% of the sample assessed.

In a study by Nunes et al.[29] analyzing baseline data from the *ELSI-Brasil* (Longitudinal Study of the Health of Older Brazilians) study involving a nationally representative sample of the non-institutionalized population aged ≥ 60, found a rising prevalence of multimorbidity with increasing age (50-59 years: 58.8%; 60-69 years: 73.4%; 70-79 years: 79.0%; and ≥80 years: 82.4%). It is important to mention that the prevalences found in the present study for chronic diseases and multimorbidity may be underestimated, given that information bias cannot be ruled out, since rural riverside populations have greater difficulties obtaining a clinical diagnosis, a factor which may have a delayed impact on functional performance. Moreover, these statistics are subject to a selective survival bias, where the population in the North region has a lower average life expectancy than the average for Brazil as a whole (72 versus 76 years)[30] and there is a tendency for survivors to have a less unfavorable health status[31].

The prevalence of signs suggestive of sarcopenia, as measured by the SARC-CalF, was 28.9% in the population assessed. A similar rate (24.9%) was observed in a cross-sectional study of 234 older adults (mean age: 69.3 years) registered with family (primary) health units of a city situated in the interior of São Paulo state[32] and also in a population-based study of 598 older individuals (22.9%: mean age: 72.5 years) from Florianópolis city, Santa Catarina state[33], according to DEXA – dual-energy X-ray absorptiometry.

An association of sarcopenia with age was identified. Sarcopenia is a progressive disorder characterized by gradual loss of skeletal muscle mass and function with advancing age, since aging changes the homeostasis of skeletal muscle[6]. This loss of muscle mass is caused by a reduction in both number and size of muscle fibers. Thus, there is reduction in metabolism, protein synthesis and muscle repair[6]. With aging, the oxidative stress associated with decline in sexual hormones, which exert anabolic effects on skeletal muscle tissue, can accelerate loss and atrophy of this tissue[34]. Therefore, sarcopenia is becoming an emerging public health problem in Brazil, amid the shift in population aging driven by the process of demographic transition in recent decades.

Besides age, higher number of dwellers in the household was also associated with the occurrence of sarcopenia. The population studied comprises older individuals living in rural riverside communities in the Amazon that have socioeconomic vulnerability, poor access to goods and services, and inadequate basic healhcare[10]. Analysis of these specific characteristics of the population showed a context of low income and an average of 3 dwellers per household. Data from a Brazilian National Survey (Pesquisa Nacional por Amostra de Domicílios – PNAD) revealed that individuals over 65 years of age in the lowest income stratum had worse health status, lower physical functioning and made less use of health services[35]. Thus, individuals who experience unfavorable socioeconomic and housing conditions have worse general health indicators. In this scenario, the challenge for health policies integrated with other social policies lies in achieving both human longevity and quality of life, particularly among populations for which accessing services is harder.

This study has some limitations inherent to its cross-sectional design, calling for caution in interpreting the direction of causality of the associations identified. Another limitation outlined previously is the risk of selective survival bias underestimating the outcomes of interest, because less healthy individuals tend to be under-represented due to lower longevity, hampering the detection of some associations. In view of the role of obesity in predicting muscle mass and strength, the non-assessment of this clinical condition by the present study can be regarded as a limitation. The present study used validated tests for assessing physical performance, considered better predictors of the outcome compared with self-report scales. Lastly, assessment of the whole population of older people at the riverside settlements was envisaged, evaluating a little studied population using a census-like approach to further the understanding of outcomes in the context of this group´s specificities, also contributing toward improving the practices of fluvial family health teams tasked with delivering primary care in the region.

CONCLUSION

The findings of this study revealed a high prevalence of signs suggestive of sarcopenia among older individuals from the rural riverside settlements assessed. Older age and greater number of dwellers in the household were associated with an increased probability of occurrence of signs suggestive of sarcopenia. The high rate of low physical performance, low hand-grip strength and high prevalence of chronic diseases in older people from rural riverside settlements highlights the need for implementing public health policies which take account of local specificities and promote healthy aging with quality of life in this population.

AUTHORSHIP

- Kaellen A. Scantbelruy - Conceptualization; Data acquisition; Interpretation of data; Writing – original draft; Approval of the final version.
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- Fernando José Herkrath - Conceptualization; Data curation; Formal analysis; Methodology; Resources; Software; Supervision; Validation; Writing – review & editing.

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Association between inflammatory markers and locomotor pattern during obstacle avoidance in older adults

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Abstract

Objective: to investigate the association of inflammatory biomarkers on the locomotor pattern during obstacle avoidance with different levels of complexity manipulated by the characteristic of the obstacle (solid and fragile) in older adults. *Method*: 17 older adults (≥60 years old) were evaluated in two moments: 1) Analysis of the locomotor pattern during obstacle crossing in two conditions (solid and fragile). The variables studied for trailing and leading limbs were: speed, length, width and duration of the stride, horizontal foot-obstacle distance, horizontal obstacle-foot distance, vertical foot-obstacle distance and Maximum foot elevation. 2) Blood collection, for analysis of the inflammatory biomarkers Interleukin 6 (IL6) and C-Reactive Protein (CRP). Multiple linear regression analysis was performed to verify association between locomotor pattern and inflammatory biomarkers (IL6 and CRP) with a significance level of $p \leq 0.05$. *Results*: The regression analysis showed that Interleukin 6 was associated with the following variables: 1) stride width in the solid obstacle condition, 2) maximum foot elevation (leading limb) to avoidance the fragile obstacle, 3) horizontal foot-obstacle distance (trailing limb) in solid obstacle condition, 4) maximum foot elevation (trailing limb) to avoidance the fragile obstacle, 5) maximum foot elevation (trailing limb) to avoidance the solid obstacle. C-Reactive Protein was associated with the horizontal foot-obstacle distance (trailing limb) only for the fragile obstacle condition. *Conclusion*: Inflammatory biomarkers are associated with the locomotor pattern in older adults, regardless of the fragility of the obstacle.

Keywords: Aging. Fall. Older adults. Walking with obstacles. Inflammatory biomarkers.

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INTRODUCTION

Falls in the older population cause reduced functionality, increased morbidity and mortality, being the main cause of death in older people over 85 years[1]. In addition, there is an increase in health care costs, use of specialized services and hospitalizations[2]. Consequently, it affects the performance of daily activities due to bone fractures, as well as the fear of falling, which directly influence the quality of life. The prevalence of falls is approximately 28 to 35% in people over 65 years old, and this rate increases with advancing age and with the level of frailty of the older people[3]. Epidemiological studies with older Brazilians estimate a prevalence of falls of approximately 30%[3,4].

In this way, most of the histories of falls in older people happen during locomotion[5]. Within this context, changes in the space-time parameters of gait, such as, for example, reduction in speed, in step length and increase in double support time contribute to the increased risk of falls in older people[1,6,7] even on regular terrain. In addition, the literature suggests that worse performance in the task of overcoming an obstacle increases the risk of tripping and falls in the older population[5]. The worsening of performance is related to positioning the foot close to the obstacle during the approaching and overcoming phases, which allows greater contact with the obstacle[8,9]. The older people modulate the locomotor pattern to successfully perform this task, however, in some cases this control may not be as effective, and consequently, falls are evidenced. The literature has shown changes in the kinematic parameters in the gait of older people when overcoming obstacles, such as, for example, reduction in length and speed before overcoming the obstacle, getting closer to the obstacle before and after, and decreasing the vertical distance of the foot in relation to the obstacle, which can increase the risk of stumbling[8,10].

Gait in general, and overcoming obstacles in particular, depend on fine control of the nervous system over the locomotor system, which involves bones, joints and muscles, among other structures. Aging is associated with many changes that affect the locomotor system, including loss of bone density, sarcopenia and joint wear[11]. This last factor is associated with the implantation of a chronic inflammatory state that can be detected by the average concentration of inflammatory biomarkers in the blood[11]. Thus, the analysis of biomarkers could also be used to assess changes in the locomotor system throughout the aging process[12]. These markers would enable a diagnostic analysis of the biological processes responsible for structural and functional changes in older people. Among these markers, the inflammatory ones are the most reported in the literature to explain the motor alterations observed in the older population[13]. Thus, the increase in inflammatory biomarkers, which in aging bring with it several changes in metabolic enzymatic activities, a phenomenon called "inflammaging", a low-grade chronic systemic inflammation, but no less harmful[14]. For example, older people with frailty syndrome (weight loss, weakness and reduction in walking speed) showed high levels of inflammatory biomarkers, such as interleukin-6 (IL-6) and C-reactive protein (CRP)[15]. Likewise, high CRP levels in older people were correlated with a reduction in handgrip strength[12]. Furthermore, the increase in the inflammatory biomarker IL-6 was associated with a reduction in gait speed in older people[12]. Thus, based on these results, it can be concluded that the analysis of biomarkers is also important for diagnosing the motor condition of the older person, as the studies presented above indicated a correlation between these biological markers and the motor tests.

However, from these analyses, it is evident that the biological and motor assessment are essential to describe the functional conditions of the older person, such as gait. The literature has shown that the increase in the inflammatory process in older people is related to the reduction in the length and speed of the step in gait[12,16]. However, the relationship between these biological and motor factors has not yet been analyzed in older people during the task of overcoming obstacles, which is a situation present in daily activities, such as climbing on the sidewalk or deviating from some holes, which requires locomotor adaptation. High concentrations of IL-6 and CRP are associated with less muscle mass, which can impair the execution of more complex locomotor functions[17,18]. To overcome an obstacle, muscle strength and high range of motion in the hip, knee and ankle joints are required to successfully perform the task. Still, any stumble in this situation can put

the older people in a situation with a high risk of falls and they are susceptible to suffering fractures, injuries and, consequently, an increase in the number of hospitalizations. Therefore, it is still not fully elucidated in the literature how inflammatory biomarkers are associated with the locomotor pattern of the older people when overcoming obstacles and whether this influence also changes with the increase in the difficulty of the locomotor task. In this study, the locomotor pattern during obstacle crossing was investigated using the variables horizontal foot-obstacle distance, horizontal obstacle-foot distance, vertical foot-obstacle distance and maximum foot elevation, both for the approach limb and the support limb. The difficulty level of the locomotor task was manipulated by the physical characteristics of the obstacle. Based on these assumptions, the following research questions arise: Is there an association between inflammatory markers and locomotor parameters during gait with overcoming obstacles in older people? Also, does this relationship depend on the difficulty level of the locomotor task?

Therefore, the objective of the study is to investigate the association of inflammatory biomarkers in the task of overcoming obstacles with different levels of complexity manipulated by the characteristic of the obstacle (solid and fragile) in older people. The hypothesis of this study is that there is an association between locomotor parameters during obstacle overcoming and interleukin and CRP levels in older people. Thus, it is expected that the higher the levels of inflammatory markers (CRP, IL-6), the lower the speed, length and width, as well as the longer duration of the stride for the approach and support limbs for the conditions of solid and fragile obstacle. During the phase of approaching and overcoming the obstacle, it is expected that the higher the levels of inflammatory markers (CRP, IL-6) the lower the horizontal foot-obstacle distance, vertical foot-obstacle distance and foot-distance from the ground, respectively. Finally, during the landing phase, it is expected that the higher the levels of inflammatory markers (CRP, IL-6) the lower the horizontal obstacle-foot distance. Still, it is expected that these effects are evidenced for both lower limbs (approach and support) and in the most challenging condition (obstacle with fragile characteristic).

METHOD

This is a quasi-experimental study. The older people were recruited through digital dissemination (instagram and email), newspaper, television and the Exercise Guidance Service (SOE). This recruitment was carried out in the region of Greater Vitória (Vitória, Vila Velha, Serra and Cariacica) in the State of Espírito Santo. After this disclosure, 100 seniors contacted, however, 60 seniors withdrew from participating, since it was a time of social isolation due to the pandemic, where the seniors were still in the beginning of the vaccination schedule and insecure about the contact external to their family environment. Of the 40 seniors, 18 did not meet the inclusion criteria (10 had neurological diseases and 8 musculoskeletal problems that prevented them from performing the task). Thus, 22 seniors met the inclusion and exclusion criteria, however, five seniors did not complete all assessments (blood and clinical). The final sample consisted of 17 older people.

As inclusion criteria, individuals should be able to walk independently without the use of walking aids (cane/walker), preserved cognitive functions and absence of neurological and musculoskeletal health conditions that made it impossible for them to perform the task.

Measures and actions against covid-19 were strictly followed. The use of a mask was mandatory throughout the evaluation, hand hygiene and safe distance between the participant and the examiner, as well as the measurement of the participant's temperature before the beginning of the collection.

Data collection was carried out in two days. In the first, clinical evaluation and gait analysis were performed at the Laboratory of Biomechanical Analysis of Movement at the Physical Education and Sports Center of the Federal University of Espírito Santo. (Bio.Mov – CEFD/UFES). On the second day, blood collection was performed at the headquarters of Projeto Elsa located in the Graduate Program in Physiological Sciences at UFES. The processing and analysis of blood samples was performed at the Experimental Physiology and Biochemistry Laboratory (LAFIBE – CEFD/UFES).

Initially, an anamnesis was carried out to verify the general health status of the participants and the inclusion criteria. Afterwards, anthropometric measurements (height and body mass and Body Mass Index - BMI) were measured. For better characterization of the sample and screening of clinical conditions, some specific tests were applied. First, the Mini-Mental State Examination was applied for cognitive screening, which addresses issues of space and time location, memory and attention (maximum score 30 points; cutoff pattern 24 points)[19]. To quantify the level of physical activity, the modified Baecke Questionnaire for older people was applied[20]. This covers and evaluates occupational, sports and leisure activities. A score equal to or less than 9.11 points indicates a low level of physical activity, between 9.12 and 16.17 points indicates a moderate level of physical activity, and a score equal to or greater than 16.18 points indicates a high level of physical activity for the older people. To assess the static and dynamic balance of the older people, the MiniBESTest[21] was applied (maximum score 28 points), and the higher the score obtained, the better the balance of the older person. Also, to assess the fear of falling, the Efficacy Scale-International scale (FES-I) was applied[22]. In this scale, the older people indicate "I am not worried", "a little worried", "moderately worried" and "very worried" for 16 daily activities regarding the fear of falling while performing them. A score greater than or equal to 23 points suggests an association with the sporadic occurrence of falls, and a score greater than or equal to 31 points suggests a recurrent occurrence of falls. Finally, to investigate the occurrence, quantity and characteristics of falls in the last year, a Falls Questionnaire was applied.

Participants were invited to walk along a non-slip rubber walkway 9 meters long and 1.20 meters wide and perform the following conditions: 1) Walking while crossing a solid obstacle and 2) Walking while crossing a fragile obstacle (Figure 1). In an attempt to make the task similar to everyday life and following the recommendations of the Brazilian Standard for Emergency Exits in Buildings (NBR 9077)[23], which regulates stairs and sidewalks, the obstacles were 15 centimeters high. However, many obstacles in the environment are not dimensioned for the size or proportions of the individual.

Both obstacles were made of gray foam and, in order to handle the complexity of the task, the properties of the obstacles were inferred. Thus, the solid obstacle was made of a single piece, offering a perception of stability. The fragile obstacle was made of four columns of stacked foam blocks, offering the perception of instability in an attempt to increase the complexity of the task.

The starting point of locomotion was adjusted by the experimenter in order to guarantee the crossing of the obstacle comfortably with the dominant limb. For analysis of the locomotor pattern, the participants wore black non-slip socks where 04 passive reflective markers made of 1.5 cm diameter Styrofoam spheres were positioned at the following anatomical points: fifth metatarsal and lateral aspect of the calcaneus of the right lower limb and first metatarsal and medial aspect of the calcaneus of the left lower limb. Also, two passive markers were positioned on the obstacle, one at the base and the other at the top of the obstacle, which allowed the calculation of variables related to overcoming.

Thus, 3 randomized trials were performed for each condition. When an error occurred (example: overcoming with the non-dominant leg, bumping into the obstacle or knocking it down), the attempt was repeated at the end of each block. Participants were not informed about any errors. For analysis purposes, the average value of three trials of each condition was considered.

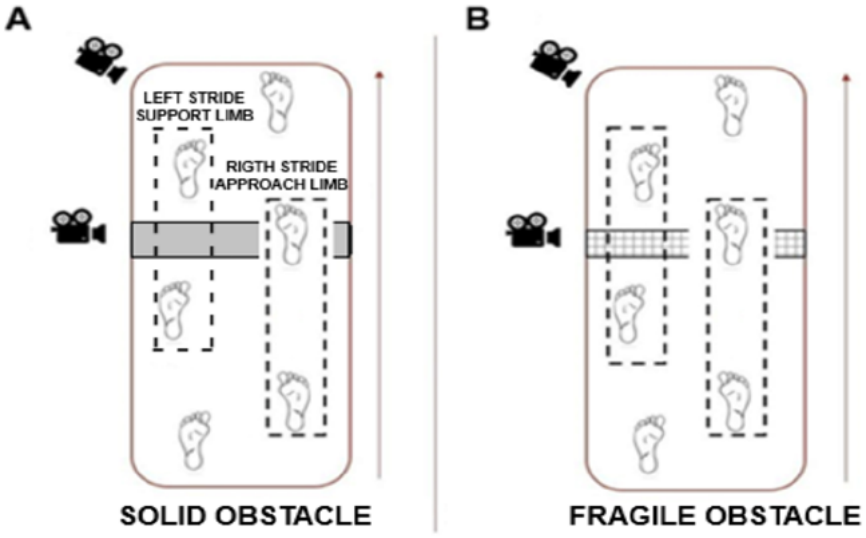

Figure 1. Experimental Design of Solid Obstacle (A) and Fragile Obstacle (B) conditions. The right and left steps represent the approach and support limb, respectively.

In the second moment, blood collection was performed. 10 mL of venous blood was collected by puncture of the forearm in the morning for analysis of inflammatory biomarkers. The older people were fasting for 10 to 12 hours and informed the use of routine medications, as well as diagnosed comorbidities. Then, the sample was centrifuged at 10,000 rpm to separate the plasma, which was stored at -80°C. To proceed with the IL-6 analysis, the samples were removed from the freezer and placed on a bench until they reached room temperature (25°C). Small samples were distributed with the pipette in microplates in a duplicate scheme and the Immunoenzymatic Assay (ELISA) method was applied using Kit R&D Systems (USA) according to the manufacturer's instructions. IL-6 analysis was performed using a microplate reader at a wavelength of 450nm, which showed the best IL-6 concentration for that standard curve, also established by the manufacturer. The closer the relationship between the standard curve and the curve presented by the sample is to 1, the more sensitive the test and the more realistic the IL-6 value obtained. CRP analysis by the Immunoturbidimetry method, according to the manufacturer's instructions, and according to the value obtained, the individuals were classified as: Low risk (less than 1.0 mg/L), medium risk (between 1.0 and 2.0 mg/L), high risk (between 2.0 and 10.0 mg/L) and very high risk (greater than or equal to 10.0 mg/L).

To capture the images in the experimental gait tasks, two digital cameras (GoPro brand, Hero 7 Black model) were used, which were positioned in order to visualize all the markers on the participant's foot and on the obstacles. The captured images were stored in AVI (Audio Video Interleaved) files for further processing. Space calibration was carried out using nine points marked on the floor (x and y axes) and seven points marked on a topographic wand (z axis), forming a large cube that served to accurately inform Dvideow of the measurements of the space through which the participant performed the task. This enabled the three-dimensional reconstruction of the markers' trajectories. Data were analyzed using routines written in Matlab language (Version 7.0 – Mathworks, Inc.) and filtered with a low-pass filter, Buttherworth.

The three-dimensional coordinates of the markers were filtered with zero phase delay, 4th order digital Butterworth filter with a cutoff frequency of 6 Hz. To determine the analyzed cycle, the contact of the heel on the ground was determined through visual inspection of the video cameras.

The dependent variables analyzed in the full stride while passing the obstacle were length, width, duration and speed of the stride. The stride started with the heel of the right foot touching the ground before the obstacle and ended with the next touch of the right foot after the obstacle. The length of the overtaking stride was calculated by subtracting the values of the points on the x-axis of the marker on the lateral surface of the right calcaneus and the medial surface of the left calcaneus, at the moment of overtaking, expressed in seconds (s). The width of the overtaking stride represents the distance between the markers of the right and left heels in the mediolateral direction added to the width of the left foot, when it was before the obstacle and the right foot after the obstacle, expressed in centimeters (cm). The duration of the overtaking stride was calculated by the frame difference between the heel contact divided by the sampling frequency, expressed in seconds (s) Finally, the speed of the overtaking stride was calculated by dividing the length by the duration of the stride, expressed in cm/s.

Still for analysis of the locomotor pattern, the variables horizontal foot-obstacle distance (DHPO) before overtaking, vertical foot-obstacle distance (DVPO) and Maximum foot elevation (ME) during overtaking and horizontal obstacle-foot distance (DHOP) after overtaking for the approach (MA – right lower limb) and support (MS – left lower limb) limbs. DHPO corresponds to the value obtained, expressed in centimeters (cm), by the linear distance in the x coordinate (horizontal in the anteroposterior direction of movement) between the metatarsal marker, when it left the ground to overtake, and the obstacle marker (Figure 2A). DVPO expresses the vertical distance, in centimeters (cm), between the metatarsal marker and the upper edge of the obstacle, when the foot was on the obstacle (Figure 2B). ME, expressed in centimeters (cm), is the ratio between the vertical distance between the metatarsal marker and the lower edge of the obstacle when the foot is on the obstacle (Figure 2C). Finally, the DHOP, expressed in centimeters (cm), corresponds to the value obtained by the distance in the x coordinate (horizontal in the anteroposterior direction of movement) between the calcaneal marker when coming into contact with the ground, after overtaking, and the marker on the obstacle; expressed in centimeters (cm) (Figure 2D).

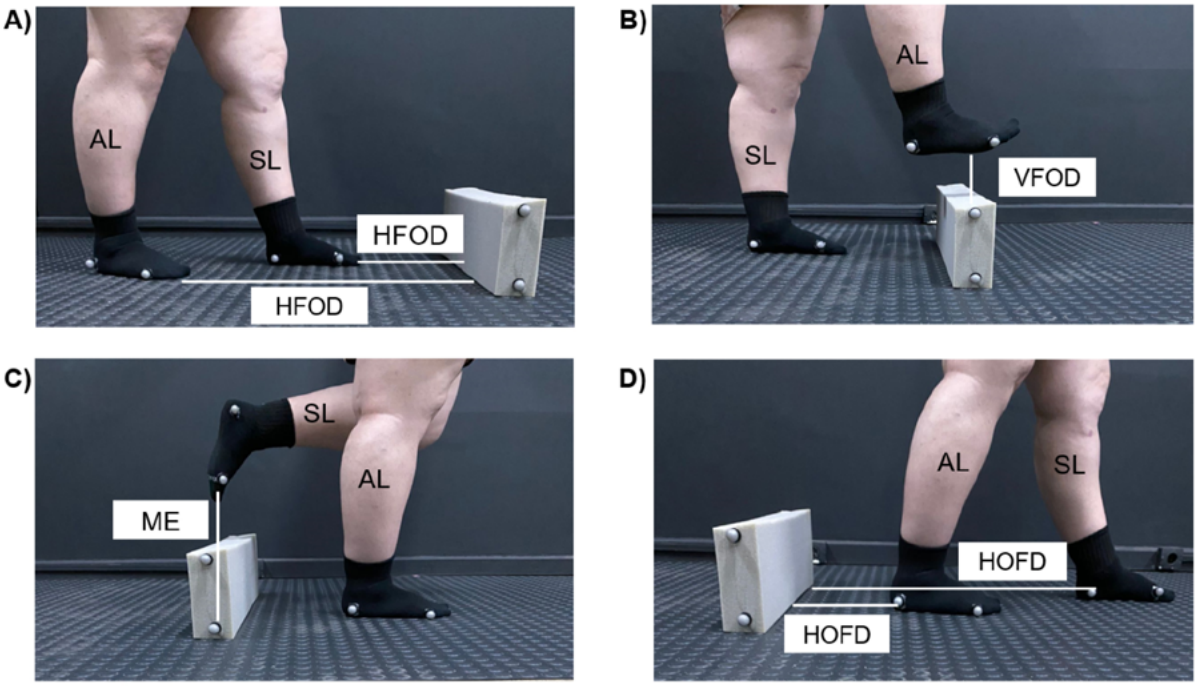

Figure 2. Side view of a participant when approaching, overcoming the obstacle to visualize the calculation of variables. A) Horizontal Foot-Obstacle Distance (HFOD); B) Vertical Foot-Obstacle Distance (VFOD); C) Maximum Foot Elevation (ME); D) Horizontal Obstacle-Foot Distance (HOFD) for the approach (AL) and support (SL) limbs.

To characterize the sample, mean and standard deviation were calculated for age, anthropometric characteristics (height, body mass), clinical (Mini-Mental, MiniBESTest, Baecke and FES-I evaluation scores), locomotor characteristics (length, width, duration and speed of the stride, DHPO, DHOP, DVPO, MH) and IL-6 and CRP levels. Multiple linear regression analyses, forced entry method (enter), were performed to investigate the association between inflammatory markers and locomotor parameters during obstacle crossing. Also, since falls can be considered a confounding variable in locomotor performance in older people, the regression model was adjusted for the number of falls. The multicollinearity test was performed by the IVF (Inflationary Variance Factor) which provides an index that measures how much the variance of an estimated regression coefficient is increased because of collinearity. If IVF is equal to 1, there is no multicollinearity between the factors and values greater than 5 indicate possible multicollinearity problems (Marôco, 2010). The confidence interval was also calculated for these analyses. These confidence intervals were calculated for unstandardized β values which are bounds constructed such that in 95% of these samples these bounds will contain true β values[24]. The significance level adopted in all analyzes was $p \leq 0.05$.

This study was approved (opinion number: 2,706,643) by the Research Ethics Committee of the Federal University of Espírito Santo (CAAE: 88258218.8.0000.5542). After consenting to participate in the study, individuals signed a Free and Informed Consent Form (TCLE) in accordance with the norms established in Resolution No. 466/12 of the National Health Council.

RESULTS

The study included 17 older people (68.9±4.7 years, 1.61±6.3 m, 68.7±11.3 kg), 15 females and 2 males living in Vitória/ES (n=16) and Cariacica (n=2). The older people had preserved cognitive function (26.6±2.11 points) and balance (21.8±5.22 points), number of falls (0.78±0.53 falls), moderate fear of falling (25.4±7.83 points) and low level of physical activity (5.3±5.3 points), which was expected since the data were collected during the covid-19 pandemic. The comorbidities reported by the patients were confirmed upon presentation of medical prescriptions with the prescription of medications. The older people were clinically healthy, as the laboratory tests did not detect anemia, acute inflammation or lack of glycemic control (Table 1). Among them, 14 used some medication. A total of 27 medications were surveyed, divided into antihypertensives (13), oral antidiabetics (6), hypolipidemic agents (5) and antiplatelet agents (3). Among these older people, some used antihypertensive drugs (n=11) associated with antiglycemic agents (n=5), antilipidemic agents (n=11) and anticoagulants (n=5).

Table 1 presents the mean and standard deviation of inflammatory biomarkers (IL-6 and CRP), laboratory tests and spatiotemporal parameters during the overcoming of obstacles in conditions of different physical characteristics (solid and fragile) for approach and support limbs.

For the multiple regression analyses, an IVF of 1 was found, which indicates that there is no multicollinearity between the factors. The regression analysis showed that Interleukin 6 was associated with the following variables: 1) stride width in the solid obstacle condition (R^2=0.88, β=0.96, p=0.03 | B=331.4 CI= [45.7–617.02]) (Figure 3A), 2) maximum elevation of the foot (support limb) to overcome the fragile obstacle (R^2=0.91, β=0.97, p=0.02, B=83.2 CI= [34.09–132.35]) (Figure 3B), 3) horizontal foot-obstacle distance (approach limb) in the solid obstacle condition (R^2=0.88, β=0.88, p=0.03, B=-165.7 CI= [-308.51– -22.88]) (Figure 3C), 4) maximum elevation of the foot (approach limb) to overcome the fragile obstacle (R^2=0.94, β=0.98, p=0.01, B=73.9 IC= [19.45–128.44]) (Figure 3D), 5) maximum elevation of the foot (approach limb) to overcome the solid obstacle (R^2=0.90, β=0.96, p=0.03, B=82.5 CI= [18.6–146.40) (Figure 3E). C-Reactive Protein was associated with the Horizontal Foot-Obstacle Distance variable (approach limb) only for the fragile obstacle condition (R^2=0.91, β=0.97, p=0.02, B=31.3 CI= [7.80–54.25]) (Figure 3F).

Table 1. Mean and standard deviation of biomarkers and locomotor variables during overcoming obstacles (solid and fragile) for approach and support limbs in older people.

	Biomarkers	
	Mean	Standard deviation
IL6 (pg/ml)	29.2	5.6
CRP (mg/L)	2.2	0.5
	Laboratory Tests	
Red blood cells (millions/mm3)	4.44	0.32
Hematocrit (%)	40.42	2.18
Hemoglobin (g/dL)	13.15	0.83
Leukocytes (thousands/mm3)	6.10	1.41
Platelets (thousands/mm3)	268.71	78.11
Fasting Glycemia (mg/dL)	108.00	26.93
Total Cholesterol (mg/dL)	182.53	46.95
LDL cholesterol (mg/dL)	100.53	43.17
Triglycerides (mg/dL)	130.88	68.72
Uric Acid (mg/dL)	4.37	1.13
Locomotive Variables		
	(Solid Obstacle|Fragile Obstacle)	
Length (m)	1.25 | 1.28	0.22 | 0.20
Width (m)	0.11 | 0.10	0.08 | 0.05
Duration (s)	1.16 | 1.18	0.16 | 0.14
Speed (m/s)	1.12 | 1.10	0.27 | 0.25
HFOD (m) – Approach	0.80 | 0.77	0.30 | 0.21
HOFD (m) – Approach	0.28 | 0.21	0.02 | 0.05
VFOD (m) – Approach	0.34 | 0.34	0.03 | 0.03
MH (m) – Approach	0.38 | 0.35	0.08 | 0.06
HFOD (m) – Support	0.36 | 0.54	0.03 | 0.02
HOFD (m) – Support	0.73 | 0.72	0.18 | 0.17
VFOD (m) – Support	0.33 | 0.35	0.05 | 0.04
MH (m) – Support	0.36 | 0.38	0.05 | 0.07

Subtittles: IL6 (interleukin-6), pg/ml (picogram per milliliter of blood), CRP (C-reactive protein), mg/L (milligram per liter), million/mm^3 (million per cubic millimeter), g/dL (gram per deciliter), thousands/mm^3 (thousands per cubic millimeter), m(meters), s (seconds), m/s (meters per second), DHPO (horizontal foot-to-obstacle distance), DHOP (horizontal obstacle-to-foot distance), DVPO (vertical foot-obstacle distance), MH (maximum elevation).

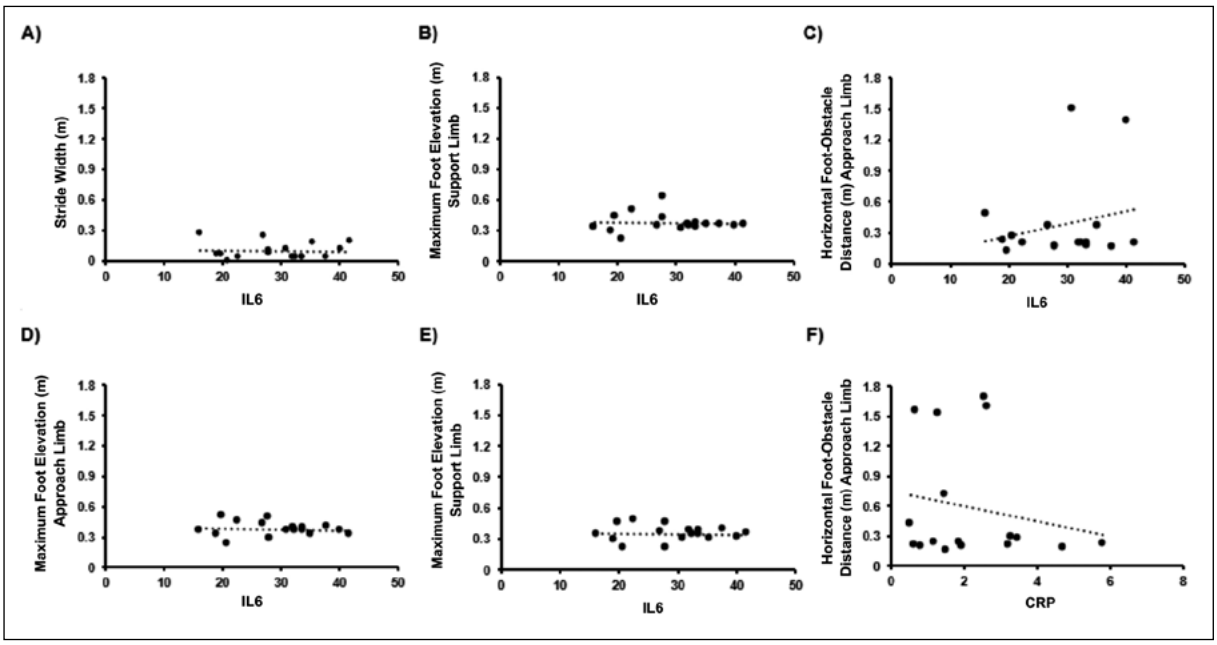

Figure 3. Association between IL6 and the variables stride width (A), maximum elevation of the support limb foot (B) and horizontal foot-obstacle distance of the approach limb (C) in gait with solid obstacle, maximum elevation of the foot of the approach limb (D) and maximum elevation of the foot to the support limb (E) in gait with overcoming a fragile obstacle and the relationship between CRP and horizontal foot-obstacle distance for the approach limb (F) in gait with overcoming a fragile obstacle.

DISCUSSION

The general objective of the study was to investigate the association between inflammatory biomarkers in the task of overcoming obstacles and the different levels of complexity manipulated by the characteristic of the obstacle (solid and fragile) in older people. The first hypothesis of the study was partially confirmed, as there was an association only between the IL-6 biomarker and the left stride width when overcoming a solid obstacle. The second hypothesis was also partially confirmed, as there was an association between the inflammatory biomarkers with the variables horizontal foot-obstacle distance for the approach limb in both obstacles and maximum elevation of the support limb foot for both obstacles and approach limb for a fragile obstacle. These associations were found for both types of obstacle fragility, solid and fragile.

Regarding inflammatory biomarkers (CRP and IL6), the older people can be classified into a medium and high risk of inflammation, according to the reference values. The literature shows that these high inflammatory patterns cause oxidative stress that directly interferes with muscle response and decreases functional fitness[17,18]. However, the lower CRP values are due to the older people in the sample not presenting, at the time of data collection, any process of acute inflammation, as CRP is a precursor of IL-6 in the inflammation cascade and both characterize healthy aging individuals. Although the two proteins are considered important inflammatory biomarkers in the aging process, CRP is a precursor signaling of IL-6, being more indicative of the existence of an inflammation process, than indicative of the time that this process began[17,18].

In this way, a reduction in muscle response and a decrease in functional fitness can influence the performance of daily activities, such as overcoming an obstacle. The literature shows that older people have a conservative pattern in relation to overcoming obstacles that put them at risk of falls, such as shorter horizontal obstacle-foot distance, stride length and speed, and vertical foot-obstacle distance[8,9]. Our results showed that the inflammation process is closely related to locomotor performance in older people

when overcoming obstacles. A possible explanation for these results is that inflammatory cytokines have a catabolic effect on muscle[25]. Furthermore, the moderate and high degree of inflammation (high concentration of IL6 and CRP in the blood) may be associated with a reduction in muscle mass and musculoskeletal changes, which may generate or lead to a reduction in the production of muscle strength and power[26]. In this way, due to this reduction in muscle function, the older people get closer to the obstacle and, when overcoming, position the foot closer to the obstacle, compromising locomotor performance with consequent risk of stumbling and falls, leading to an increased risk of fractures and impacting directly quality of life in a negative way.

In addition, another possible explanation for the relationship between biomarkers and locomotor pattern when overcoming obstacles may be associated with a high concentration of IL-6, which may lead to a reduction in corticospinal tract activity[27]. Consequently, this alteration in cortical activity suggests that the pattern of coordination of muscle activity between lower limbs can be influenced during the positioning of the foot when overcoming obstacles in older people.

However, from these analyses, it is evident that the evaluation with inflammatory biomarkers and overcoming obstacles and motor skills are essential to describe and diagnose the clinical condition of the older people, which can be used as a complement to the clinical batteries (MiniBESTest, MiniMental, Baecke and Fear of Falling). Thus, the association between inflammatory biomarkers and locomotor performance during overcoming obstacles allows understanding that high inflammation can impact locomotor parameters. This result deserves attention, as it may put these older people at risk of falls, as they are susceptible to fractures, injuries and, consequently, an increase in the number of hospitalizations in the SUS. Thus, the present study carried out a diagnosis of gait and inflammatory biomarkers in the older people with the aim of developing guidelines and interventional strategies so that this index is reduced, such as physical exercises to improve muscle function and motor coordination.

This study has some limitations, data collection took place during the pandemic, when restrictive measures were severe, especially for the older people, who were considered a risk group. Also due to the pandemic, we had to ensure a safe environment for the participant, with minimal movement of people. Some individuals, because they did not have vaccination coverage, were also insecure about completing the survey. These limitations directly affected the total study sample with a small number of older people. In addition, it is suggested for future studies that the clinical batteries are also included in the regression model to verify how these variables are related to the locomotor pattern and the inflammatory profile of the older people.

CONCLUSION

The inflammatory biomarkers IL-6 and CRP are associated with locomotor parameters during obstacle crossing, regardless of the fragility condition of the obstacle, in older people. It should be noted that, from these analyses, it is evident that the evaluation with inflammatory biomarkers and overcoming obstacles are essential to describe and diagnose the functional condition of older people, which can be used as a complement to clinical batteries.

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AUTHORSHIP

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- Gabriela Vigorito Magalhães – article writing, data analysis and interpretation.
- Milena Razuk – data analysis.

- André Soares Leopoldo – article writing, data analysis and interpretation.
- José Geraldo Mill – article writing, data analysis and interpretation.
- Natalia Madalena Rinaldi – responsible for all aspects of the work, ensuring that issues relating to the accuracy or completeness of any part of the work and approval of the version to be published.

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Advance directives in the perspective of the older adults of a municipality in the Midwest of Santa Catarina

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Abstract

Objective: To analyze the knowledge of older individuals in a municipality in the Midwestern region of Santa Catarina regarding the development of Advance Directives, their preferences regarding the available models, and the selection of a representative to make decisions on their behalf. *Method:* Cross-sectional study carried out by providing participants with two models of Advance Directives were made available to the participants for completion and applied a questionnaire on knowledge, acceptance, and evaluation of the device. *Results:* There were 85.63% of the participants who were unaware of the Advance Directives, 98.13% who were unaware of document models, 100% who considered model 1, more complete, to be good or acceptable, and 66.88% who indicated an adult child as its representative. When asked about the importance of preparing, making available to the population, and passing a law that regulates this right, the participants were assertive respectively by 91.88%, 91.25% and 91.25%. *Conclusion:* Most older people were unaware of the AD models, but mentioned model 1, considering it good or acceptable. Most had no difficulties in understanding and recognized the importance of preparing and making AD available to the population, as well as the need for a law to regulate this right. There was a high proportion of participants indicating an adult child as a legal representative, emphasizing the importance of involving the family in this process. These results highlight the need to make older people aware of AD and provide clear and comprehensive models.

Keywords: Advance Directives. Bioethics. Personal Autonomy. Aged rights.

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INTRODUCTION

The patient's dignity is supported by the exercise of their autonomy, a right guaranteed by the Universal Declaration on Bioethics and Human Rights[1], the Charter of Rights of Health Users[2] and the Code of Medical Ethics[3]. The autonomy of a person capable of communicating is exercised through Free and Informed Consent and, if incapable, through their Advance Directives (AD). In Brazil, ADs were introduced by Resolution of the Federal Council of Medicine (CFM) Nº. 1995/2012[4]. However, the Statute of Older People (Law 10.741/2003), in its article 17, guarantees older people the "right to choose the treatment they consider more favorable"[5]. All rights are based on articles 1 and 5 of the Federal Constitution[6].

The Ministry of Health established AD as guidelines for patients in palliative care through Resolution n.º 41/2018[7] and Ordinance SAES/MS n.º 1.399/2019[8]. However, no information was found about the availability of a model that facilitates its preparation by patients. However, until the end of 2022, a Bill (PLS n.º 149/2018)[9] with the purpose of regulating the AD[10], however, it was archived at the end of the 2022 legislature.

The United States was the first country to adopt AD in Federal Law, through the PSDA (*Patient Self-Determination Act*)[11]; in Europe, it started with Spain, through Law n.º 41/2002, followed by 15 other countries, such as France, Germany, Portugal and Italy[12]. In Latin America, countries such as Puerto Rico, Argentina, Mexico, Uruguay and Colombia have approved a federal law on AD[11].

The existence of a law on AD drives its development, as shown by a study carried out in Germany with more than 500 hematological and oncological patients, in which the majority only elaborated AD after the legal provision[13]. In Spain, by January 2023, 8.68 out of every 1,000 inhabitants had registered their AD in the National Registry[14].

In Brazil, there are two distinct models of AD. The first presents significant similarities with the one used in the present research, although it has a slightly different structure for entering data and offers less personalized options for the care of specific diseases[15]. On the other hand, the second model presents a less didactic text to fill in and has some important complications, such as the requirement of five witnesses and the need for registration at a notary, which makes its application on a large scale unfeasible[16].

When death is seen as a failure and even professional incompetence, the care process can drag on for longer than necessary, leading to dysthanasia[17]. Although individuals are marked by the temporality of life, the idea of finitude is fought against, an aspect that makes it difficult to approach AD in our country[18].

In this context, several questions emerge: what is the level of familiarity of the older people with AD? After acquiring knowledge about the AD, what is the relevance attributed to its elaboration? Which AD model is preferred? What are the difficulties faced in applying and understanding the available models? Which individual will be selected as a legal representative to ensure the autonomy of the older people?

Research with this category of people, especially the older people who are likely to need instruments to maintain their autonomy, is justified with the aim of developing an AD model that is as appropriate and understandable as possible. Thus, the objectives of the present research were to analyze the knowledge of the older people in a municipality in the midwest of Santa Catarina on the elaboration of AD, their preference and their difficulties in relation to the filling models and the choice of the representative who will replace them in the decision making.

METHOD

This is a descriptive and cross-sectional study with a quantitative approach, and of a regional nature, conducted through the application of a specific questionnaire and subsequent completion of two AD models, by older people in the city of Joaçaba - SC. The main objective of the questionnaire was to collect sociodemographic data and verify these people's knowledge about AD. Subsequently, the participants completed two AD models: a complete one (model 1) and an abbreviated one (model 2).

For this study, patients assisted in Health Strategies of the Unified Health System were included; patients from the Oncology Service of the University Hospital Santa Terezinha; and seniors who attended the University of the Third Age (UNITI), within the scope of the University of the West of Santa Catarina (UNOESC - Joaçaba).

In the Health Strategies, oncology service and UNITI, data collection was carried out by the authors and, at the homes, by the Health Agents, from March to September 2022. Before the field interviews, all researchers went through a guidance and training process provided by project coordinators.

For the sample calculation, a population of 5,865 older people in the city was considered[19]. In this calculation, a 90% reliability index and a 5% margin of error were used, estimating the need to include 169 participants. At the end, valid responses were obtained from 160 participants aged 60 years or older[3]. In addition to the inclusion criteria regarding age, the older people had to be lucid, capable of understanding and answering the questions presented to them. As an exclusion criterion, filling out the questionnaire was observed, in which incomplete questionnaires were excluded.

The objectives of the study were explained to each interviewee and the Free and Informed Consent Form (ICF) was presented, which is an integral part of the research protocol submitted to the Committee for Ethics in Research with Human Beings – CEP of UNOESC, approved under opinion n. 4,868,841. After explaining the purpose of the study, participants were asked to complete a questionnaire consisting of two parts. The first part included four questions about sociodemographic data, such as gender, age, education and profession. The second part consisted of two specific questions: one about knowledge about AD and the other about familiarity with existing AD models. For each participant who showed lack of knowledge, explanations about the AD were provided, followed by the presentation of two AD models, to which they should respond. Then, the participants were directed to a questionnaire with 12 specific questions, addressing their perception of the importance of ADs in relation to different aspects, such as the need to prepare and make them available to the population, the approval of specific laws for ADs, classifying their importance as "very important", "not important" or "not at all important". After that, the participants evaluated the presented models, classifying them as "good", "acceptable" or "bad". They were also asked if they would recommend these models, in addition to evaluating their understanding and possible comprehension difficulties. Then, participants were invited to point out the important items of the AD, indicate a legal representative who was not present in the alternatives provided, and express the importance of health professionals talking to patients about AD. In total, 18 questions were presented, including closed and open questions. The two open questions regarded AD items that were not understood and the indication of a representative not mentioned in the alternatives.

The two AD models were model 1 (complete) and model 2 (abbreviated). These models were prepared by the authors after consulting international models, especially the one adopted by the County of Yukon, in Canada[20], and by the Autonomous Community of Catalonia, in Spain[21] due to its objective writing and easy-to-understand explanatory texts. In order to understand the answer difficulties, the models proposed for this study underwent several discussions in the Bioethics Committee of the University Hospital Santa Terezinha de Joaçaba, were submitted during the last years to several pre-tests in different cultural contexts, receiving the pertinent modifications.

AD Model 1. We present, below, an indicative model for the elaboration of a document on Advance Directives in which you can register your wishes to be fulfilled in a situation where you are unable to communicate, as well as designate a representative to participate in the decisions in your place. Carefully read the explanations for alternatives 1 and 2 and record your preferences. I ... CPF nº... RG nº... date of birth .../.../..., domiciled in ..., in the fullness of my mental faculties, freely and after prolonged reflection, declare: Part 1. Expression of wishes about health care. If I find myself in a situation where I cannot make decisions about my health care, my wishes regarding care and treatment are indicated in alternatives 1 or 2, which should serve as a guide for the professionals who assist me and my representative

who will participate in the decision in my place. In both cases, comfort measures and palliative care are included when indicated.

1. Limited care. If, among the alternatives A-E, which are below, I mark "1. Limited care" means avoiding measures that do not benefit me. It only includes comfort measures, such as: nursing care, medication to minimize pain and suffering, oxygen, general care and emotional support. 2. Specific care. If, among the alternatives A-E, which are below, I mark "2. Specific care", in addition to comfort measures, I wish to receive other procedures that are indicated to me by the attending physician. I will express my wishes for five possible situations.

A. Terminal illness. If I find myself in the irreversible process of death, attested by two doctors, in which any life-sustaining treatment would only postpone it and prolong my suffering, I wish to receive: () 1. Limited care. () 2. Specific care. B. Permanent unconsciousness. If the disease is not terminal, but I am in a persistent coma, with no chance of regaining consciousness, attested by two doctors, I wish to receive: () 1. Limited care. () 2. Specific care. C. Brain injury. If the illness is not terminal, but there is demonstrably severe permanent brain damage that indicates an advanced stage of dementia, my wish is to receive: () 1. Limited care. () 2. Specific care. D. Kidney failure. If I find myself with a terminal illness (my death will occur in a few months) and my body has a permanent and serious failure of the functions of my vital organs that cannot be treated, such as the failure of both kidneys, with the need for permanent hemodialysis, I wish to receive: () 1. Limited care. () 2. Specific care. E. Respiratory failure. If I am terminally ill (my death will occur in a few months) and my body has a permanent and serious failure of the functions of my vital organs that cannot be recovered, such as severe respiratory failure, which requires continuous mechanical ventilation, I wish to receive: ( ) 1. Limited care. () 2. Specific care.

*Complete this item only if you checked alternative 2 in items A-E. When there is a medical indication, in addition to comfort measures and palliative care, I wish to receive some specific care that I will point out below: () Surgery. () Radiotherapy. () Intubation (in case of respiratory failure). () Renal dialysis (in case of failure of both kidneys). () Chemotherapy. () Blood transfusion. () Tube feeding. () Antibiotic therapy. () Other medications. () Other treatments. () Cardiopulmonary resuscitation. Explain if you want to clarify the choice: ...

Part 2. Manifestation of other wills: F. Regarding the donation of organs and tissues, my will is: () Not to donate. () Donate. () Donate only the following organs (describe which ones): ... G. Regarding Cremation: () Yes, I wish to be cremated. () I do not wish to be cremated. H. I have other wishes, for example: receiving spiritual/religious assistance, using experimental drugs, etc. (describe): ...

Part 3. Signature of witnesses and designation of representatives: Witnesses: 1. Name... CPF... Signature... 2. Name... CPF... Signature... I designate the representative (1) and his substitute (2) as people who can decide for me: 1) Name .... CPF ... Phone: ... Full address (include e-mail): ... 2) Name ... CPF... Phone: ... Full address (include e-mail): ... Date and Signature of declarant.

AD Model 2. We present, below, an abbreviated model for the elaboration of an Advance Directives document in which you can register your wishes to be fulfilled in a situation in which you are unable to communicate, as well as designate your representative to participate in the decisions in your place. Carefully read the explanations for alternatives 1 and 2 and record your preferences.

I... CPF nº.:. RG Nº. ..., date of birth.../.../..., domiciled on ..., in the fullness of my mental faculties, freely and after prolonged reflection, declare: Part 1. Manifestation of wills regarding health care. If I find myself unable to communicate, unable to make decisions, in very poor health that will cause me to die within months, or in a condition where there is little hope that I will regain a quality of life acceptable to me, my will with respect to the care and treatments I wish to receive is marked in alternatives 1 or 2, which should serve as a guide for the professionals who assist me and for my representative who will participate in the decision in my place. In both cases comfort measures and palliative care are included.

1. Limited care. If I check alternative 1, I want limited care and treatment. It means avoiding measures that do not benefit me, but it includes: nursing care, medication to minimize pain and suffering, oxygen, general care and emotional support. 2. Specific care. If I check alternative 2, I would like to receive some specific care and treatment. () 1. Limited care. Only comfort measures and palliative care. () 2. Specific care. It includes care other than comfort measures and palliative care.

If I have checked option 2, when there is a medical indication, I would like to receive care for the procedures or treatments that I will check below: () Surgery. ( ) Radiotherapy. ( ) Intubation. () Renal dialysis. () Chemotherapy. () Blood transfusion. () Tube feeding. () Antibiotic therapy. () Other medications. () Other treatments. () Cardiopulmonary resuscitation.

Part 2. Content identical to that presented in Part 2 of Model 1.

Part 3. Content identical to that presented in Part 3 of Model 1.

After the research, the models received the relevant modifications, which are available at: https://diretivasantecipadas.com.br/modeos-de-diretivas/[22]

Data were analyzed using bivariate statistics, using frequency tables. To define the number of classes for constructing the frequency table for the participants' age group, the Sturges equation was used. The chi-square test was used to verify the association between the variables sex, age group and education, and aspects related to AD, the result being considered significant when $p<0.05$.

RESULTS

Of the 163 participants who filled out the questionnaire, three of them were excluded from the study due to incomplete filling. It is observed (Fig. 1) that, of the 160 participants, the majority were female (69.37%) (Fig. 1a), aged between 60 and 69 years (55.65%) (Fig. 1b), and had only elementary education (51.88%) (Fig. 1c). As for profession, 55.7% were retired, 10.7% worked in agriculture and 7.5% were housewives. The remaining 26.1% were distributed among 26 different occupations.

As for knowledge, 85.62% had never heard of AD. Likewise, 98.13% of respondents did not know any model. There was no significant difference in terms of knowledge of ADs with regard to gender ($p=0.918$), age group ($p=0.915$) and education ($p=0.325$) of respondents.

Faced with each finding of lack of knowledge, an explanation of the AD was presented to the participants, taking the opportunity to resolve doubts regarding the document. Subsequently, the questionnaire on the perception of the importance of AD was followed (Table 1).

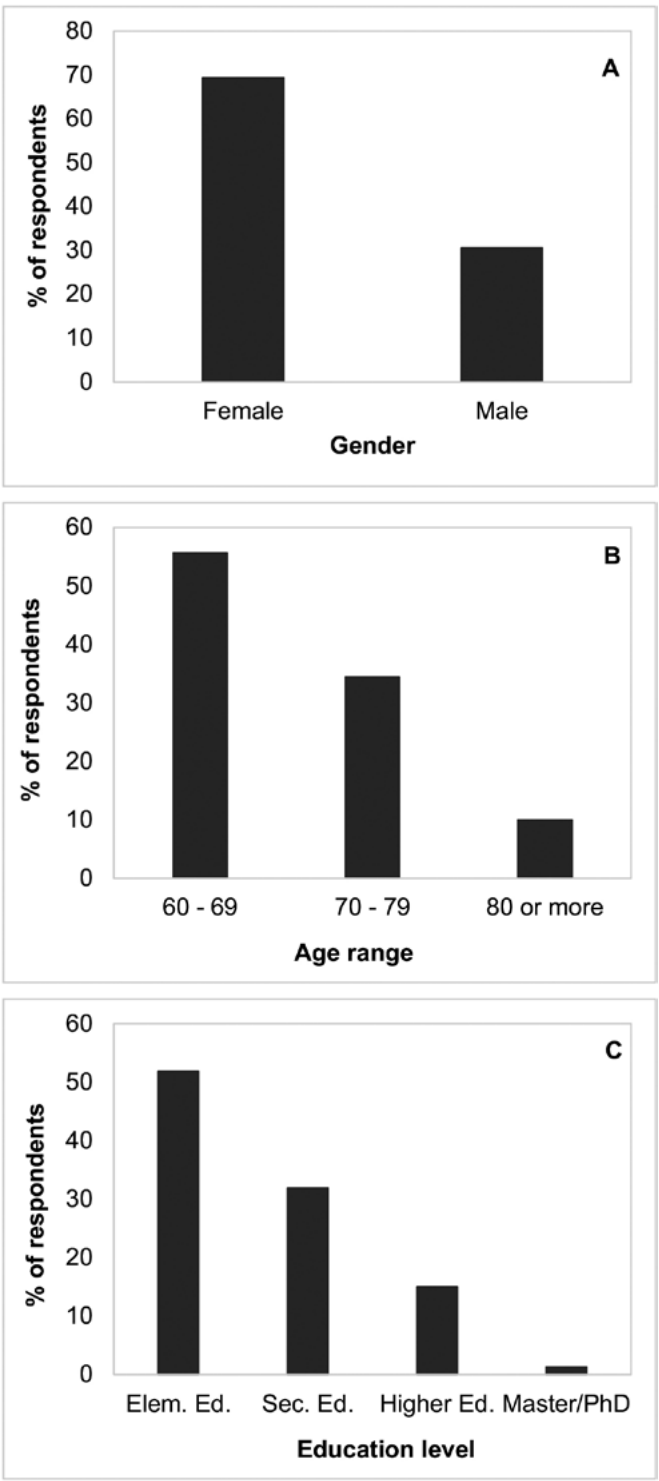

Figure 1. Profile of research participants regarding: a) gender (mas = male; fem = female); b) age range; c) education (Ens. Fund. = elementary education; Ens. médio = secondary education; Ens. sup. = higher education; Me = master's degree; Dr = doctorate). Joaçaba, SC, 2022.

Table 1. Perception of respondents regarding the importance of preparing, making available and passing a law on Advance Directives. Joaçaba, SC, 2022.

	Importance of preparing	Importance of making available	Importance of passing a law
	n (%)	n (%)	n (%)
Very important	147 (91.87)	146 (91.25)	146 (91.25)
Little important	11 (6.88)	12 (7.50)	11 (6.88)
Not important	2 (1.25)	2 (1.25)	3 (1.87)
Total	160 (100)	160 (100)	160 (100)

Comparing the perception of the importance of elaborating, making available and creating a specific law for AD between the groups separated by sex, age group and education, no significant differences were observed (p>0.05).

After explaining the ADs, the participants got to know and evaluated two models of ADs. From the results (Figure 2), it is observed that model 1 (complete) was better evaluated, receiving a classification of "good" by 72.50% of the respondents.

When asked to recommend one of the AD models, 63.75% of respondents recommended both models, 27.50% recommended model 1 and 8.75% recommended model 2. There was no significant difference in relation to the choice of model and gender (p=0.969), education (p=0.814) and age group (p=0.962) of respondents. However, it is important to highlight that 5% of the participants pointed out difficulties in understanding the models, especially with regard to the language of the questions (Table 2).

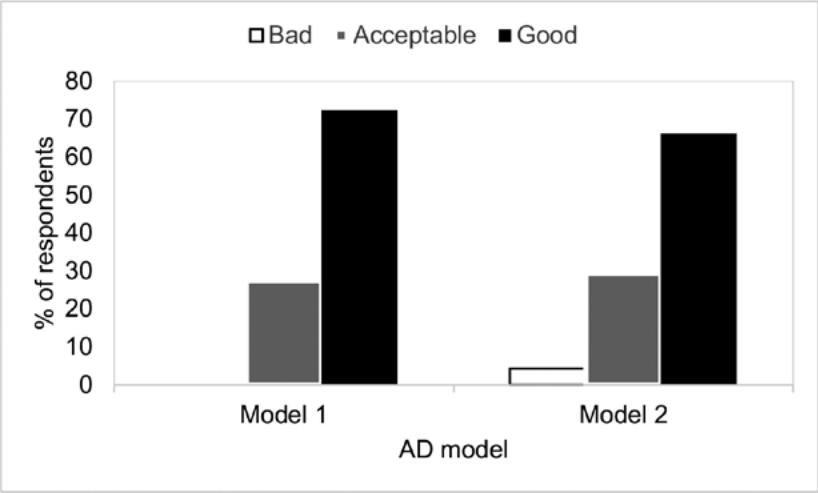

Figure 2. Evaluation, by the participants, of models 1 (complete) and 2 (abbreviated) of Advance Directives. Joaçaba, SC, 2022.

Table 2. Difficulty in understanding models of Advance Directives. Joaçaba, SC, 2022.

Specification of difficulties	n (%)
Language	4 (2.5)
Meaning of "treatment limitation".	1 (0.65)
Meaning of "health care" in model 2.	1 (0.65)
Did not specify	2 (1.2)

As for the importance of the AD items, 43.75% of the participants considered all the items important. The other participants indicated: designation of a legal representative (15%), organ donation (10%), limitation of treatments (8.75%), limitation of treatments and designation of a legal representative (8.13%), organ donation and limitation of treatments (5.63%), and designation of a legal representative and cremation (0.63%).

Given the emphasis on designating a legal representative, allowing for multiple responses, participants were asked who they would choose. The results were: adult child (66.88%), partner (11.25%), adult grandchild (1.88%), friend (0.63%), or any one of these options (19.37%).

Finally, participants were asked about the importance of health professionals talking to patients about preparing for the death process, as well as the importance of patients leaving guidelines through the AD. In this sense, 90% of respondents indicated that communication between health professionals and patients is important, while 88.75% considered it important to leave guidance about their wishes through the AD.

DISCUSSION

The older population is prone to reflection on the end of life, instigating the approach to the theme[23]. Regarding the knowledge of the participants about the AD, most were unaware of the device, a result similar to a survey carried out in a geriatrics outpatient clinic in Minas Gerais, with older patients and companions, in which only 3% knew the AD and 2% the CFM norm (Resolution 1995/12)[4].

However, the result was different from that reported in a survey carried out in Switzerland, applied to older people, where 78.7% had already heard about AD and 76.7% approved of them, especially women, showing the existing mismatch between countries[24]. In a study with cancer patients in the same region of the current research, most respondents were unaware of AD, but after clarifying their meaning, the desire to develop their own device was almost unanimous, evidencing the relevance of information for the implementation of AD in Brazil[25].

As for the difficulty in understanding the items presented in the research, the manifestations of will about limiting treatment and health care were pointed out. This finding emphasizes the need for prior clarifications, carried out by health professionals, for those who wish to complete the document. Decision-making about the future during the preparation of the ADs occurs in a context of solidary autonomy where the decision is shared[26]. Possible limitations in terms of education, beliefs or cultural differences require availability of time to explain the meaning of AD, clarifying doubts regarding treatment indications and restrictions, as well as contributing to the applicability of AD[27].

Often, low adherence to AD is associated with the country's culture and the lack of habit or resistance to talking about finitude[28]. In some countries, it is noted that the level of education is a factor that influences the knowledge of AD, as shown in a survey carried out in Switzerland[24].

It is estimated that the difficulties regarding the elaboration of ADs can be circumvented through carefully written documents, with advice and explanations about possibilities and treatment options[27]. Thus, directives are a promising way to exercise autonomy when there is no communication. When the participants of this research were questioned about the importance of elaborating ADs, the majority answered that they consider it important, with no difference by sex, education or age groups.

As for the participants' assessment of the AD models, there was better acceptance of model 1, although both were indicated by the majority. In this sense, the Brazilian Society of Geriatrics and Gerontology created the online application "Minhas Vontades" (My Will), accompanied by explanations that allow people to prepare their AD[29].

The passing of a law, which enables their right to autonomy, was evaluated as very important, by men and women, with no variation between age groups and education. In the Brazilian context, the initiative of the Ministry of Health should be highlighted, which included AD as guidelines for the organization of palliative care and cancer patients[7].

Thus, it is observed the existence of state legislation in Brazil that contributes to the execution of the right of patients to refuse painful or extraordinary medical treatments to prolong life[30]. Although they do not directly mention AD, among the various published laws, the most emblematic is the Covas Law (10,241/1999)[31].

In this scenario, the lack of progress is shown in a recent survey carried out at a teaching hospital in Curitiba-PR with physicians, nurses and nursing technicians and SUS users (patients and companions) in which most professionals (61.9%) and users (91.7%) were unaware of AD and the CFM Resolution 1995/2012[32].

Among the items that make up the AD models presented, all were considered important, but there was emphasis on the designation of the representative and organ donation. Regarding the representatives, the most mentioned were the adult children and the spouses. The appointment of a representative is accompanied by the need to keep them aware of your wishes. A Korean study elucidates that, among the reasons for registering their wishes in an AD, "not to burden families with end-of-life decisions" (82.1%), followed by "possibility of differences of opinion between themselves and other family members" (78.9%) and "due to the conscious risk of losing decision-making capacity in the event of an unexpected accident or serious illness" (75.9%)[33]. As for the order of choice of the representative, as in this research, in a study carried out in Malaysia, 38.8% of respondents chose their adult children and 22.4% their spouses, revealing that the preference is among the closest family members[34].

In this context, when it comes to the medical team, a survey carried out in a hospital in RS pointed out that physicians have difficulty in following the desire expressed by the patient in AD when the family is against it, demonstrating the need for greater prior communication between the team, patient and family members, otherwise new dilemmas may arise[27].

With regard to the importance of preparing ADs and making them available to the population, it is inferred that the lack of federal legislation and lack of knowledge about ADs contribute to the non-appearance of significant differences in understanding. A survey showed that both professionals and users of health services point to the need for the physician to take the initiative to talk about ADs[32]. A promising aspect was that 95% of Brazilian medical students interviewed in a survey attributed this function to the physician, demonstrating that they were already aware of the topic[35].

In the present research, the participants considered it important that health professionals take the initiative to talk about death and that patients leave their wishes in writing. However, the results of one study attribute the low adherence of physicians to AD to lack of knowledge and experience, paternalism, difficulties in defining the patient's prognosis, legal concerns, the influence of family members, in addition to cultural and religious factors[36]. However, it is necessary for health professionals to have acquired skills on AD in order to guide their patients, in addition to striving to ensure that their wishes are fulfilled[37]. On the other hand, conditions must be created, especially from a legal point of view, so that patients have the means to make their directives available.

This research has as limitations the regional character and the number of its sample, making generalizations difficult. Furthermore, the population's lack of knowledge about AD may have caused a bias in the acceptance and evaluation of the presented models, as well as in explaining the lack of difference in responses between the groups.

CONCLUSION

The results allow us to conclude that the evaluated older population knew little about Advance Directives. However, after knowing its purpose, they considered its elaboration important, preferred the more complete model and, as a legal representative, the adult children and spouses.

Almost all considered it necessary to pass a law to encourage the implementation of Advance Directives in Brazil and guarantee the accessibility of this right to the population. It is understood that, for the benefits

to become real, legal, cultural and structural changes are necessary in health institutions, professional entities and educational institutions. Finally, there is a need to prepare health professionals, starting from graduation, in the discipline of Bioethics or through specific courses, to approach this right that is so important to the population.

AUTHORSHIP

- Gustavo S. Vanzella - conception and design of the study, analysis and interpretation of data, data collection, writing of the manuscript.
- Isadora C. D. Souza - conception and design of the study, analysis and interpretation of data, data collection, writing of the manuscript.
- Juliano C. Ferreira - data collection and writing of the manuscript.
- Vilma Beltrame - conception and design of the study, analysis and interpretation of data and writing of the manuscript.
- Sirlei Favero Cetolin - conception and design of the study, analysis and interpretation of data and writing of the manuscript.
- Elcio L. Bonamigo - conception and design of the study, analysis and interpretation of data, writing of the manuscript, critical revision of the text and general responsible for the study. All authors approved the final version of the manuscript.

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Frailty syndrome and quality of life in hospitalized older adults

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Abstract

Objective: to analyze the relationship between frailty syndrome and quality of life in hospitalized older adults. *Methods:* a quantitative cross-sectional study of 323 older individuals was carried out at university hospitals of Paraíba from August 2019 to July 2020. Data were analyzed by SPSS, version 26.0, using Pearson´s chi-square, Spearman´s correlation and multiple logistic regression for sociodemographic, frailty and quality of life variables. *Results:* regarding participant profile, 60.7% were women, 49.2% aged 60-69 years, 51% had a partner, 67.8% were literate, 89.2% lived with at least 1 other person, 78.3% were not working, and 57.9% received ≤ 1 minimum wage. Frailty syndrome was significantly associated with gender, age, literacy, work status, income, and quality of life. Quality of life was statistically significantly associated with only gender and work status. Results showed that illiteracy, not working and low quality of life increased the probability of frailty syndrome by 3.04 (95%CI; 1.70–5.4), 4.51 (95%CI; 2.39–8.49), and 3.81 (95%CI; 2.22–6.53), respectively; while not working increased the probability of low quality of life.by 2.61 (95%CI;1,45–4,73). *Conclusions:* frailty syndrome was associated with low quality of life in the hospitalized older adults, indicating the need for measures by hospital managers to improve care beyond the clinical conditions addressed in routine practice.

Keywords: Aged. Frailty. Quality of Life. Hospitals.

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INTRODUCTION

Cardiovascular diseases constitute one of the leading causes of hospitalizations, followed by cancers and diseases of the digestive tract. Falls are also a frequent cause of hospitalization in older individuals and are associated with functional decline and, thus, contribute to health problems[1]. During the aging process, older people develop vulnerabilities that can directly impact quality of life[2]. The physical and psychic changes which accompany this stage of life are not directly associated with the development of diseases. However, owing to both intrinsic and extrinsic factors, older people can exhibit signs of frailty and a vulnerable state of health susceptible to diseases, emotional stress and falls[3].

Frailty syndrome is defined as a cumulative state of homeostatic imbalance and reduction in muscle strength that predicts adverse health events in the older population[4]. The syndrome is characterized by multiple etiologies and complex outcomes and can lead to cognitive and functional decline, risk of falls, depression, violence and institutionalization or hospitalization[5].

Frailty can be measured based on several criteria which are related to the phenotype of older people, namely: reduced level of physical activity, self-reported fatigue, non-intentional weight loss, and reduced handgrip strength and gait speed[6]. Criteria for diagnosing frailty include signs such as slowed movements, exhaustion, involuntary weight loss, loss of muscle strength and sedentarism[7]. Early detection of these signs and symptoms favors timely prevention and rehabilitation measures, as well as improved quality of life of this group.

Frailty can manifest differently in each individual and requires different levels of care. Development of frailty is associated with a greater likelihood of falls and hospitalizations[8]. In a recent Brazilian study of 461 older individuals aged ≥66 years, 5.2% of participants were classified as frail (≥3 signs of frailty) and 49.9% as pre-frail (1-2 signs of the syndrome)[9].

Therefore, as a result of the physiological changes induced by aging, frail older adults require a greater level of assistance and care, rendering them more dependent[2]. Family members, unable to meet the care needs of the older individual, resort to hospital admission as an alternative[10]. Hospitalization, albeit necessary, can become a negative measure due to the need for the patient to adapt to the new routine and procedures, affecting their wellbeing and quality of life[11].

Quality of life (QoL) comprises a group of factors which directly influence the way the individual perceives their position in life. Aspects such as financial stability, physical health and productivity, among others, are parameters used to characterize the level of quality of life of an individual. Frail older individuals face a significant decline in performance of activities of daily living which negatively impacts their QoL[3].

Although health professionals are trained to recognize diseases and devise an advance care plan based on clinical diagnosis, approaches in cases of frailty can lack effectiveness. Older individuals with moderate-to-severe frailty are sometimes not recognized as frail by health teams, impacting the planning of interventions to promote health in this contingent of the population[12].

Moreover, QoL is often not taken into account in assessments by professionals, given the invisible nature of the subjective dynamic, yet it represents an aspect that can exert influence on other health outcomes of older individuals. Thus, understanding the relationship between frailty of hospitalized older individuals and quality of life proves important for implementing timely interventions in this group, and helps establish the hypothesis that frailty syndrome can promote negative outcomes from a social and psychological perspective for older patients who are placed in a hospital environment.

Therefore, the objective of the present study was to investigate the relationship between frailty syndrome and quality of life in hospitalized older adults.

METHODS

A quantitative cross-sectional study was carried out at the sectors of Internal Medicine, Surgery, Contagious-Infectious and Parasitic Diseases Unit of the Lauro Wanderley University Hospital (HULW)

in the city of João Pessoa, and in the A surgical, B pneumology and C & D Internal Medicine wards (male and female) of the Alcides Carneiro University Hospital (HUAC) in the city of Campina Grande. Data collection was performed between August 2019 and July 2020.

The study inclusion criteria were older adults aged ≥60 years hospitalized at the institutions outlined above. Exclusion criteria were individuals who were terminally ill, had severe communication difficulty, clinical conditions which precluded participation, or severe cognitive deficit. Cognitive status was based on reports by the professionals of the sector and on observations of the researchers, consistent with criteria given during data collection training.

The study population comprised 774 older patients from the HULW and 485 from the HUAC. Thus, the initial study population consisted of 1259 older participants. Sample size was estimated using the equation for sample calculation in a finite population proportion, with 5% error, 95% confidence interval and 60% phenomenon rate, giving an estimated sample of 285. A further 10% was added to allow for potential losses, giving a final sample size of 323 older individuals. Participant selection was proportional among the different sectors included.

The instruments used for data collection were the Brazil Old Age Schedule (BOAS), allowing sociodemographic characteristics of the study sample to be determined for the parameters age, sex, marital status, literacy, years of education, work status and income[13]. The variables literacy and education were included for their different forms, where literacy served as a qualitative measure for analyzing association and education in years as a quantitative measure for correlation. In addition, the Edmonton Frail Scale (EFS) for classifying frailty[14] and the World Health Organization Quality of Life Group instrument (WHOQOL-OLD)[15] for measuring quality of the participants were applied.

The EFS comprises 9 domains and classifies frailty into frail, pre-frail and not frail based on predetermined cut-off scores. Thus, a scale score of 0-4 indicates not frail, 5-6 pre-frail and ≥7 frail[14]. For this study, a dichotomous classification was employed according to which pre-frail and frail older individuals were pooled and classified as "yes" on the frailty assessment, whereas those rated as not frail were classified as "no". The aim of the researchers was to identify the occurrence of frailty or otherwise.

The WHOQOL-OLD is an instrument developed by the World Health Organization (WHO) for assessing quality of life of older individuals. The questionnaire comprises 24 questions divided into the facets of autonomy, past, present and future activities; death and dying; intimacy; sensory functioning; and social participation. Higher scores indicate better quality of life of the respondent[5]. The cut-off point for this variable was based on the median, where ≤ 85 points indicated low quality of life and scores above this point indicated high quality of life.

The research team underwent previous training prior to conducting data collection. The instruments were applied in a quiet, private environment, without supervision, so as to minimize the risk of embarrassment. The data gathered were double-keyed by two collectors into computers in the research group office at the university.

The data collected were then tabulated and analyzed using statistical software according to descriptive statistics (absolute and relative frequency) and inferential statistics (Pearson´s chi-square, Spearman´s correlation and multiple logistic regression) to analyze association, correlation and regression. A 5% level of significance (p-value < 0.05) was adopted for all statistical analyses.

Normalcy of the distribution was checked by applying the Kolmogorov-Smirnov test for normality, whose results confirmed a tendency toward non-normalcy and defined the use of non-parametric tests.

On the regression analysis, variables with $p<0.2$ on the association analysis were entered in the model. The hierarchical type regression model was elected, with successive removal of variables with higher p-value. In the final model, however, variables with $p<0.05$ were retained.

Explanations about the study objectives, secrecy, anonymity and right to refuse to take part were given to all study participants. Subjects that agreed to take part signed, initialed or fingerprinted the

Free and Informed Consent Form. The research project was previously approved by the Research Ethics Committee, in accordance with Resolution no. 466/12, by both the HULW/UFPB (permit no. 3.709.600) and the HUAC/UFCG (permit no. 3.594.339).

RESULTS

The study included 323 older participants, who were predominantly women (60.7%, n=196), aged 60-69 years (49.2%, n=159), had a partner (51%, n=167), were literate (67.8%, n=219), and lived with at least 1 other person (89.2%, n=288). Most participants were not working (78.3%, n=253), and received ≤1 minimum wage (57.9%, n=187). Also, the sample had a high rate of frailty (61%, n=197) and low quality of life (43.2%, n=137).

Regarding the association among frailty, quality of life and sociodemographic variables, there was a statistically significant association of frailty with the variables sex (p=0.027), age (p=0.001), literacy (p<0.001), work status (p<0.001) and income (p=0.001). There was also an association of quality of life with sex (p=0.011) and work status (p=0.006).

A statistically significant association between the variables frailty and quality of life was found, where frail participants had low quality of life (79.6%; n=109) (p<0.001) (Table 2).

Table 1. Distribution of frequency and association of frailty and quality of life with sociodemographic variables. Paraíba state, Brazil, 2019-2020.

Variables	Frailty		p-value*	Quality of Life		p-value*
	Yes n (%)	No n (%)		High n (%)	Low n (%)	
Sex						
Male	68 (53.5)	59(46.5)	0.027	82(65.6)	43(34.4)	0.011
Female	129(65.8)	67(34.2)		98(51.0)	94(49.0)	
Age (years)						
60-69	83 (52.2)	76(47.8)	0.001	86(54.8)	71(45.2)	0.439
70-79	75(64.7)	41(35.3)		70(61.4)	44(38.6)	
≥80	39(81.2)	9(18.8)		24(52.2)	22(47.8)	
Marital status						
No partner	100(64.5)	55(35.5)	0.196	81(53.6)	70(46.4)	0.254
With partner	96(57.5)	71(42.5)		99(60.0)	66(40.0)	
Literacy						
Yes	116(53.0)	103(47.0)	<0.001	128(60.1)	85(39.9)	0.089
No	81(77.9)	23(22.1)		52(50.0)	52(50.0)	
Living arrangement						
Living alone	18(51.4)	17 (48.6)	0.219	18(52.9)	16(47.1)	0.632
Living with other(s)	179(62.2)	109(37.8)		162(57.2)	121(42.8)	
Working						
Yes	21(30.0)	49(70.0)	<0.001	51(73.9)	18(26.1)	0.001
No	176(69.6)	77(30.4)		129(52.0)	119(48.0)	
Income						
≤ 1 MW	129(69.0)	58(31.0)	0.001	95(52.2)	87(47.8)	0.056
> 1 MW	68(50.0)	68(50.0)		85(63,0)	50(37.0)	

Note: * Pearson´s chi-square test; MW: Minimum Wage.

Table 2. Association of frailty with quality of life. João Pessoa city, Paraíba state, Brazil, 2019-2020.

Variables	Frailty		
	Yes n (%)	No n (%)	p-value
Quality of life			
High	84 (46.7)	96(53.3)	<0.001
Low	109(79.6)	28(20.4)	

Note: * Pearson´s chi-square test.

The correlation of frailty and quality of life scores with sociodemographic variables is presented in Table 3. Frailty was positively correlated with participant age (p<0.001), where higher age was associated with greater frailty. Also, frailty was negatively correlated with years of education and income (p<0,001), where lower education and income were associated with higher frailty score. With regard to quality of life score, no statistically significant correlation with other variables was found.

A negative correlation between frailty and quality of life was detected, suggesting that as frailty increased, quality of life decreased, and vice-versa (Table 4).

For the logistic regression analysis, all variables with p< 0.2 were entered in the model (Table 2). The results showed that illiteracy, not working, and low quality of life increased the probability of having frailty syndrome by 3.04 (95%CI= 1.70-5.44; p<0.001), 4.51 (95%CI= 2.39-8.49; p<0.001) and 3.81 (95%CI= 2.22-6.53; p<0.001), respectively. In addition, having no paid work activity also increased the probity of low quality of life by 2.61 (95%CI=1.45-4.73; p = 0.001).

Table 3. Correlation of frailty and quality of life scores with sociodemographic variables. João Pessoa city, Paraíba state, Brazil, 2019-2020.

Variables	Frailty score		Quality of Life score	
	Correlation coefficient	p-value*	Correlation coefficient	p-value*
Age	0.221**	<0.001	0.014	0.802
Years of education	-0.344**	<0.001	0.104	0.064
Number in household	0.025	0.674	-0.010	0.871
Income	-0.228**	<0.001	0.147**	0.009

Note: * Spearman´s correlation test.

Table 4. Correlation of frailty scores and quality of life. João Pessoa city, Paraíba state, Brazil, 2019-2020.

Variables	Frailty score	
	Correlation coefficient	p-value*
Quality of Life	-0.448**	<0.001

Note: * Spearman´s Correlation test.

Table 5. Variables associated with frailty and quality of life on adjusted logistic regression. Paraíba state, Brazil, 2019-2020. (N=323)

Variables	OR	CI	p-value*
Frailty			
Literacy			
Yes	1.00	-	-
No	3.04	[1.70 – 5.44]	<0.001
Working			
Yes	1.00	-	-
No	4.51	[2.39 – 8.49]	<0.001
Quality of Life			
Low	3.81	[2.22 – 6.53]	<0.001
High	1.00	-	-
Quality of Life			
Working			
Yes	1.00	-	-
No	2.61	[1.45 – 4.73]	0.001

Note: Frailty: R^2 adjusted: 0.206; Quality of Life: R^2 adjusted: 0.046; OR: Odds Ratio; CI: Confidence Interval; * Significance of test.

DISCUSSION

The present study results revealed a significant association of frailty with gender, age, literacy, work status, income and quality of life. Of these relationships, the correlation was positive for age, and negative for education, income and quality of life. For quality of life, this variable exhibited a significant association with gender, work status and income.

The frailty rate was 61%, where this high percentage of frail individuals can be explained by the susceptibility of older people to physiological declines. These deficits, together with external factors such as diseases, reduced mobility and poor dietary intake, can favor the development of frailty syndrome[16]. At the university hospital affiliated to the Universidade Federal de São Paulo (UNIFESP), a study found a 76.5% frailty rate in older individuals admitted to the ICU, placing a higher nursing workload in the areas of ventilatory and renal support, and intravenous hyperfeeding, particularly on the first day of ICU admission[17].

Similar results have been reported, such as in the study assessing frailty in older users of a Social Assistance Referral Center, which found 33.4% were non-frail, 20.8% apparently vulnerable, and 45.8% frail at some level (mild, moderate and severe)[18].

In the present study, the profile of hospitalized older patients was predominantly female, aged 60-69 years, married or living with someone, and not working, corroborating the results of a study by the Universidade do Chile showing a frailty prevalence 81.1% in females, 55.3% of whom were not working, and a mean age of 68.5 years[2]. The high proportion of older women can be explained by the feminization of aging. The female population, besides having greater life expectancy due to lower susceptibility to occupational and external risks, also has lower alcohol and tobacco use and seeks health services more readily compared with the male population[19].

Moreover, the higher prevalence of frailty in females can be interpreted in the context that older women have a longer life expectancy after the age of 60 years than men, but this longevity does not necessarily translate to good health or quality of life. These additional years can contribute to greater physical disability and development of chronic diseases which change the way women perform their daily activities, rendering them vulnerable to the symptoms of the syndrome.

Socioeconomic disparity proved a factor contributing to a higher rate of frailty. Among the group of frail participants, 69% had an income of

one minimum wage or less. Low educational level associated with low income are factors contributing heavily to the development of the syndrome in older individuals, rendering this group more vulnerable to morbidities and mortality due to their unfavorable social conditions[20].

With regard to the different levels of frailty, participants who were older exhibited greater severity of signs of the syndrome. With increasing age, older people experience more morbidities and, consequently, make greater use of medications. Although the presence of comorbidities is indicative of frailty, their occurrence can precede the syndrome itself, rendering the individual more prone to frailty from 80 years of age or older, with a 1.24 times higher risk of frailty compared to those aged 65-79 years[21,22].

Frailty manifesting with weight loss, functional dependence, slowed gait, exhaustion and fatigue,[23] progresses year by year and worsens with advancing age and health problems[24]. A significant relationship of frailty with hospitalization was found, showing its prevalence in pre-frail and frail older individuals aged over 60 years,[25] revealing an inversely proportional relation with QoL[24].

The correlation of frailty with low socioeconomic level and age found among the study participants points to the need to include social determinants of health in the clinical decision-making of comprehensive geriatric care[7].

With respect to the relationship between frailty syndrome and quality of life, a study of community-dwelling older people showed a strong association that can be influenced by health, environmental and socioeconomic aspects of these individuals[26]. In two Spanish studies, this association was also found to be significant (OR: 0.95; 95%CI: 0.93-0.97) ($R^2 = 0.395$), and that this relationship is strongly influenced by aspects of physical health in frailty syndrome, given the consequences of disability and functional dependence[27,28].

Hospitalization, although necessary for stabilizing the health of older patients in cases of severe frailty, can itself give rise to anxiety, fear and discomfort due to the user´s removal from the family fold, leading to feelings of isolation and impotence amid the process of coping with frail health. Long hospital stays can have negative repercussions and deleterious effects on the health status of older patients, owing to extended periods lying in a hospital bed, sleep deprivation, and iatrogenic events[29].

Nursing has a key role in the care offered to pre-frail and frail older patients. Through continuous monitoring of patients, in conjunction with a screening system, cases can be identified and tools devised to improve outcomes, delay progression of frailty and contribute to patient and family-centered inteventions[30].

Nurses play a key role in identifying the needs of each patient, seeking to contribute to direct continuous care. Effective interventions can allow technologies to be offered that promote care with the aim of avoiding problems caused by frailty and improve the quality of life of frail older people[31].

Nurses, the protagonist in the art of caring, is of critical importance in identifying each individual patient´s needs with the aim of providing follow-up and guidance to older patients and their family members. Nursing enables care promotion, intervention, recovery and rehabilitation, with the goal of enhancing quality of life of each individual according to their circumstances.

The present study has some limitations, such as its cross-sectional design, which precluded drawing meaningful conclusions about the causal relationships between variables, and also the lack of similar studies conducted in the hospital setting and Brazilian milieu against which to compare the present investigation. Many of the instruments used for comprehensive geriatric assessment are designed for the primary care setting and, hence, these should be integrated into all care scenarios involving this population, including hospitals.

CONCLUSION

Frailty syndrome poses a growing challenge to health professionals, where nursing plays a key role in care and management of this condition. Based on the study results, occurrence of the syndrome is associated with lower quality of life of hospitalized individuals, highlighting the need for measures by

hospital managers to improve care beyond the clinical conditions addressed in routine practice.

Elucidating this relationship, the present study results indicate the need to refocus healthcare toward the promotion of quality of life of older people in the hospital setting, whereby the multidisciplinary team can address the psychological and social needs of older patients in this scenario to better define the hospital stay and inform gerontological health practices.

AUTHORSHIP

- Eduarda C. D'Ó. Alves – conception and design, writing of article, data analysis and interpretation, approval of final version for publication.
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- Rafaella Q. Souto – conception and design, critical review, approval of final version for publication.

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Comparison of frailty in oldest-old people using the Clinical-Functional Vulnerability Index-20 (IVCF-20) and Edmonton Frail Scale (EFS)

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Abstract

Objective: To compare Clinical-Functional Vulnerability Index-20 (IVCF-20) and Edmonton Frail Scale (EFS) scores among community-dwelling older people aged ≥80 years for prevalence and degree of agreement. *Method*: A cross-sectional study nested within a population-based cohort, was conducted. Baseline sampling was probabilistic by two-stage clustering. In the first stage, the census tract was used as the sampling unit. In the second stage, the number of households was defined according to the population density of individuals aged ≥60 years. Sensitivity, specificity and predictive values were determined and Kappa statistics expressed degree of agreement between the instruments. *Results*: 92 oldest-old people were evaluated. The prevalence of high risk of clinical and functional vulnerability on the IVCF, indicating frailty, was 45,7%, whereas the prevalence of frailty using the EFS was 44,6%. Sensitivity, specificity, positive predictive value and negative predictive values were 88,23%, 87,80%, 90,0% and 85,71%, respectively. Accuracy was 88,04% and the Kappa statistic 0.759 (p<0.001). *Conclusion:* The IVCF-20 and EFS instruments showed good accuracy and strong agreement when applied to community-dwelling oldest-old people. The identification of frailty was superior using the IVCF-20. These results show that the instruments detected similar frailty prevalence in community-dwelling oldest-old people.

Keywords: Aged. Aged, 80 and over. Frail Elderly. Frailty. Elderly Health.

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INTRODUCTION

Amid the process of Brazilian population aging - a consequence of demographic and epidemiological transitions - the proportion of older individuals aged 80 or over has grown considerably[1]. Oldest-old people tend to have multiple comorbidities and complex clinical conditions, leading to an increased prevalence of frailty and higher costs with health care[2,3].

Recognized as a multidimensional syndrome, frailty can be identified clinically in older people with age-related physiological vulnerability, which may be the result of factors ranging from a reduced homeostatic reserve to disproportionate changes in health status following stressor events. Frailty renders older people susceptible to adverse clinical events, such as impacted activities of daily living, physical limitation, falls, hospitalizations and mortality[2,4].

Identifying older individuals at risk of frailty is a public health priority[2,5]. A number of instruments are available for screening and measuring frailty in this population group. Currently, there is no consensus on the best choice of instrument for use by researchers and clinicians, since no universal standard measure for frailty exists[6]. This situation creates the need for studies comparing tools for detecting frailty in this group by applying them concomitantly in the same population. The results yielded can help elucidate more standardized ways of measuring frailty in older adults.

The Clinical Functional-Vulnerability Index-20 (IVCF-20) and the Edmonton Frail Scale (EFS) are tools frequently analyzed for their clinimetric properties[6]. The IVCF-20 offers a high degree of validity and reliability[7], whereas the EFS adheres to recommendations describing the best practices in the development of complex measures[8]. The IVCF-20 was developed in Brazil and has been highly recommended for routine use in Primary Care services[7]. The EFS is acknowledged as clinical tool that is easy-to-use and apply for detecting frailty in the older population[9]. Culturally adapted for use in Brazil, the EFS is considered reliable, valid and easy to apply, including professionals who are not specialists in geriatrics or gerontology[10].

The growth in the oldest-old, together with the dearth of studies comparing instruments for identifying and measuring frailty, creates the need to investigate this condition in older individuals aged 80 and over living in the community. Including oldest-old in assessments with age strata using a cut-off of 60 years can mask the important specificities of this group. A search of the relevant literature[11-13] confirmed that the IVCF-2 and EFS have not hitherto been employed concomitantly in the same non-institutionalized population aged 80 and over. Moreover, few studies are available comparing these instruments, developed to measure frailty in individuals aged 60 or older, in the primary care setting in Brazil[11-13]. In the study by Carneiro et al.[11], the EFS and IVCF-20 instruments were compared for degree of agreement and correlation in community-dwelling older people from Montes Claros city, Minas Gerais state. The results showed moderate agreement and strong positive correlation between the instruments although the frailty prevalence proved disparate. Another study[12], in Belo Horizonte, Minas Gerais state, compared the EFS versus the IVCF-20 and found a positive correlation and significant agreement among individuals aged 60 or over. However, detection of frailty was higher when using the EFS. In a study[13] carried out in the city of Três Lagoas, Minas Gerais state, comparing the IVCF-20 with the Subjective Frailty Assessment (SFA), agreement between the 2 instruments ranged from low to moderate. Overall, there is an evident need to standardize the ways of screening frailty. Comparing different instruments enables analysis of evidence of convergent validity, i.e. the level of agreement between the constructs assessed. Working on the assumption that both the IVCF-20 and EFS identify and measure frailty in community-dwelling older adults and were developed based on Comprehensive Geriatric Assessment (CGA), a high level of correlation between the 2 instruments can be expected. The objective of the present study was to compare the EFS and IVCF-20 instruments in community-dwelling older adults for prevalence, accuracy and level of agreement.

METHOD

A cross-sectional study, nested within a population-based cohort of community-dwelling oldest-old, longitudinally assessing frailty in older

people was carried out. The study was conducted in a medium-sized city situated in the state of Minas Gerais, Southeast Brazil. The city has a population of approximately 400,000 people and constitutes the main urban center in the region. The larger study involved 2 stages comprising the baseline and first wave.

Sample size at baseline was calculated based on the estimated older population of 30,790 in the urban region, according to data from the Brazilian Institute of Geography and Statistics (IBGE), for a 95% confidence level, conservative prevalence of 50% and sample error of 5%.

Given cluster sampling was employed, the estimated sample size was multiplied by a correction factor and design effect (*deff*) of 1,5%, with the addition of 15% to allow for losses. The minimum number of older people defined by the sample size calculation was 656 participants.

Probabilistic sampling by 2-stage clustering was used. In the first stage, census sector was used as the sample unit. During this stage, the districts, streets and blocks were identified on maps of the census sectors of the urban area of the city. A total of 42 census sectors were randomly selected from among the 362 urban sectors of the city, according to IBGE data.

In the second stage, the number of households, according to population density of individuals aged ≥60 years, was defined. In this stage, the sectors with a higher number of older individuals had more households allocated, so as to produce a more representative sample.

The inclusion criteria were: age ≥60 years, residing at the household allocated; and agreeing to take part in the study. Subjects not available after a minimum of 3 visits during different times and days, despite previous scheduling, were deemed losses.

The first data (baseline) collection was carried out at participants´ homes between May and July 2013. The interviewers (nursing and medical graduates), previously trained and calibrated according the Kappa agreement statistic (0.8), visited the census sectors from a pre-defined point in each census sector to conduct the interviews. The households to be investigated were defined by visiting the randomly selected sector, commencing from the start point and visiting every other (alternating) household. At the household visited, if older individuals were present, one was invited to take part in the study. In the case of no older individuals at the household, the next household was selected according to the criteria of alternating house numbers. If more than one older individual lived at the address, the oldest was selected for interview.

The first wave of the study (second collection) was carried out after a mean interval of 42 months from baseline, i.e. between November 2016 and February 2017. In this stage, households of all older respondents interviewed at baseline were eligible for the second interview (first wave). A total of 334 older individuals participated in the first wave.

In the present study, only individuals aged ≥ 80 years (oldest-old) were included, giving a total sample of 92 participants. The population of oldest-old has grown considerably and has specific inherent characteristics which require individual assessment[1]. Losses were defined as older individuals not available to take part after a minimum of 3 visits during different hours and days, in addition to those who had moved with change of address[14]. The questions from the questionnaire were answered with the help of family members or guardians/caregivers for older respondents unable to answer, as per instructions contained in the data collection instruments[7,9,10].

The frailty status of the participants was measured by the IVCF-20[7] and EFS[9,10]. The IVCF-20 is a 20-item multidimensional assessment instrument covering 8 conditions predicting clinical-functional decline of older adults[7]. The scale score ranges from 0-40, where a final score of 0-6 points indicates low risk of clinical-functional vulnerability; 7-14 moderate risk; and ≥15 points high risk of clinical-functional vulnerability, or potentially frail[15]. For interpreting the IVCF-20 results, the respondent is classified as: robust (0-6 points), displays independence and autonomy and no functional disability; risk of frailty/pre-frail (7-14 points) where, despite enjoying autonomy, there is risk of functional loss; and frail (≥15 points), including older individuals exhibiting functional decline and disabilities that affect

autonomy[16]. The EFS measures 9 domains across 11 items scored 0-17. A final score of 0-4 indicates no frailty; 5-6, defines apparently vulnerable for frailty; 7-8, mild frailty; 9-10, moderate frailty; and ≥11, severe frailty[9,10].

The results for frailty status were dichotomized into 2 levels: Not Frail (final score <15) on IVCF-20, including robust older individuals and those at risk of frailty (pre-frail); and Frail (final score ≥15[16]). Using the EFS, Not Frail was defined for final score ≤6, including "non-frail" older individuals and "vulnerable"; and Frail (final score >6) including those with mild, moderate and severe frailty"[9,10].

Similarly, social, demographic and economic variables, as well as the morbidity and health-related care characteristics assessed, were also dichotomized: sex (male x female), age group (≤84 x ≥85 years), marital status (with partner, including married and de facto partnership x no partner, including single, widowed and divorced), family arrangement (lives alone x lives with others), formal education (≤ 4 x >4 years), literacy (can read x cannot read), own income (yes x no), monthly family income (≤ 1 minimum wage x > 1 minimum wage), presence of self-reported chronic morbidities (arterial hypertension, diabetes mellitus, heart disease, osteoarticular disease, neoplasia, stroke), polypharmacy – defined by regular use of ≥5 medications (yes x no) and self-rated health assessed by the question "How would you rate your health status?". Choice of answers were: "Very good"; "Good"; "Fair"; "Poor"; and "Very poor". For analysis, a positive perceived health status included the answers "Very good" and "Good", whereas a negative status included "Fair", "Poor" and "Very poor", attributions consistent with those used by a similar study on the subject[17]. Other parameters assessed were reported weight loss (yes x no), presence of caregiver (yes x no), fall in past 12 months (yes x no), and hospitalization in past 12 months (yes x no).

For data analysis, a descriptive analysis of the frequency distribution of independent variable was performed. The prevalence of frailty was also estimated for the 2 instruments. For the analysis of normality of the variables, the Kolmogorov-Smirnov was employed. In order to analyze the accuracy of the IVCF-20 as compared to the EFS, the sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated, evaluating rates of false-positive, false-negative, true-negative and true-positive cases. Interpretation of the data was performed, defining sensitivity as a percentage of correctly identified frail participants and specificity as percentage of correctly identified non-frail individuals. The PPV was defined as the percentage of positive tests that correctly identified non-frail individuals. Sensitivity and specificity values ≥ 50% were deemed adequate, values of 51-69% poor/limited accuracy and >70% good accuracy. The Kappa statistic was applied to check level of agreement between the instruments for the dichotomization of frailty (frail x non-frail). For analysis of the results of the Kappa statistic, values were interpreted according to Landis & Koch[18]. A final level of significance of 5% ($p<0.05$) was adopted for all analyses. The data collected were analyzed using the Statistical Package for the Social Sciences (SPSS), version 20 (SPSS for Windows, Chicago, USA).

All participants were provided with explanations about the study and agreed to take part by signing the Free and Informed Consent Form. The study project was approved by the local Research Ethics Committee, officially regulated by Permit no. 1.629.395 in compliance with Resolution no. 466/2012 of the National Board of Health/Ministry of Health.

RESULTS

A total of 92 community-dwelling oldest-old individuals took part in this study. Most of the study participants (58,7%) were aged 80-84 years. Regarding sample characteristics, 64,1% were female, 68,5% lived alone and 80,4% had ≤4 years of education. Overall, 70,7% of participants had no caregiver, 73,9% hypertension, 52,2% negative self-rated health, 39,1% reported falls in past 12 months, and 82,6% had a medical consultation in past 12 months. Characteristics of the group are presented in Tables 1 and 2, which show similar prevalence for independent variables on the 2 instruments.

Table 1. Sociodemographic and economic characteristics of community-dwelling oldest-old, according to Edmonton Frail Scale (EFS) and Clinical-Functional Vulnerability Index (IVCF-20) (N=92). Montes Claros, Minas Gerais, 2017.

Independent Variables	Sample	Frail on EFS		P-value	Frail on IVCF-20		P-value
		Yes	No		Yes	No	
	n (%)	n (%)	n (%)		n (%)	n (%)	
Sex				0.455			0.642
Male	33 (35.9)	13 (39.4)	20 (60.6)		14 (42.4)	19 (57.6	
Female	59 (64.1)	28 (47.5)	31 (52.5)		28 (47.5)	31 (52.5)	
Age Group				<0.001			<0.001
≤ 84 years	54 (58.7)	15 (27.8)	39 (70.2)		16 (29.6)	38 (70.4)	
≥ 85 years	38 (41.3)	26 (68.4)	12 (31.6)		26 (68.4)	12 (31.6	
Marital status				0.973			0.428
With partner	29 (31.5)	13 (44.8)	16 (55.2)		15 (51.7)	14 (48.3)	
Without partner	63 (68.5)	28 (44.4)	35 (55.6)		27 (42.9)	36 (57.1)	
Family Arrangement				0.633			0.574
Lives alone	13 (14.1)	05 (38.5)	08 (61.5)		05 (38.5)	08 (61.5)	
Lives with other(s)	79 (85.9)	36 (45.6)	43 (54.4)		37 (46.8)	42 (53.2)	
Education				0.008			0.026
≤ 4 years	74 (80.4)	38 (51.4)	36 (48.6)		38 (51.4)	36 (48.6)	
> 4 years	18 (19.6)	03 (16.7)	15 (83.3)		04 (22.2)	14 (77.8)	
Can read				0.037			0.293
Yes	60 (65.2)	22 (36.7)	38 (63.3)		25 (41.7)	35 (58.3)	
No	32 (34.8)	19 (59.4)	13 (40.6)		17 (53.1)	15 (46.9)	
Own income				0.421			0.397
No	04 (04.3)	01 (25.0)	03 (75.0)		01 (25.0)	03 (75.0)	
Yes	88 (95.7)	40 (45.5)	48 (54.5)		41 (46.6)	47 (53.4)	
Monthly Family Income				0.165			0.914
≤ 1 minimum wage	29 (31.5)	16 (55.8)	13 (44.8)		13 (44.8)	16 (55.2)	
> 1 minimum wage	63 (68.5)	25 (39.7)	38 (60.3)		29 (46.0)	34 (54.0)	
Private health plan				0.466			0.589
Yes	38 (41.3)	14 (36.8)	24 (63.2)		13 (34.2)	25 (65.8)	
No	54 (58.7)	27 (50.0)	27 (50.0)		29 (53.7)	25 (46.3)	
Difficulty accessing health services				0.017			0.076
Yes	39 (42.4)	23 (59.0)	16 (41.0)		22 (56.4)	17 (43.6)	
No	53 (57.6)	18 (34.0)	35 (66.0)		20 (37.7)	33 (62.3)	

The prevalence of high risk of clinical-functional vulnerability, indicating frail status, was 45,7% on the IVCF-20 versus 44,6% on the EFS. The frequency distribution for the IVCF-20 components is given in Table 3, and for the EFS components is presented in Table 4.

With regard to clinical-functional vulnerability profile, 28 (30,4%) participants were classified as low risk, 22 (23,9%) as moderate risk, and 42 (45,7%) as high risk of vulnerability, i.e. frail status on the IVCF-20. Using the EFS, the profile of frailty indicated that 26 (28,3%) participants were not frail, 25 (27,2%)

apparently vulnerable, 26 (28,3%) mild frailty, 13 (14,1%) moderate frailty and 2 (2,2%) had severe frailty.

The Kappa statistic revealed an agreement index of 0.759 (p<0.001), 95%CI=[2.98-13.29] between EFS and IVCF-20 values. Sensitivity, specificity, positive predictive value and negative predictive value were 88,23%, 87,80%, 90,0% and 85,71%, respectively. The rate of accuracy obtained was 88,04% (Table 5).

Table 2. Morbidity and health-related care characteristics of community-dwelling oldest-old, according to Edmonton Frail Scale (EFS) and Clinical-Functional Vulnerability Index (IVCF-20) (N=92). Montes Claros, Minas Gerais, 2017.

Independent Variables	Sample	Frail on EFS		P-value	Frail on IVCF-20		P-value
		Yes	No		Yes	No	
	n (%)	n (%)	n (%)		n (%)	n (%)	
Arterial Hypertension				0.740			0.983
Yes	68 (73.9)	31 (45.6)	37 (54.4)		31 (45.6)	37 (54.4)	
No	24 (26.1)	10 (41.7)	14 (58.3)		11 (45.8)	13 (54.2)	
Diabetes Mellitus				0.394			0.137
Yes	17 (18.5)	06 (35.3)	11 (64.7)		05 (29.4)	12 (70.6)	
No	75 (81.5)	35 (46.7)	40 (53.3)		37 (49.3)	38 (50.7)	
Cardiovascular Disease				0.316			0.031
Yes	33 (35.9)	17 (51.5)	16 (48.5)		20 (60.6)	13 (39.4)	
No	59 (64.1)	24 (40.7)	35 (59.3)		22 (37.3)	37 (62.7)	
Osteoarticular disease				0.098			0.062
Yes	45 (48.9)	24 (53.3)	21 (46.7)		25 (55.6)	20 (44.4)	
No	47 (51.1)	17 (36.2)	30 (63.8)		17 (36.2)	30 (63.8)	
Cancer				0.112			0.041
Yes	16 (17.4)	10 (62.5)	06 (37.5)		11 (68.8)	05 (31.2)	
No	76 (82.6)	31 (40.8)	45 (59.2)		31 (40.8)	45 (59.2)	
Osteoporosis				0.016			0.008
Yes	41 (44.6)	24 (58.5)	17 (41.5)		25 (61.0)	16 (39.0)	
No	51 (55.4)	17 (33.3)	34 (66.7)		17 (33.3)	34 (66.7	
Stroke				0.925			0.154
Yes	07 (07.6)	03 (42.9)	04 (57.1)		05 (71.4)	02 (28.6)	
No	85 (92.4)	38 (44.7)	47 (55.3)		37 (43.5)	48 (56.5)	
Asthma				0.950			0.528
Yes	11 (12.0)	05 (45.5)	06 (54.5)		06 (54.5)	05 (45.5)	
No	81 (88.0)	36 (44.4)	45 (55.6)		36 (44.4)	45 (55.6)	
Polypharmacy				0.012			0.055
Yes	25 (27.2)	15 (60.0)	10 (40.0)		15 (60.0)	10 (40.0)	
No	67 (72.8)	26 (38.8)	41 (61.2)		27 (40.3)	40 (59.7)	
Self-rated health				<0.001			<0.001
Negative	48 (52.2)	34 (70.8)	14 (29.2)		32 (66.7)	16 (33.3)	
Positive	44 (47.8)	07 (15.9)	37 (84.1)		10 (22.7)	34 (77.3)	
Weight Loss				0.289			0.659
Yes	40 (43.5)	18 (45.0)	22 (55.0)		20 (50.0)	20 (50.0)	
No	52 (56.5)	23 (44.2)	29 (55.8)		22 (42.3)	30 (57.7)	

to be continued

Continuation of Table 2

Independent Variables	Sample	Frail on EFS		P-value	Frail on IVCF-20		P-value
		Yes	No		Yes	No	
	n (%)	n (%)	n (%)		n (%)	n (%)	
Has Caregiver				0.022			0.009
Yes	27 (29.3)	17 (63.0)	10 (37.0)		18 (66.7)	09 (33.3)	
No	65 (70.7)	24 (36.9)	41 (63.1)		24 (36.9)	41 (63.1)	
Fall in past 12 months				0.098			0.271
Yes	36 (39.1)	20 (55.6)	16 (44.4)		19 (52.8)	17 (47.2)	
No	56 (60.9)	21 (37.5)	35 (62.5)		23 (41.1)	33 (58.9)	
Medical consultation in past 12 months				0.532			0.701
Yes	76 (82.6)	35 (46.1)	41 (53.9)		34 (44.7)	42 (55.3)	
No	16 (17.4)	06 (37.5)	10 (62.5)		08 (50.0)	08 (50.0)	
Hospital admission in past 12 months				<0.001			0.015
Yes	13 (14.1)	12 (92.3)	01 (07.7)		10 (76.9)	03 (23.1)	
No	79 (85.9)	29 (36.7)	50 (63.3)		32 (40.5)	47 (59.5	

Table 3. Frequency distribution of components of Clinical-Functional Vulnerability Index (IVCF-20) in community-dwelling oldest-old (N=92). Montes Claros, Minas Gerais, 2017.

Components of Clinical-Functional Vulnerability Index	n (%)
Age	
80-84 years	54 (58.7)
≥85 years	38 (41.3)
Self-rated HEALTH (Health compared to others of same age)	
Excellent / Very Good/ Good	54 (58.7)
Fair or Poor	46 (50.0)
Activities of Daily Living (Instrumental)	
Stopped doing shopping	
Yes	38 (41.3)
No	46 (50.0)
Stopped controlling finances	
Yes	41 (44.6)
No	51 (55.4)
Stopped doing small domestic chores	
Yes	42 (45.7)
No	50 (54.3)
Activities of Daily Living (Basic)	
Stopped bathing alone	
Yes	16 (17.4)
No	76 (82.6)
Cognition	
Becoming forgetful	
Yes	30 (32.6)
No	62 (67.4)

to be continued

Continuation of Table 3

Components of Clinical-Functional Vulnerability Index	n (%)
Forgetfulness worsened in recent months	
Yes	22 (23.9)
No	70 (76.1)
Forgetfulness preventing performance of daily activities	
Yes	18 (19.6)
No	74 (80.4)
Mood	
Dispiritedness, sadness or hopelessness in last past	
Yes	33 (35.9)
No	59 (64.1)
Loss of interest or pleasure in previously enjoyable activities	
Yes	24 (26.1)
No	68 (73.9)
MOBILITY (reach, grasp and pincer grip)	
Inability to raise arm above shoulder level	
Yes	11 (12.0)
No	81 (88.0)
Unable to hold or handle small objects	
Yes	9 (09.8)
No	83 (90.2)
Aerobic and/or muscle capacity	
Unintentional weight loss/ BMI <22 kg/m²/ calf circumference <31 cm or gait speed test time (4m) >5 sec	
Yes	17 (18.5)
No	75 (81.5)
Gait	
Walking difficulty preventing daily activities	
Yes	37 (40.2)
No	55 (59.8)
≥2 falls in past year	
Yes	18 (19.6)
No	74 (80.4)
Urinary/Fecal Continence	
Involuntary loss of urine or feces	
Yes	39 (42.4)
No	53 (57.6)
Communication	
Vision problems	
Yes	29 (31.5)
No	63 (68.5)
Hearing problems	
Yes	32 (34.8)
No	60 (65.2)
Multiple comorbidities	
Polypathology polypharmacy/ recent hospitalization (< 6 months)	
Yes	23 (25.0)
No	69 (75.0)

Table 4. Frequency distribution of components of Edmonton Frail Scale (EFS) in community-dwelling oldest-old people (N=92). Montes Claros, Minas Gerais, 2017.

Components of Edmonton Frail Scale	n (%)
Cognition (Clock Drawing Test)	
No errors	07 (07.6)
Failed minor errors	05 (05.4)
Failed with major errors	80 (87.0)
General health status (hospital admissions in past 12 months)	
None	79 (85.9)
1-2	10 (10.9)
>2	03 (03.2)
Sell-rated health	
Excellent / Very Good / Good	44 (47.8)
Fair	41 (44.6)
Poor	07 (07.6)
Functional Independence (Activities needing help)	
0-1	37 (40.2)
2-4	54 (58.7)
5-8	01 (01.1)
Social Support (When needing help, can count on someone)	
Always	85 (92.4)
Sometimes	05 (05.4)
Never	02 (02.2)
Medications use (≥5)	
No	62 (67.4)
Yes	30 (32.6)
Forget to take medications	
No	65 (70.7)
Yes	27 (29.3)
Nutrition (Weight loss)	
No	72 (78.3)
Yes	20 (21.7)
Mood (Sad or depressed)	
No	69 (75.0)
Yes	23 (25.0)
Urinary incontinence	
No	59 (64.1)
Yes	33 (35.9)
Functional Performance (Timed “stand-to-walk”)	
0-10 seconds	15 (16.3)
11-20 seconds	41 (44.6)
> 20 seconds	36 (39.1)

Table 5. Analysis of agreement for frailty classification, according to Clinical-Functional Vulnerability Index (IVCF-20) and Edmonton Frail Scale, in community-dwelling oldest-old people (N=92). Montes Claros, Minas Gerais, 2017.

	Edmonton Frail Scale		
	Not Frail	Frail	Total
Clinical-Functional Vulnerability Index-20	n (%)	n (%)	
Not Frail	45(a) (90.0)	05(b) (10.0)	50
Frail	06(c) (14.3)	36(d) (85.7)	42

S=a/(a+c)=88.23%; E=d/(b+d)=87.80%; PPV=a/(a+b)=90.0%; NPV=d/(c+d)=85.71%; accuracy=a+d/(a+b+c+d)=88.04%; Kappa=0.759 95%CI=[2.98-13.29] (p<0.001).

DISCUSSION

This study found good accuracy of the IVCF-20 as compared with the EFS and strong agreement between the two instruments in the screening and measuring of frailty in the oldest-old community-dwelling individuals assessed. The prevalence of frailty detected in the group was slightly higher when using the IVCF-20. Previous studies[11,12] applying the same two instruments concomitantly among older individuals aged ≥60 years have found major disparities in values. The current results suggest the instruments correlated more closely for identifying frailty in the oldest-old population assessed.

Older individuals scoring ≥15 are classified as frail, with the IVCF-20 exhibiting high sensitivity of over 88% and specificity exceeding 87% This high sensitivity is desirable where, ideally, screening instruments should be sufficiently sensitive to detect the majority of individuals with frailty (false negatives).

The strong agreement between the IVCF-20 and EFS reflects the relevance and similarity of the main constituent components making up the instruments[7,9,10,15]. The IVCF-20[7,15] contains 8 sections probing age, self-rated health, functional disabilities, cognition, mood, mobility, communication and multiple comorbidities. The EFS[9,10] covers 9 domains: cognition, general health status, functional independence, social support, medication use, nutrition, mood, urinary continence and functional performance.

It is important to note the differences among some of the components of the two instruments. While the IVCF-20[7,15] contains the components "Age" and "Communication", the EFS[9,10] has "Social Support". Moreover, similar components are treated differently. For example, "Cognition" as assessed by the IVCF-20[7,15] involves memory via forgetfulness, whereas the EFS[9,10] uses the Clock Drawing Test (CDT). This component of the EFS[9,10] warrants attention. The low performance on the CDT seen in the oldest-old respondents of the present study might be explained by difficulties not necessary associated with cognitive deficit[10], given that 87,0% failed with significant errors and 80.4% had ≤4 years of education. The low educational level in oldest-old individuals can negatively distort the identification and measurement of frailty when using the EFS, promoting a high estimate of frailty prevalence, since the CDT requires prior knowledge of numbers[10].

The items "hospitalization" and "self-rated health" are also addressed differently by the 2 frailty screening instruments. The IVCF-20[7,15] asks whether the hospitalization occurred or not in the past 6 months under the component "multiple comorbidities". The EFS[9,10], on the other hand, records the number of times admitted to a hospital in the past 12 months under the component "general health status". Regarding "self-rated health", the IVCF-20[7,15] stratifies response into 2 levels ("Excellent/Very good/Good" and "Fair or Poor"), assessing this status relative to other individuals of the same age. The EFS[9,10], however, stratifies this parameter into 3 levels ("Excellent/Very good/Good", "Fair" and "Poor").

With respect to "activities of daily living" or "functional independence", there are also differences between the instruments. The IVCF-20[7,15] addresses each of the following activities individually: "doing

shopping", "handling money", "perform light household chores", "take a bath alone". The EFS[9,10], however, attributes a single score to all activities as a whole: "meal preparation, shopping, transportation, telephone, housekeeping, laundry, managing money and taking medication".

The instruments also differ for other specificities. The IVCF-20[7,15] addresses polypathology in the "multiple comorbidities" component, while the EFS[9,10] features the component "medication use" to probe forgetting to take medications on a regular basis. The IVCF-20[7,15] evaluates whether the time taken on the 4-meter gait speed test exceeds 5 seconds or not. In the component "functional performance" of the EFS[9,10], the timed "stand-to-walk" test is stratified into ">20 seconds", "11-20 s" and "0-10 s" for a 3-meter distance.

The IVCF-20[7,15] also differs to the EFS[9,10] by incorporating the "mobility component", which evaluates the ability to raise arms above shoulder level, handle or grip small objects, body mass index, calf circumference, an ordeal to walk which hampers the performance of routine activities, falls in past year, and fecal incontinence. The IVCF-20[7,15] contains a larger number of components for identifying and measuring frailty in older adults than the EFS[9,10]. Consequently, the IVCF-20 may take longer to assess frailty in older adults. When comparing two instruments which are very similar, the one which takes less time to apply has the edge. Future studies could determine the mean application time of each instrument in the same older respondent to assess frailty.

These results confirm that the instruments have some different features. Nonetheless, the analysis also revealed a positive correlation and strong agreement for measuring frailty in oldest-old community-dwelling individuals. A systematic review on the subject[19] found a lack of consistency in the components of frailty and in the corresponding indictors used to measure these components. The components of frailty and corresponding indicators vary widely across different frailty instruments. Depending on the method employed, the instruments can cover different domains, while each domain may include many elements, measured by a variety of indicators. There is a gap in knowledge on which conditions should be incorporated into instruments to predict frailty and, consequently, improve accuracy for screening older people that actually display frailty[19].

Taken together, the evidence demonstrates that comparing instruments designed for screening and measuring frailty in community-dwelling older adults is important, because this can help in the analysis of their components both individually and as a group. This helps inform both the decision on which instrument can be used immediately in primary care in settings with few specialists in geriatrics[11], and also toward refining or creating instruments with better sensitivity and flexibility[20]. The IVCF-20 and EFS tools were shown to have similar characteristics, despite the differences outlined. Further studies are warranted to assess the pertinence of each instrument in the work process of Family Health (Primary Care) Teams. Both instruments can be used for screening and may be useful to health teams, highlighting those components which most impact the development of frailty in older patients and allowing timely detection of components that require specialist care.

This study has some limitations. The main limitation was not performing a Comprehensive Geriatric Assessment (CGA) for the sample of older individuals aged ≥80 years included in the study. Comparing the IVCF-20 and EFS against the CGA could yield other information useful for devising a more appropriate instrument for use by researchers and clinicians, given there is currently no universal standard instrument for measuring frailty in older adults. It is also Important to bear in mind that some components of the 2 instruments are self-reported and rely on respondent memory or that of their carer. Nonetheless, it is worth highlighting that this study included a random representative sample of community-dwelling older people aged 80 or over which was carefully assessed by validated, reliable instruments applied in many previous studies.

CONCLUSION

The IVCF-20 and EFS instruments exhibited good accuracy and strong agreement when applied to community-dwelling oldest-old individuals. The prevalence of frailty detected was higher for the IVCF-20. This result shows that the instruments

assessed are largely similar for identifying frailty in community-dwelling oldest-old.

AUTHORSHIP

- Tahiana Ferreira Freitas - conception and design, writing of article, critical review and approval of final version for publication.
- Walker Henrique Viana Caixeta - critical review, approval of final version for publication.
- Ronilson Ferreira Freitas - critical review and approval of final version for publication.
- Antônio Prates Caldeira - concepção e delineamento, revisão crítica e aprovação da versão a ser publicada.
- Fernanda Marques da Costa - concepção e delineamento, análise e interpretação dos dados, revisão crítica e aprovação da versão a ser publicada.
- Jair Almeida Carneiro - concepção e delineamento, análise e interpretação dos dados, revisão crítica e aprovação da versão a ser publicada.

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Functional status and associated factors in older persons living on the island of Fernando de Noronha: a cross-sectional study

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Abstract

Objective: To analyze the functional status profile and associated factors in older persons living on Fernando de Noronha Island/Pernambuco, Brazil. *Method:* This was a cross-sectional, analytical study, and data collection was conducted between August and October 2019. The study population comprised 176 older persons living on the island. The collection protocol was applied through an interview to respond to the behavior of demographic, social, clinical and environmental variables, and to the assessment instruments. The functional status was determined from the Analysis of Latent Classes, evaluated by the protocols of the domains: cognition, mood, instrumental activities of daily living, mobility and communication. *Results:* The chosen analysis model had two classes, named as: "Good autonomy and independence" and "Moderate autonomy and partial dependence". Most older persons had good functional status and the associated factors were: being male, being separated or divorced, living alone, visiting friends or relatives, having worked more than 36 years, being literate, not having a visual or hearing impairment, taking one or two medications and having a history of falls. *Conclusion:* The functional status of island older persons was presented as a multifactorial phenomenon, as demographic, social and clinical factors remained independently associated with good functionality. It is important that the maintenance of the functional state is encouraged in the implementation of public policies aimed at the specificities of populations residing on islands.

Keywords: Aged. Islands. Functional status. Activities of daily living. Personal autonomy.

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INTRODUCTION

Functional status constitutes a crucial component for successful aging and was initially described as the ability to perform basic activities of daily living (BADLs) and instrumental activities of daily living (IADLs) in an independent manner[1]. The World Health Organization (WHO)[2] conceptualizes functional status as a combination of two components: functional ability and intrinsic capacity. In this context, functional ability denotes the meeting of basic needs to ensure standard of living, learning, decision-making, mobility, building/maintaining relationships, and contribution to society. Intrinsic capacity refers to the composite of all physical and mental capacities: physical movement, vitality, cognition, and psychological and sensory capacity.

More recently, the term Functional Status has been included as the descriptor of the official list of Descritores em Ciências da Saúde (DECS) – Health Sciences Descriptors, and is defined as the ability for basic physical and cognitive activities such as walking or reaching, focusing attention, and communicating, and for life situations such as school or play/leisure, work outside the home or maintaining a household.

The use of functional status as an indicator of health of older populations is important for health policy planning. Public authorities should join forces to promote healthy aging, by preserving functional status and maintaining quality of life of older adults[4] in different social contexts.

Minority isolated populations, either geographically, ethnically or culturally, should be respected, and their lifestyles, socioeconomic and health status elucidated[5]. Among the different circumstances in which older people live, the situation of the geographical isolation of island dwellers has been little explored[6].

Islands are associated with the notion of vulnerability and permanent dependence. Numerous difficulties and potentialities can be found on islands, particularly those covering a small land mass. These areas are fertile ground for conducting scientific studies[7,8].

Brazil has only one inhabited oceanic island, a status conferred for its geographic isolation, namely, Fernando de Noronha (part of Pernambuco state). From a scientific standpoint, little is known about the older population living on this island. Although the older population represents a small minority (3.7% of general population), the Aging Index is rising steadily as the older contingent on the island continues to grow[9].

Determining the profile of functional status of older individuals and identifying its associated factors is important for interventions for health promotion, prevention and control of health conditions in this group. Therefore, the objective of the present study was to analyze functional status and its associated factors in older individuals from Fernando de Noronha Island, Pernambuco state.

METHOD

An analytical cross-sectional study, previously approved by the Research Ethics Committee under permit no. 3.371.307, was conducted.

The study population comprised individuals aged >60 years who had lived on the island of Fernando de Noronha, Pernambuco state for at least 1 year and were registered at the island´s only Family Health Clinic. Fernando de Noronha island is considered a district of Pernambuco state. Exclusion criteria were older individuals not present on the island at the time of the study, and subjects who failed to fully complete the collection protocol.

Data collection was carried out between August and October 2019. The interview and application of instruments for the assessment of functional status were performed during home visits from community health workers by a trained, degree-qualified professional. The tests assessing cognition, mood, ADLs and mobility were conducted together with the older individual. Communication was evaluated based on answers given by the caregiver or family member[10]. In cases of cognitive impairment or other impediment, the questions were addressed to the caregiver or family member, since the study sought not to exclude participants with low functional status.

The data collection protocol consisted of a questionnaire devised by the authors covering 43 independent variables plus validated assessment instruments. Information was collected from participants on social characteristics (sex, years living on the island, age, race/color and marital status), demographics (main source of income, main breadwinner, number of people sharing household, water supply, literacy, time working, education, religion, health care, participation in group of representatives, visits friends or relatives, channel of information), clinical status (Systemic Arterial Hypertension – SAH, diabetes, osteopenia/osteoporosis, visual deficit, hearing deficit, number of comorbidities, history of falls in past year, number of medications used, physical exercise, body mass index (BMI), leisure, general health status rating, nutritional health status rating, alcohol and tobacco use) and environmental aspects (quality public transportation, main mode of transport used and frequency of leaving house). The interview entailed applying the closed digital questionnaire, allowing data collection via tablets.

Given the difficulty measuring the dependent variable (functional stratus) through direct observation of performance on activities, Latent Class Analysis was performed. In this process, functional status was the latent phenomenon which was not observed directly, but measured indirectly by the protocols for the domains proposed by Moraes (2012) and adapted for the present study[11].

The concept of Moraes (2012) was adapted by including the assessment of IADLs among the domains: cognition, mood, mobility and communication, given that autonomy and independence are important for carrying out daily activities. The domains of functional status of participants were measured using the tests: Mini-Mental State Exam[12], Geriatric Depression Scale short[13], Lawton & Brody scale[1], Short Physical Performance Battery[14], and the ASHA FACS protocol[10].

The profiles of functioning were identified according to the homogeneity of responses of the population, found in models with different numbers of classes[15]. The final categorization of each instrument used in the assessment of each of the 5 domains was determined.

The following statistical criteria were employed to select the optimal statistical model of the latent variable: Akaike information criterion (AIC), Bayesian information criterion (BIC) and adjusted BIC, observing the lowest values when comparing the k models with k-1 class. The highest entropy value was also considered. On the assessment of statistical significance ($p<0.05$) for evaluating the LCA models, three likelihood ratio tests (LRTs) were used: the Lo, Mendell and Rubin likelihood ratio test (LMR-LRT), the Vuong, Lo, Mendell and Rubin likelihood ratio test (VLMR-LRT) and the Bootstrap likelihood ratio test (BLRT).

Data analysis was carried out using descriptive and analytical procedures. Initially, quantitative independent variables were transformed into qualitative variables and their absolute and relative frequency determined.

Pearson´s chi-square test or Fisher´s Exact test was used among qualitative and dependent variables, with a 5% significance level, together with the Standardized Residuals analysis with one-tailed test and standardized large values of over 1.96 ($p<0.025$ one-tailed).

Simple analysis revealed whether the distribution of demographic, social, clinical and environmental factors, according to functional status, was random or a pattern determined by dependence among the variables. Standardized Residual Analysis between dependent and independent variable category pairs enabled comparison of characteristic patterns of each category.

Measures of effect were calculated to check the magnitude and direction of the association of factors related to functional status, and were expressed as Odds Ratio (OR) and respective 95% Confidence Intervals. Binary logistic regression models were constructed and confounding factors were controlled using the analytical approach.

Thus, for the multiple analysis, variables with p-value <0.25 on the chi-square test were elected and the other conclusions reached for a 5% significance level. After applying the stepwise forward method, variables with $p<0.05$ remained. The choice of final model was based on the highest number of

significant variables, lowest confidence interval values, highest log-likelihood value, a Nagelkerke R^2 value nearest 1, and >0.05 significance on the Hosmer and Lemeshow test, besides the possibility of the existence of a fit variable.

RESULTS

A total of 176 older adults of both genders from Fernando de Noronha island took part in the study. From the initial sample of 241 older users followed at the health clinic, 65 individuals were excluded: 61 for being away from the island during the study and 4 for not having at least one of the domains of functional status assessed, not having fully completed the collection protocol.

Functional status of the participants was determined using the 5-model test for LCA. The most parsimonious model identified was that containing 2 classes, exhibiting significant LRT values, along with lower AIC. BIC and adjusted BIC values (Table 1).

Naming of the 2 classes found was derived from the analysis of response patterns in each of the 5 protocols applied to assess functional status. The response patterns identified in the population analyzed were: normal cognition and cognitive decline (Cognition); absence of Depression and possible Depression (Mood); partial dependence and total independence (IADLs); moderate capacity and good capacity (Mobility), and; no assistance and moderate assistance (Communication) (Table 2).

Names were attributed according the 2 patterns of responses. Class 1, denoted "Good autonomy and independence", had a high response rate for: normal cognition, absence of depression (normal mood), total independence for IADLs, good mobility, and lower response rate for moderate assistance in communication, compared to Class 2. Class 2 was called "Moderate autonomy and partial dependence", and had lower response rate for: normal cognition, absence of depression (normal mood), and good mobility; and higher response rate for moderate assistance in communication compared to Class 1. In addition, Class 2 had a high response rate for partial dependence in IADLs (Table 2).

With regard to functional profile of the study population, the prevalence of good autonomy and independence among the older islanders was 80.7%, whereas the percentage exhibiting moderate autonomy and partial independence was 19.3%.

The population of older individuals investigated was characterized according to social, demographic, clinical and environmental variables. Regarding demographic aspects, of the 176 individuals analyzed, most (78.4%) were aged 60-69 years, i.e. young-old adults. Mean age was 66 years (range 60-99 years).

In terms of gender distribution, there was a slight predominance of females (51.1%) over males (48.9%). For skin color, 31.3% were white, 66.5% black/brown, and 2.8% yellow or indigenous. Regarding marital status, 48.3% were married, 22.7% single, and 16.5% widowed (Table 3).

Table 1. Analyses of models with different patterns of responses on LCA. Fernando de Noronha, Pernambuco state, 2019.

Number of Classes	Model 2	Model 3	Model 4	Model 5	Model 6
AIC	909,005	916,199	921,966	929,313	938,876
BIC	943,881	970,097	994,888	1,021,257	1,049,843
Adjusted BIC	909,046	916,263	922,052	929,422	939,006
Entropy	0.613	0.833	0.934	0.902	0.915
LRT VLMR-LRT	$p = 0.0200$	$p = 0.3693$	$p = 0.1531$	$p = 0.1038$	$p = 0.3701$
LRT LMR-LRT	$p = 0.0226$	$p = 0.3801$	$p = 0.1583$	$p = 0.1089$	$p = 0.3806$
LRT BLRT	$p = 0.0000$	$p = 1.0000$	$p = 1.0000$	$p = 0.5000$	$p = 0.5000$

Legend: LCA – Latent Class Analysis; AIC - Akaike Information Criterion; BIC - Bayesian Information Criterion; LRTs – Likelihood Ratio Tests; LMR-LRT - Lo, Mendell & Rubin Likelihood Ratio Test; VLMR-LRT - Vuong, Lo, Mendell & Rubin Likelihood Ratio Test; and BLRT - Bootstrap Likelihood Ratio Test.

Table 2. Distribution for response patterns on each domain of functional status, according to result on Latent Class Analysis. Fernando de Noronha, Pernambuco state, 2019.

Domains and categories	Total	Latent Classes of Functional Status**	
	n (%)	Class 1 – Good autonomy and independence	Class 2 – Moderate autonomy and partial dependence
Cognition			
Normal cognition	123 (69.9)	73.6%	57.9%
Cognitive decline	53 (30.1)	26.4%	42.1%
Mood			
Absence of depression	117 (66.5)	79.4%	72.9%
Possible depression	39 (33.5)	20.6%	27.1%
IADLs*			
Total independence	130 (73.9)	87.5%	29.6%
Partial dependence	46 (26.1)	12.5%	70.4%
Mobility			
Moderate capacity	17 (9.7)	0%	41.0%
Good capacity	159 (90.3)	100.0%	59.0%
Communication			
Moderate assistance	127 (72.2)	70.0%	93.6%
No assistance	43 (24.4)	30.0%	6.4%

Legend: * IADLs: Instrumental Activities of Daily Living.

Table 3. Distribution of demographic and social variables according to functional status of participants. Fernando de Noronha, Pernambuco, 2019.

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
DEMOGRAPHIC				
Sex				**0.001***
Male	86(48.9)	8 (23.5)	**78 (54.9‡)**	
Female	90 (51.1)	**26 (76.5‡)**	64 (45.1)	
Years living on island				0.127
Below median (≤39)	88 (50.0)	13 (38.2)	75 (52.8)	
Above median (>39)	88 (50.0)	21 (61.8)	67 (47.2)	
Age in categories				**0.000***
60-69 years	138(78.4)	19 (55.9)	**119 (83.8‡)**	
70 years	38 (21.6)	**15 (44.1‡)**	23 (16.2)	
Race/ Color				0.373
White	54 (30.7)	9 (26.5)	45 (31.7)	
Black/Brown	117 (66.5)	23 (67.6)	94 (66.2)	
Yellow or Indigenous	5 (2.8)	2 (5.9)	3 (2.1)	

to be continued

Continuation of Table 3

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
Marital status				**0.001***
Married	85 (48.3)	12 (35.3)	73 (51.4)	
Single, separated or divorced	62 (35.2)	9 (26.5)	53 (37.3)	
Widowed	29 (16.5)	**13 (38.2‡)**	16 (11.3)	
SOCIAL				
Main source of income				**0.001†**
Formal/informal work	100 (56.8)	11 (32.4)	**89 (62.7‡)**	
Retirement/social security benefit	51 (29.0)	10 (29.4)	41 (28.9)	
Pension	15 (8.5)	**7 (20.6‡)**	8 (5.6)	
Third-party	10 (5.7)	**6 (17.6‡)**	4 (2.8)	
Main breadwinner				**0.000***
Older individual and family member	86 (48.9)	11 (32.4)	**75 (52.8‡)**	
Older individual	71 (40.3)	12 (35.3)	59 (41.5)	
Other family member	19 (10.8)	**11 (32.4‡)**	8 (5.6)	
Number of people sharing household				0.098
1	42 (23.9)	5 (14.7)	37 (26.1)	
2	54 (30.7)	8 (23.5)	46 (32.4)	
≥3	80 (45.5)	21 (61.8)	59 (41.5)	
Water supply				**0.002***
Well or spring	8 (4.5)	**5 (14.7‡)**	3 (2.1)	
Mains network	168 (95.5)	29 (85.3)	**139 (97.9‡)**	
Literacy				**0.000***
Yes	146 (83.0)	20 (58.8)	**126 (88.7‡)**	
No	30 (17.0)	**14 (41.2‡)**	16 (11.3)	
Education				**0.001†**
No formal education	11 (6.3)	**6 (17.6‡)**	5 (3.5)	
1-3 years	14 (8.0)	4 (11.8)	10 (7.0)	
4-7 years	50 (28.4)	14 (41.2)	36 (25.4)	
>7 years	101 (57.4)	10 (29.4)	**91 (64.1‡)**	
Time working				**0.000***
0-35 years	37 (21.0)	**18 (52.9‡)**	19 (13.4)	
> 36 years	139 (79.0)	16 (47.1)	**123 (86.6‡)**	
Health care				0.114
Hospital	96 (54.5)	23 (67.6)	73 (51.4)	
Health Clinic	47 (26.7)	8 (23.5)	39 (27.5)	
Pharmacy	18 (10.2)	0 (0.0)	18 (12.7)	
Other	15 (8.5)	3 (8.8)	12 (8.5)	

to be continued

Continuation of Table 3

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
Participation in group of representatives				0.214
Yes	34 (19.3)	4 (11.8)	30 (21.1)	
No	142 (80.7)	30 (88.2)	112 (78.9)	
Visits friends or relatives				**0.010***
Yes	92 (52.3)	11 (32.4)	**81 (57.0‡)**	
No	84 (47.7)	**23 (67.6‡)**	61 (43.0)	
Religion				**0.024┼**
Protestant/Evangelist	63 (35.8)	**18 (52.9‡)**	45 (31.7)	
Catholic	88 (50.0)	15 (44.1)	73 (51.4)	
Spiritist or other religion	7 (4.0)	1 (2.9)	6 (4.2)	
No religion	18 (10.2)	0 (0.0)	**18 (12.7‡)**	
Channel of information				**0.019***
TV	103 (58.5)	**25 (73.5‡)**	78 (54.9)	
Internet	61 (34.7)	5 (14.7)	**56 (39.4‡)**	
Radio, Newspaper/Magazine, other	12 (6.8)	4 (11.8)	8 (5.6)	
TOTAL	**176 (100.0)**	**34 (19.3)**	**142 (80.7)**	

Legend: n: number of participants; *Chi-square test; ┼ Fisher Exact test; ‡ standardized residuals > 1.96 p < 0.05

On the analysis of social conditions, 83% of participants were literate. Regarding number sharing household: 23.9% lived alone, 30.7% lived with one other person, and 45.5% lived with 2 people or more. For time working, 79% had worked for over 35 years (Table 3).

In terms of pertinent clinical conditions, 35.2% had visual deficit, 14.8% hearing deficit, and 35.8% had at least one fall in the past year. Regarding lifestyle and number of medications used, 25% used no medications, 40.3% 1 or 2 medications, and 34.7% used 3 or more medications (Table 4).

On the simple analysis, the factors associated with functional status were identified: age, sex, marital status, literacy, main source of income, main breadwinner, time working, education, water supply, information channel, religion, SAH, diabetes, osteopenia/osteoporosis, visual deficit, hearing deficit, number of comorbidities, number of medications used, remaining teeth, physical exercise, BMI, visits friend or relatives, leisure, general health rating, alcohol use, quality public transportation, main mode of transport used, and frequency leaving the home.

Of the 43 variables analyzed, 41 yielded p-values<0.25 and were included in the multiple model test. Subsequently, 10 variables remained independently associated with functional status. The final model was selected based on the highest number of significant variables, lowest values for confidence intervals, highest log-likelihood value, a Nagelkerke R^2 value nearest 1, and $p>0.05$ significance on the Hosmer and Lemeshow test (Table 5).

Table 4. Distribution of clinical and environmental variables according to functional status of participants, Fernando de Noronha, Pernambuco state, 2019.

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
CLINICAL - MORBIDITY				
Diabetes mellitus				**0.048***
Yes	53 (30.1)	**15 (44.1‡)**	38 (26.8)	
No	123 (69.9)	19 (55.9)	**104 (73.2‡)**	
SAH				**0.034***
Yes	101 (57.4)	**25 (73.5‡)**	76 (53.5)	
No	75 (42.6)	9 (26.5)	**66 (46.5‡)**	
Osteopenia/Osteoporosis				**0.004***
Yes	21 (11.9)	**9 (26.5‡)**	12 (8.5)	
No	155 (88.1)	25 (73.5)	**130 (91.5‡)**	
Visual deficit				**0.045***
Yes	62 (35.2)	**17 (50.0‡)**	45 (31.7)	
No	114 (64.8)	17 (50.0)	**97 (68.3‡)**	
Hearing deficit				**0.007***
Yes	26 (14.8)	**10 (29.4‡)**	16 (11.3)	
No	150 (85.2)	24 (70.6)	126 (**88.7‡**)	
Number of comorbidities				**0.005***
0	13 (7.4)	3 (8.8)	10 (7.0)	
1	39 (22.1)	1 (2.9)	**38 (26.8‡)**	
2	42 (23.9)	6 (17.6)	36 (25.4)	
≥3	82 (46.6)	**24 (70.6‡)**	58 (40.8)	
History of falls in past year				0.207
0	113 (64.2)	25 (73.5)	88 (62.0)	
≥1	63 (35.8)	9 (26.5)	54 (38.0)	
CLINICAL – LIFE STYLE				
Physical exercise				**0.006***
Inactive (<3 days)	108 (61.4)	**29 (85.3‡)**	79 (55.6)	
Active (3-4 days)	28 (15.9)	3 (8.8)	25 (17.6)	
Active (≥5 days)	40 (22.7)	2 (5.9)	**38 (26.8‡)**	
Sleep per night (hours)				0.196
Below median (≤7)	90 (51.1)	14 (41.2)	76 (53.5)	
Above median (>7)	86 (48.9)	20 (58.8)	66 (46.5)	
General health status				**0.034***
Excellent or good	120 (68.2)	18 (52.9)	**102 (71.8‡)**	
Fair, poor, very poor	56 (31.8)	**16 (47.1‡)**	40 (28.2)	
Nutritional health status				0.256
Excellent or good	118 (67.0)	20 (58.8)	98 (69.0)	
Fair, poor, very poor	58 (33.0)	14 (41.2)	44 (31.0)	

to be continued

Continuation of Table 4

VARIABLES	TOTAL	FUNCTIONAL STATUS		*p-value*
		Moderate autonomy and partial dependence	Good autonomy and independence	
	n (%)	n (%)	n (%)	
Smoking status				0.381
Smoker	22 (12.5)	2 (5.9)	20 (14.1)	
Non-smoker	72 (40.9)	16 (47.1)	56 (39.4)	
Ex-smoker	82 (46.6)	16 (47.1)	66 (46.5)	
Alcohol use				**0.040***
Non-user	83 (47.2)	21 (61.8)	62 (43.7)	
Ex-user	34 (19.3)	8 (23.5)	26 (18.3)	
User	59 (33.5)	5 (14.7)	**54 (38.0‡)**	
Leisure				0.012*
Yes	106 (60.2)	14 (41.2)	**92 (64.8‡)**	
No	70 (39.8)	**20 (58.8‡)**	50 (35.2)	
Number of medications				0.001*
0	44 (25.0)	5 (14.7)	39 (27.5)	
1-2	71 (40.3)	7 (20.6)	**64 (45.1‡)**	
≥3	61 (34.7)	**22 (64.7‡)**	39 (27.5)	
Body Mass Index				0.009*
Underweight	16 (9.1)	**7 (20.6‡)**	9 (6.3)	
Normal weight	47 (26.7)	4 (11.8)	**43 (30.3‡)**	
Excess weight	113 (64.2)	23 (67.6)	90 (63.4)	
ENVIRONMENTAL				
Quality public transportation				0.009*
Yes	94 (53.4)	**25 (73.5‡)**	69 (48.6)	
No	82 (46.6)	9 (26.5)	**73 (51.4‡)**	
Mode of transport used				0.005*
None	90 (51.1)	9 (26.5)	**81 (57.0‡)**	
Personal/family vehicle	52 (29.5)	14 (41.2)	38 (26.8)	
Taxi, public transport or third	34 (19.3)	**11 (32.4‡)**	23 (16.2)	
Frequency leaving home				0.000*
Always	125 (71.0)	14 (41.2)	**111 (78.2‡)**	
Sometimes	36 (20.5)	11 (32.4)	25 (17.6)	
Rarely	15 (8.5)	**9 (26.5‡)**	6 (4.2)	
TOTAL	176 (100.0)	34 (19.3)	142 (80.7)	

Legend: n: number of participants; Chi-square test; ┼ Fisher Exact test; ‡ standardized residuals > 1.96 $p < 0.05$

Table 5. Multiple analysis of association of functional status of participants with independent variables, odds ratios and estimated confidence intervals, Fernando de Noronha, Pernambuco, 2019.

VARIABLE	Good autonomy and independence		
	OR	CI	*p*-value
Sex			
Male	6.93	(1.471-32.685)	0.014
Female	1.00	-	-
Marital status			
Married	2.82	(0.553-14.355)	0.212
Separated or divorced	**14.87**	(1.212-82.413)	**0.035**
Single	3.24	(0.495-21.195)	0.220
Widowed	1.00	-	-
Number of people sharing household			
1	**5.49**	(1.058-28.560)	**0.043**
2	**5.30**	(1.221-23.016)	**0.026**
≥3	1.00	-	-
Time working			
0-35 years	1.00	-	-
>36 years	**6.38**	(1.622-25.089)	**0.008**
Literacy			
Yes	**13.19**	(2.874-60.535)	**0.001**
No	1.00	-	-
Visits friends or relatives			
Yes	**5.20**	(1.478-18.311)	**0.010**
No	1.00	-	-
Visual deficit			
Yes	1.00	-	-
No	**4.96**	(1.284-19.171)	**0.020**
Hearing deficit			
Yes	1.00	-	-
No	**9.23**	(1.846-46.192)	**0.007**
Number of medications used			
0	3.93	(0.712-21.691)	0.117
1-2	**7.23**	(1.697-30.822)	**0.007**
≥3	1.00	-	-
Falls History			
0 falls	1.00	-	-
≥ 1 fall	**4.72**	(1.200-18.564)	**0.026**
Hours sleep per night*			
Below median (≤7)	3.18	(0.942-10.751)	0.062
Above median (>7)	1.00	-	-

Legend: OR - odds ratio; CI – confidence interval; * fit variable of final model.

Regarding the demographic aspects, sex and marital status were independently associated with functional status. Male participants had a 6.93 times greater chance of having good autonomy and independence compared to females. Subjects who were separated or divorced had a 14.87 times greater chance of having good functional status than individuals who were widowed (Table 5).

For social characteristics, the variables number of people sharing household, time working, visits friends or relatives, and literacy showed an independent association with functional status, as measured by OR analysis. Participants that lived alone (OR=5.49 or with 1 other person (OR=5.30), visited friends or relatives at least twice a week (OR=5.20), had worked for longer than 36 years (OR=6.38) and were literate (OR=13.19), all had a greater chance of exhibiting good autonomy and independence (Table 5).

Of the clinical characteristics assessed, the variables exerting a positive effect on good functional status were: not having visual (OR=4.96) or hearing (OR=9.23) deficits; having at least 1 fall in past year (OR=4.72) and using 1 or 2 medications (OR=7.23), as opposed to using no medication or ≥3 medications (Table 5).

DISCUSSION

Overall, the profile of functional status of the older people from Fernando de Noronha island, Pernambuco state, was good, where 80% exhibited good autonomy and independence. Demographic, social and clinical factors were independently associated with functional status of the older islanders. It is important to point out that the findings of the present study represent the functional status of the participants prior to the COVID-19 pandemic.

Maintaining autonomy and independence during the aging process is a fundamental goal for individuals and public authorities[16]. Functional status can be strongly influenced by a variety of different demographic and socioeconomic factors, associated with the physical and social environments, as well as with life style[2,17].

Some studies carried out on islands have investigated functional status of older residents. However, the situation on isolated (remote) islands such as Fernando de Noronha has been less explored. The findings on the functional status of the older residents of Fernando de Noronha proved similar to that of other populations, albeit with different spatial characteristics of the island.

In a study of the rural community of Yoita city, located on a Japanese island, 84.7% of the 1,274 subjects showed maintenance or improvement in IADLs. Moreover, the authors found that positive self-rated health and cognition predicted protection against decline in functional status[18]. A longitudinal study of 505 older individuals from the city of Tosa, on a large Japanese island, found that 85.7% of participants maintained good functional status, as assessed by performance in BADLs, and that psychological wellbeing can have a favorable effect on maintaining this status[19].

Assessing IADL is an approach commonly used for measuring functional status in a number of studies[18-20]. However, in this type of analysis, key aspects are not considered, such as the domains of cognition, mood, mobility and communication. Disparities in the different methods used hampers comparison of results across studies, highlighting the need for standardizing this measure. Environmental aspects related to the type of community in which the older person lives are also often overlooked in these studies.

With regard to the demographic profile of the older Fernando de Noronha islanders, most were female and younger-old individuals. These data match the profile of the older Brazilian general population, which features more women than men and a predominance of individuals aged 60-69 years[21]. In the present study, however, the proportion of older islanders in this age group was 78.4%, characterizing a larger contingent of younger-old compared to the 55.7% in the Brazilian population as a whole.

This island´s population consisting of predominantly younger-old individuals might be explained by the fact that many individuals whose

functional status declines or who require more intensive care tend to migrate back to the mainland. This occurs because the healthcare available on the island is of lower quality. Also, if the population has not reached more advanced age, it does not manifest significant functional decline, a scenario which can explain the overall good functional status of the islanders assessed. On a national level, migratory movements have led to spatial heterogeneity of aging in the Brazilian population. A phenomenon of "expulsion" of oldest-old individuals from the towns has occurred owing to shortcomings in social policy, health care and social support at older ages[22].

In the present study, the demographic, social and clinical aspects that impact functioning of the older islanders were identified. Sex and marital status were demographic factors retained in the final multiple analysis model. Males were more likely to have good functional status than females, corroborating an earlier study which identified an association between female gender and functional decline[23].

Having separated or divorced status was associated with a 14 times greater probability of having good functional status compared to being a widow/widower. This finding, however, conflicts with the literature. A previous study of community-dwelling Brazilians found that dependence for IADLs and/or BADLs was associated with not having a partner[24]. In the present study, information bias may have occurred due to incorrect classification of individuals in terms of marital status. Alternatively, this may represent a case of reverse causality, whereby more autonomous independent older individuals may be a marker of the categories (separated or divorced) and not of its effect.

With regard to the social variable "time working", participants working for 36 years or longer had a higher probability of having good functional status. Carrying on working, even after retirement, is a characteristic of most of the older people evaluated, likely because of the high cost of living on the island. These data corroborate a 2004 study investigating the socioeconomic and epidemiological profile of the older population on the island, which revealed that 66.3% were engaged in paid work[25]. It is noteworthy that Brazil´s workforce includes a large contingent of older people. The proportion of older individuals that stop working upon retirement is shrinking[26]. On the island of Shikoku, positive self-rated health, self-maintenance of instrumental tasks, and working at least 1 day a week, were strong protective factors against functional decline[27].

Paying visits to friends and relatives at least twice a week was associated with a 5 times greater chance of good functional status. A Brazilian study found that not having formal and informal social network components was associated with disability for performing IADLs and BADLs. According to the authors, not engaging in group social or work activities can play an important role in the deterioration of functioning of older people. The study also revealed that not having family members to rely on and not living with a partner can have a greater impact on older women[28].

By contrast, in the present study, individuals living alone, or with one person, was associated with a 5-fold greater chance of having good functional status than those living with 3 or more others. The present study was cross-sectional, precluding any conclusions on whether number of people sharing the household influenced functional status or otherwise.

This study, besides its design, had some limitations, including memory bias, given that the older participants interviewed could potentially have answered questions inaccurately, while caregivers and family members may also have reported erroneous information on the older subject´s independence for communication. The small sample size and dearth of previous investigations of islanders also limited the discussion of the results of the present study.

Strengths of the study include the fact that it was conducted within a primary care setting and employed validated instruments, designed specifically for assessing older populations, that were both fast and easy to apply. Studies conducted in situations closely reflecting real-life circumstances can help promote the introduction of more effective actions to improve the health of community-dwelling older people.

Being literate correlated with a high likelihood of good functional status, mirroring the findings in the literature. In a study of community-dwelling older individuals, limited formal education was associated with lower cognitive performance, functional disability and frailty[29].

Concerning clinical aspects assessed in the present study, having a history of at least one fall in the past year was associated with greater odds of good functional status, a relationship possibly explained by reverse causality. Older individuals who fall are possibly more exposed to the environment than those who remain housebound. A study of community-dwelling older individuals from Hokkaido island concluded that being homebound predicted functional decline for BADLs, where as those having a history of falls were at greater risk of worse functional status compared to those who were homebound without falls[30].

In the present investigation, using one or two medications, as opposed to not using 3 or more medications, was associated with good functional status. This finding may constitute an information bias, because use of no medications was associated with lower chance of good functional status. Only 7.4% of older islanders reported no comorbidities and 25% of the older population used no medications, indicating possible poor control of diseases and consequent erroneous information. This raises the questions as to whether participants who reported not using any medications should in fact be using them. The literature shows that the use of numerous medications (polypharmacy) is negatively associated with functional status[31,32], a relationship confirmed by the current study.

In the present study, absence of visual or hearing deficits was associated with greater likelihood of good functional status. Impaired vision and hearing can negatively impact social life and physical functioning, while also causing mobility and communication problems and negatively impacting functional status[25].

Overall, few of the variables in the final multiple analysis model were independently associated with functional status, replicating the findings of other studies of older islanders worldwide. Difference among regions (developed or underdeveloped) and settings (rural or urban) might be a more plausible explanation for this phenomenon. Moreover, the spatial status of being on an island was not explored by studies in community-dwelling older people.

Continued participation in social, economic, cultural, spiritual and community affairs characterizes active aging[16,33]. To this end, stimulating improvement in the physical and social environment, mobilizing groups and individuals to support health, and greater dissemination of knowledge and skills toward promoting and protecting health of older people are critical.

Further studies should be conducted to elucidate the possible differences in factors affecting older islanders, particularly for islands that are smaller, more remote and with sparse populations, as is the case for Fernando de Noronha. It is important that, in any social setting of older people, actions to help maintain functional status during the aging process be fostered, along with the implementation and improvement of public policies for community-dwelling older adults, including those who live on islands.

CONCLUSION

The majority of the older islanders from Fernando de Noronha had good autonomy and independence. Functional status was shown to be a complex multifactorial phenomenon, in as far as demographic, social and clinical factors were independently associated with good functioning.

The variables sex, marital status, number sharing the household, time working, literacy, visits friends or relatives, visual and hearing deficits, number of medications used, falls history, and hours sleep per night all proved factors associated with good autonomy and independence in older Fernando de Noronha islanders.

Identifying the factors which positively influence functional status of older individuals from Fernando de Noronha is valuable for promoting the implementation of public policies addressing the specificities of the local population.

Lastly, the study findings highlight the importance of further investigating this small community population, isolated from the continent, residing on Brazil´s only inhabited oceanic island.

AUTHORSHIP

- Amanda Maria Santiago de Mello – conception, data analysis and interpretation, writing and critical review of article; approval of version for publication; and involvement in all aspects of the study, vouching for issues related to the accuracy or integrity of any part of the work.
- Rafael da Silveira Moreira – data analysis and interpretation, critical review, approval of version for publication.
- Vanessa de Lima Silva – conception, design, data analysis and interpretation, writing or critical review of article; approval of version for publication.

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Risk of falls and its associated factors in hospitalized older adults

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Abstract

Objective: To analyze the risk of falls and its association with demographic and clinical variables, cognitive status, risk of sarcopenia and frailty among older adults hospitalized in a medical clinic of a university hospital. *Method:* A quantitative, observational, cross-sectional analytical study of 60 older adults hospitalized in the medical clinic of a university hospital in São Paulo city, São Paulo state, Brazil, was carried out. Questionnaires collecting demographic profile and clinical data, the Mini-Mental State Examination, Morse Scale, SARC-F Scale and Tilburg Frailty Indicator were applied. Descriptive analyses and the Kolmogorov-Smirnov normality test were performed. Spearman's correlation test was used for quantitative variables and the Mann-Whitney U-test for categorical variables. Multiple linear regression was used to identify the associations and a significance level of 5% was adopted. *Results:* The study sample comprised predominantly individuals that were female, aged 60-79 years and without a partner. Overall, 80% had cognitive impairment, 88.3% were diagnosed as frail, 60% were at risk for sarcopenia, and 75% had a high risk of falls during hospitalization. Cognitive impairment, frailty and sarcopenia risk were associated with risk of falls in the hospitalized older adults. *Conclusion:* High risk of falls in the hospitalized older adults was directly associated with the presence of cognitive impairment, frailty syndrome and sarcopenia risk, confirming that these factors warrant attention from managers and nursing professionals.

Keywords: Aged. Accidental Falls. Geriatric nursing. Inpatients.

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INTRODUCTION

Population aging is a challenging and complex process because, the growth in the older adult population is accompanied by an increase in demand for health care and in hospital admissions[1]. The World Health Organization (WHO) estimates that a third of older adults experience at least one fall per year. These figures make falls the second-leading cause of death from unintentional injuries, defined as an involuntary event where the body falls to the ground or onto another surface[2].

Hospitalized older adults often present changes and physiological complications affecting the body, such as decreased tonus, loss of muscle mass, flexibility, balance, cognitive changes, polypharmacy, and complications due to chronic non-communicable diseases (NCDs). This scenario gives rise to vulnerabilities and limitations, making this group more susceptible to unfavorable health outcomes such as falls[3,4].

A fall in the intra-hospital environment poses a challenge for health professionals and health services, potentially resulting in increased morbidity and mortality, longer hospital stay and higher care costs. In addition, falls can cause injuries, fractures, traumatic brain injury and fear of falling again, which are linked to immobility and a progressive loss of independence[5].

The pathophysiology of falls can vary depending on individual circumstances. The even is typically the result of an imbalance between the individual's ability to maintain postural stability and the demands placed on them by the physical environment in which they are. This means that falls can result from an imbalance between sensory, motor and cognitive information necessary to maintain postural stability under normal conditions[6].

The pathophysiology of falls in older adults is more complex due to the changes associated with the aging process, including musculoskeletal and neurosensory changes. These sensory changes can make it difficult to perceive obstacles and/or recognize changes in ground surface, which can cause a loss of balance[6].

Falls are an avoidable multifactorial incident and, for preventive measures to be implemented, it is fundamental for nurses to identify fall risk at the time of patient admission and whenever their clinical picture changes. Several risk assessment scales are available in the literature to aid diagnosis and nurses must be able to apply the assessment in an institutional protocol[7].

This event cannot and should not be considered as an isolated occurrence, and its associated factors must also be analyzed. Thus, it is considered necessary and timely to conduct studies which contribute to comprehensively assessing the health status of hospitalized older adults.

This study seeks to understand the association between the risk of falls and several relevant variables, based on the need to improve prevention and intervention in falls, thereby promoting greater safety and health of older patients in the hospital environment.

In view of the above, the objective of this study was to analyze the risk of falls and its association with demographic and clinical variables, cognitive status, risk of sarcopenia and frailty among older adults hospitalized in a medical clinic of a university hospital.

METHOD

A quantitative, observational, cross-sectional analytical study of patients hospitalized in the medical clinic of a University Hospital in the city of São Paulo, Brazil, from August 2021 to January 2022 was carried out. The hospital is a public state teaching institution with a secondary level of care complexity. The facility currently has a maximum capacity of 236 beds, but 141 beds were active in 2021. The hospital serves employees of the University of São Paulo and also an estimated population of more than 500,000 in the surrounding area and users of the Unified Health System (Sistema Único de Saúde - SUS)[8]. The medical ward has 28 active beds, split equally between two wards, and receives patients requiring treatment from minimal to high-dependency care, classified according to the degree of dependency scale adopted in the unit, and handles about 270 admissions per quarter.

The study sample size was calculated using a type I error rate with an alpha of 0.05, a beta equivalent to a type II error rate of 0.30, and an expected correlation coefficient of 0.30, yielding an estimated total of 67 participants.

The study population was selected using convenience sampling by interviewing 60 older adults hospitalized at the medical clinic. The following inclusion criteria were defined for participation in the study: patients aged ≥60 years, hospitalized in the medical clinic, and evaluated within the first 72 hours. Exclusion criteria were: inability to communicate verbally, altered level of consciousness, and patients with suspected covid-19 placed in isolation for droplets and aerosols, as determined by the Hospital Infection Control Commission.

The information was collected by a researcher with previous training by the study coordinator via a patient interview and by extracting information from the patient's medical record, using:

- Demographic profile questionnaire: to identify information such as gender (male or female); age (years); marital status (single, married, widowed or divorced) and monthly income (Brazilian Reals (BRL) – R$).

- Clinical data questionnaire: data such as blood pressure, heart rate, respiratory rate and pulse oximetry were obtained from the medical records upon admission to the unit.

- Mini-Mental State Examination (MMSE): this test was used to assess cognitive function of participants. It consists of questions grouped into seven categories, each of which has the objective of assessing different specific cognitive functions: orientation to time (5 points), orientation to place (5 points), three-word registration (3 points), attention and calculus (5 points), delayed recall of words (3 points), language (2 points), sentence repetition(1 point), visuoconstruction ability (1 points), comprehension of commands (3 points), sentence writing (1 point) and drawing (1 point). Scale score ranges from 0 to 30 points; the cut-off point for illiterate individuals is 20 points, 24 for those with 1-4years of formal education, 26.5 for 5-8 years, 28 for 9-11 years, and 29 points for individuals with >11 years of education[9].

- Morse Fall Scale: this was used to assess the risk of falling in hospitalized patients, translated and validated into Portuguese[10]. The scale consists of six domains with different scores ranging from 0 to 125 points. The evaluated domains are: history of falling; secondary diagnosis; use of intravenous device; ambulatory aid; gait; and mental status. A patient scoring 0-24 points is classified as having a low risk of falling during hospitalization; 25-44 as a moderate risk; and ≥45 as having a high risk of falling[10].

- SARC-F: a simple questionnaire for rapidly diagnosis of sarcopenia (by screening the risk of sarcopenia in older adults. The SARC-F version was validated for use in Portuguese and consisted of five objective questions about strength, walking, rising from a chair, climbing a flight of stairs and falls history. In addition, it includes measurement of calf circumference. Scale score ranges from 0 to 20, and older adults scoring 0-10 points do not present signs suggestive of sarcopenia, while scores of 11-20 are suggestive of sarcopenia[11].

- Tilburg Frailty Indicator (TFI): this instrument measures the frailty level of older adults. The TFI has been validated and translated into Portuguese[12], and is made up of 15 objective self-reported questions, of which 11 are answered with "yes or no" and 4 also provide the option "sometimes". These questions are divided into three domains: physical, psychological and social. The final score ranges from 0-15 points, with scores ≥ 5 points indicating the individual is considered frail[12].

Descriptive analyses were performed to analyze the information. Categorical variables were expressed as frequency and percentages, while numerical variables were expressed as measures of central tendency (mean and standard deviation). In addition, the normality of the data was tested using the Kolmogorov-Smirnov test.

Having confirmed the data did not display normality, non-parametric statistics using the

Spearman's correlation test and Mann-Whitney U test-were employed. Multiple linear regression was used to identify the association of fall risk with demographic and clinical variables, cognitive status, risk of sarcopenia and frailty. A significance level of 5% was adopted for all statistical tests.

The participants and researchers signed the Informed Consent Form (ICF) in two copies before starting data collection, with one copy retained by the participant. The present study was approved by the Ethics Committee of the School of Nursing of the University of São Paulo under permit number 4.960.408 and by the University Hospital under permit number 4.994.951, complying with the requirements of Resolution No. 466/2012.

RESULTS

Analysis of the sociodemographic characteristics of the 60 participants showed that 53.3% were female, 71.7% aged 60-79 years, mean age 73.9 years (SD=8.70), and 56.7% had no partner. For the sample assessed, mean number of years of formal education was 6.9 (SD=4.18), 76.7% were retired, and mean income was R$3,401.67 (SD=3,040.21). In addition, 81.7% lived with a mean of 3.2 (SD=2.2) other people (Table 1).

For the clinical evaluation, mean results for vital signs were within the normal range and mean oxygen saturation was 93.5% (SD=3.7). Overall, 80% of the sample had cognitive impairment according to the scale used, while 88.3% were categorized as frail, 60% at risk for sarcopenia and 75% high-risk for falling during hospitalization (Table 2).

A correlation was identified on the bivariate analysis of age (p=0.020), frailty (p=0.002) and sarcopenia (p=0.001) with the risk of falling (Table 3).

Comparison of the means revealed an association between cognitive status (p= 0.003) and risk of falling (Table 4).

The regression analysis showed that cognitive impairment, frail status and sarcopenia risk were associated with risk of falling in the hospitalized older adults (Table 5).

Table 1. Sociodemographic data of older adults hospitalized at the medical clinic of a hospital in São Paulo, Brazil, 2021.

Variable	n (%)
Gender	
Female	32 (53.3)
Male	28 (46.7)
Age (years)	
60-79	43 (71.7)
≥80	17 (28.3)
Marital status	
No partner	34 (56.7)
Has partner	26 (43.3)
Employment status	
Retired	46 (76.6)
Homemaker	9 (15.0)
Self-employed	3 (5..0)
Employed	1 (1..7)
Unemployed	1 (1..7)
Lives alone	
No	49 (81.7)
Yes	11 (18.3)

Table 2. Clinical evaluation of older adults hospitalized at the medical clinic of a hospital in São Paulo, Brazil, 2021.

Variable	n (%)	Mean (=SD)
Cognitive status (MMSE)		
Impairment	48 (80.0)	
No impairment	12 (20.0)	
Frailty (TFI)		
Frail	53 (88.3)	
Not frail	7 (11.7)	
Sarcopenia (SARC-F)		
At risk	36 (60.0)	
No risk	24 (40.0)	
Risk of falling (MORSE)		
Low risk	4 (6.7)	
Moderate risk	11 (18.3)	
High risk	45 (75.0)	
Systolic blood pressure (mmHg)		128.32 (25.3)
Diastolic blood pressure (mmHg)		88.42 (91.8)
Heart rate (bpm)		82.32 (16.5)
Respiratory rate (rpm)		21.20 (3.9)
Oxygen saturation (%)		93.52 (3.7)

Table 3. Correlation of demographic and clinical variables with risk of falling in older adults hospitalized at the medical clinic of a hospital in São Paulo, Brazil, 2021.

Variable	Correlation	*p*-value
Age	0.29	0.020
Education	-0.14	0.270
Frailty	0.39	0.002
Sarcopenia	0.43	0.001
Systolic blood pressure	0.01	0.910
Diastolic blood pressure	-0.16	0.220
Temperature	0.15	0.240
Heart rate	0.09	0.450
Respiratory rate	0.09	0.450
Oxygen saturation	0.04	0.700

Spearman's correlation = $p<0.05$

Table 4. Analysis of risk of falling for demographic variables and cognitive status of older adults hospitalized at the medical clinic of a hospital in São Paulo, Brazil, 2021

Variable	n	Mean risk of falling (Morse scale)	*p*-value
Sex			0.62
Female	32	29.47	
Male	28	31.68	
Marital status			0.66
Has partner	26	29.38	
No partner	34	31.35	
Lives alone			0.29
No	49	31.61	
Yes	11	25.55	
Cognitive status (MMSE)			0.003
Impairment	48	33.78	
No impairment	12	17.38	

Mann-Whitney U = $p<0.05$

Table 5. Association of risk of falling with clinical variables of older adults hospitalized at the medical clinic of a hospital in São Paulo, Brazil, 2021.

Variable	B	*p*-value	95%CI
Cognitive status (no impairment) (MMSE)	17.66	0.030	1.49 – 33.84
Frailty (TFI)	2.94	0.010	1.55 – 5.33
Sarcopenia (SAC-F)	1.41	0.010	1.30 – 2.53

Multiple linear regression = $p<0.05$.

Variables excluded from the model were age, gender, number of people living with the older adult, marital status, education, heart rate, respiratory rate, blood pressure, temperature, and oxygen saturation.

DISCUSSION

The study population comprised predominantly females and younger older adults without a partner. The risk of falling was greater among older adults with impaired cognitive status, presence of frailty and risk of sarcopenia at hospital admission. These results corroborate the national and international literature, where similar studies show that the older adult population is mostly female with a mean age of 70 years[13-16].

A total of 75% of the participants in this study were at risk of falls during hospitalization. Similar results were found in a study that also used the Morse Fall Scale to assess the risk of falls[17]. The authors of the study found that more than half of the sample of hospitalized older adults had a high risk of fall events[17].

It is noteworthy that falling is associated with the presence of intrinsic factors such as age, multimorbidity, psychomotor agitation, mental confusion, history of falls, visual impairment, muscle weakness, gait disorders, incontinence, hypotension, and may be aggravated by frailty, polypharmacy and possible drug-drug interactions[5,17,18]. The authors of an integrative review concluded that the main risk factors for falls among older adults in the hospital environment were visual impairment and polypharmacy[19].

In addition, falling is also associated with the presence of extrinsic factors within the hospital environment, which include inadequate lighting in

the wards and rooms, slippery floors, poorly placed furniture, excess furniture, non-adapted bathrooms, stairs and lack of bed rails[5,18,20]. Although many risk factors are not unique to hospital settings, they may be more commonly associated with hospitals due to their higher prevalence among hospitalized patients[21].

Hospitalized older adults were found to have a predominance of cognitive impairment. In a study carried out in Saudi Arabia of 130 hospitalized older adults, the authors found that 48.6% had cognitive impairment[22]. Another study carried out in Germany involving 1,469 hospitalized older adults showed that 40% of participants had cognitive impairment[23].

According to the results of the present study, older adults with MMSE results suggestive of cognitive impairment had a 17.66 times greater risk of falling. This result is similar to other national studies[24-26]. These data are also consistent with international studies. For example, a study conducted in the United States comparing risk of fall scores determined using two different evaluation forms found that older adults with cognitive impairment were 14 times more likely to have postural instabilities and consequent falls[27].

Hospitalization itself is recognized as a risk factor for functional and cognitive decline in older adults as, in this situation, they are subject to immobility, loss of autonomy and complications[24,28]. Cognitive impairment and high risk of falling may be associated due to the link between motor and sensory systems during the neurological processes involved in the cognition needed for motor planning, dual-tasking and adaptation to the environment. Thus, older adults with cognitive impairment may slow down their movements to react to imbalances and impaired mobility, constituting factors which contribute to fall events[26].

Over half of the participants in the present study were diagnosed as frail. In a Brazilian study determining the prevalence of frailty syndrome in older adults and its relationship with the risk of falling in 101 older adults of both sexes, results showed that 84.1% of the sample were at risk of falls and that fall prevalence among those classified as frail was 100%[29].

There is agreement among scholars on the subject regarding the senescence process associated with changes to multiple systems, favoring the emergence of the frailty syndrome and unfavorable health outcomes which can, in turn, lead to hospitalizations and falls[30].

Science and research have long recognized and investigated the relationship between frailty syndrome in older adults and the risk and occurrence of falls[30,31]. Frailty is considered a clinical syndrome of a multifactorial nature, characterized by a decrease in energy reserves and reduced resistance to stressors; these conditions result from the cumulative decline of physiological systems[32]. Thus, a strong association has been found between frailty and the occurrence of falls, as explained by the increase in comorbidities, cognitive impairment and sarcopenia[33].

This study showed a predominance of high risk for falling in older adults at greater risk for sarcopenia in a directly proportional relationship. Sarcopenia is defined as a progressive generalized muscle disorder which is directly associated with a greater probability of developing complications such as fractures and physical immobility[34.] The European consensus on sarcopenia (EWGSOP 2) highlighted a loss of muscle strength as an important predictor for adverse outcomes, thus defining it as a primary parameter of sarcopenia; and sarcopenia is considered severe when associated with low physical performance[34].

A Japanese study in which the SARC-F was used (same tool used in the present investigation for sarcopenia screening), found a statistical association between SARC-F score and in-hospital falls. A SARC-F score ≥2 was found to be significantly associated with a higher incidence and risk of falls. Among the subitems of the SARC-F, the hazard ratios for climbing stairs and for a history of falls were significantly higher. These findings suggests that the SARC-F score can help predict falls among hospitalized older adults[26].

Sarcopenia is part of the complex picture of frailty as a key element in this syndrome due to its relationship with the significant loss of muscle mass, and is associated with fall events in older adults[33]. The multiple causes of sarcopenia are congruent with the causes of frailty syndrome, including hormonal and nutritional alterations, physical inactivity, decline in motor neurons and chronic inflammation[35].

The present study has an important limitation with regard to the small number of older adult participants. The factors associated with the risk of falling might have stronger links if investigated in a larger sample. Nevertheless, the results reported are relevant in providing theoretical and practical support to devise strategies for reducing fall risk in hospitalized older adults. Identifying the risk of falling in hospitalized older adults is a nurse's responsibility to improve patient safety. On a broader level, identifying the factors which contribute to increased risk leads to greater safety of this population, thereby avoiding injuries, longer hospitalization and premature death.

CONCLUSION

The results showed that the high risk of falling in older adults hospitalized in the medical clinic of a university hospital was directly associated with the presence of cognitive impairment, frailty syndrome and the risk of sarcopenia, confirming that these factors warrant attention from health managers and nursing professionals.

The study makes a strong contribution toward planning nursing care for hospitalized older adults, provides easily accessible scales that can be incorporated and applied in protocols for evaluating older adults, thereby preventing falls and other complications while accommodating the particularities and health demands of this group.

Future studies in the area could collect data in different wards to identify health conditions that can cause older adults to sustain more falls. Nursing professionals should thoroughly investigate the variables involved in the risk and occurrence of in-hospital falls, together with the associated factors revealed in this study, to improve protocols for the prevention of falls and health-related complications of hospitalized older adults and improving patient safety.

AUTHORSHIP

- Gideany Maiara Caetano - Responsible for all aspects of the work, ensuring that issues related to the accuracy or integrity of any part of the work are resolved.
- Alexandre Pereira dos Santos Neto - Data interpretation, article writing and approval of the version to be published.
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Antithrombotic agents used by older people: prevalence and associated factors

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Abstract

Objective: To analyze the types and prevalence of use of antithrombotic drugs by older people and associated factors. *Method:* A cross-sectional study of community-dwelling older people was carried out in the city of Goiânia, Midwest Brazil. The pharmacological classification of antithrombotic drugs was performed according to the Anatomical Therapeutic Chemical (ATC) classification. Bivariate and multivariate analyses were performed with a significance level of 5%. *Results:* 212 older people participated in the study and the prevalence of antithrombotic drug use was 27.8%. The most used types were acetylsalicylic acid (ASA) (n= 49; 83%), Clopidogrel (n=6; 10.1%) and Cilostazol (n=4; 6.7%). Associated factors were the 70-79 years age group (p<0.001) and polypharmacy (p<0.001). *Conclusion:* The proportion of antithrombotic use by the participants was high and the most used drugs posed a risk of complications and drug-drug interactions. Attention should be heightened in individuals aged >70 years and in use of polypharmacy and efforts must be made to clinically monitor these users of antithrombotic drugs therapy.

Keywords: Anticoagulants. Venous thromboembolism. Cardiovascular nursing. Polypharmacy. Aged.

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INTRODUCTION

Cardiovascular Disease (CVD) is one of the leading causes of morbimortality globally, with a prevalence rising from 271 million in 1990 to 523 million in 2019. Due to the growth in the older population, estimated to number 1.5 billion by 2050, CVDs are expected increase in the years ahead[1,2]. Of the different CVDs, thromboembolic diseases (involving formation of anomalous thrombus in the vascular system) are important, being classified into arterial and venous thrombosis[3]. Acute Coronary Syndrome (ACS) and stroke are two of the main cardiovascular outcomes of arterial thrombosis[2,4], while Deep Vein Thrombosis (DVT) and Pulmonary Thromboembolism (PTE) are consequences of venous thrombosis[5].

The use of antithrombotic agents is a pillar of thromboembolic disease management and involves the use of the antiplatelet, anticoagulant class drugs, substances which can prevent thrombus progression, recurrence and embolism[6].

The literature reports high use of medications in older people to treat the multiple diseases affecting this population[7,8]. Estimates in Iran suggest that 55.1% of older individuals with chronic diseases use antithrombotic agents compared with 23.8% in community-dwelling older Brazilians[10]. Another Brazilian study found that up to 5% self-medicated with antithrombotic drugs[11]. Moreover, mortality from adverse events arising from the use of anticoagulants in older users totaled 632 deaths during 2008-2016[12]. However, there is a lack of recent studies specifically addressing the antithrombotic agent class of drugs and factors associated with their use in older people.

Depending on the class of antithrombotic agents used, their use can pose greater risk of complications, such as hemorrhaging, renal issues and drug-drug interactions[8]. In older patients, drug treatment should balance the risk of bleeding against the benefits of antithrombotic therapy, since greater age is associated with a higher chance of bleeding associated with anticoagulation[13]. The use of antithrombotic medications in older people warrants greater research attention, since few studies have investigated antithrombotics use in oldest-old, who typically exhibit multimorbidity, frailty and polypharmacy[13].

In addition, antithrombotic therapy, particularly when prescribed to reduce disease recurrence after a first thromboembolic episode, sometimes requires outpatient follow-up and regular laboratory tests, besides health treatments for hemorrhagic complications which, ultimately, increase total health costs[14].

The projected growth in the older population, together with the incidence of thromboembolic diseases and antithrombotic use, make understanding the use of antithrombotic therapy in older people a priority. This knowledge can serve to inform health actions with specific approaches aimed at reducing health risks, as well as help relieve the burden on health systems[3,8,14].

Therefore, the primary objective of the present study is to report the types of antithrombotic agents used by older people. The secondary objective of the investigation is to analyze the prevalence of antithrombotic drugs use and its associated factors.

METHOD

A cross-sectional study, nested within a cohort study called "Life, health and frailty status and body composition of older adults: a cohort of the Older Adult/Goiânia project" was conducted. The current research project commenced in 2009 in Goiânia city, Goiás state, when the baseline stage of the study was performed, followed in 2018/2019 by the second wave of the cohort study. Details of the sampling procedure have been reported elsewhere[15,16].

The present study included the population of the second wave of the cohort, carried out between July 2018 and March 2019. The sample included 221 subjects who were older adults aged >70 years, survivors since the baseline study 10 years earlier, residing within the catchment area of Primary Care units, and located by the researchers.

Given this study was part of a larger research project, the sample size was defined based on the

outcome of interest with lower prevalence. Thus, to check whether the present study sample had statistical power to identify statistically significant differences, the sample size was calculated *a posteriori*. The following parameters were applied: outcome of interest (antithrombotics use) prevalence of 23.8%[11]; confidence interval of 95% (a<0.05); statistical power of 80%; exposed:non-exposed ratio of 2:1; and prevalence ratio (PR) of 2. Employing these parameters yielded an estimated final sample size of 210 people. Therefore, the sample for this stage of the project (221 participants) met the objectives of the present study.

The study participants had sufficient cognitive capacity to answer the questionnaire, as determined by applying the Mini-Mental State Exam (MMSE). In cases of cognitive deficit of the respondent, a guardian answered the objective questions on health.

Individuals not found at the home after 3 tries, whose address was not found during the visit, or who had moved to another city, were excluded.

At the time of data collection, after presenting and explaining of the study aims, the standardized questionnaire was applied, gathering information on demographic conditions, general health status and medication use.

The main variable of interest was use of direct oral anticoagulants. Thus, the respondents were first probed about use of medications via the question: *"Are you taking any medications?"*. When the response was affirmative, the respondent was then asked to provide the prescription and/or packaging, if available, allowing the main active ingredient and posology to be recorded. All of the medications were then classified according to the Anatomical Therapeutic Chemical Classification System (ATC)[17], as per the anatomical classification.

For direct oral anticoagulants, ATC code B (Blood and blood forming organs) was referenced, the B01A antithrombotics therapeutic subgroup, and the drug groups, namely: B01AA - Vitamin K antagonists; B01AB - Heparin groups; B01AC – Platelet aggregation inhibitors; B01AD - Enzymes; B01AE – Direct thrombin inhibitors; B01AF – Direct factor Xa inhibitors; and B01AX – other antithrombotic agents[17].

The sociodemographic exposure variables were sex, age group, marital status, education, and economic class (A/B, C and D/E)[18]. The health-related variables were number of morbidities reported, polypharmacy, hospitalization in past year, self-rated health, nutritional status, hypertension, diabetes mellitus, current smoking and sedentarism[19-23].

Number of diseases was obtained by asking the question: *"What diseases has your physician said you have*?"; self-rated health: "*How would you rate your health status in the past month?*"; and for hospitalization: "*Have you been hospitalized in the past year?"*. Presence of polypharmacy was determined as the use of 5 or more medications, based on the medical prescription and/or packaging provided[20]. Estimated body mass index (BMI) was calculated using the formula: (kg)/ height² (m), where weight was measured by electronic scales (Tanita model, capacity 200 kg; accuracy nearest 100 g), and height by a wall-mounted stadiometer (accurate to nearest 0.1cm). BMI value was classified as underweight (≤22kg/m²), normal weight (22-26.9kg/m²) or excess weight (≥27kg/m²)[19-21].

All statistical analyses were performed using the STATA software package, version 12.0 (StataCorp, College Station, USA). All variables were analyzed descriptively and expressed as mean, median, standard deviation, and absolute and relative frequency. The prevalence of antithrombotics use was estimated for all variables assessed in the study. The measure of association employed was Prevalence Ratio (PR) together with the respective 95% confidence interval (95%CI) obtained using simple Poisson regression for a 5% level of significance (p<0.05). Variables with a p-value <0.20 were entered in the multiple regression model using the stepwise forward approach. Variables with a p-value <0.05 were retained in the model.

The study was approved by the Research Ethics Committee of the Clínicas Hospital of the Federal University of Goiás (UFG) (permit no. 2.500.441). Before completing the questionnaire, the Free and Informed Consent Form was read and explained to all respondents, who subsequently signed or fingerprinted the document. The study posed low risk to patients given the observational nature of the research.

RESULTS

In this study, a total of 221 older participants were interviewed, of which 212 (95.9%) were in use of some type of medication (95%CI.92.4–98.1). With regard to general characteristics, 66.0% were women, 58.5% aged 70-79 years, and 25.1% economic class D/E. Regarding level of education, 84.4% were illiterate.

Of the 212 users of medication, 27.8% (95%CI 21.9–34.4) (n=59) used drugs for antithrombotic therapy, where the most used were acetylsalicylic acid (ASA)(n= 43; 72.8%%), Clopidogrel (n=6; 10.1%) and Cilostazol (n=4; 6.7%), classified as antiplatelet drugs (Table 1).

The use of antithrombotic drugs was more frequent in participants who were female (29.2%), aged 70-79 years (36.3%), with economic class C (26.8%) and educational level of ≥9 years (50.0%). However, a statistically significant difference was only evident for age (PR 2.28, p<0.001, 95%CI 1.33-3.89) (Table 2).

Table 1. Antithrombotic agents used by older participants, based on ATC classification (N=59). Goiânia, Goiás state, 2018-2019.

Antithrombotic agents	n(%)[1]
Antiplatelet drugs	49 (83.0)
Acetylsalicylic acid (ASA)	43 (72.8)
Clopidogrel	6 (10.1)
Cilostazol	4 (6.7)
Clonidine	2 (3.3)
Direct factor Xa inhibitors (xabans)	5 (8.3)
Rivaroxaban	3 (5.0)
Apixaban	2 (3.3)
Vitamin K antagonists (VKAs)	3 (5.2)
Vitamin K	3 (5.2)
Heparin group	2 (3.5)
Heparin	2 (3.5)
Total	59 (100.0)

[1]Respondents can be in use of more than 1 antithrombotic drug concomitantly.

Table 2. Occurrence and association of antithrombotics use by older participants, according to sociodemographic characteristics. Goiânia, Goiás state, 2018-2019.

Variables	Sample n(%)	Antithrombotics use (n= 59)	PR (95%CI)	p-value
Sex				
Female	140 (66.0)	21 (29.2)	1.09 (0.69-1.72)	0.756
Male	72 (34.0)	38 (27.1)	1.00	
Age group (years)				
70-79	124 (58.5)	45 (36.3)	2.28 (1.33-3.89)	<0.001
≥80	88 (41.5)	14 (15.9)	1.00	
Economic class				
A/B	32 (15.0)	12 (37.5)	1.09 (0.62-1.89)	0.757
C	127 (60.0)	34 (26.8)	1.52 (0.79-2.93)	0.202
D/E	53 (25.0)	13 (24.5)	1.00	
Education (years)				
Illiterate	178 (84.4)	48 (27.0)	1.00	
1-4	19 (9.0)	8 (42.1)	1.56 (0.87-2.79)	0.133
5-8	10 (4.7)	1 (10.0)	0.37 (0.06-2.42)	0.301
≥9	4 (1.9)	2 (50.0)	1.85 (0.67-5.09)	0.232

Analysis of antithrombotic use according to health status revealed that use was greater in participants with good/fair health (29.1%), hypertensive (28.7%), diabetic (32.9%), presenting ≥3 diseases (28.8%), presence of polypharmacy (35.0%), and overweight/obesity (31.0%). The presence of polypharmacy was statistically significant (PR=8.56, p<0.001, 95%CI 2.16-33.9) (Table 3).

On the multivariate analysis, the factors associated with use of antithrombotic agents were the 70-79 years age group (PR_{adj} 2.20, 95%CI 1.31-3.69) and presence of polypharmacy (PR_{adj} 8.30, 95%CI 2.12-32.46) (Table 4).

Table 3. Occurrence and association of antithrombotics use by older participants, according to health status. Goiânia, Goiás state, 2018-2019.

Variables	Sample n(%)	Antithrombotics use (n= 59)	PR (95%CI)	p-value
Self-rated health				
Very good/Good/Fair	165 (78.6)	48 (29.1)	1,30 (0,72-2,37)	0,361
Poor/Very poor	45 (21.4)	10 (22.2)	1,00	
Arterial hypertension				
Yes	150 (71.1)	43 (28.7)	1,09 (0.67-1.78)	0,721
No	61 (28.9)	16 (26.2)	1,00	
Diabetes mellitus				
Yes	82 (38.6)	27 (32.9)	1,31 (0.84-2.03)	0,188
No	130 (61.3)	32 (24.6)	1,00	
Multimorbidities				
0-2	66 (31.1)	17 (25.7)	1,00	
≥3	146 (68.9)	42 (28.8)	1,12 (0.69-1.81)	0,651
Polypharmacy				
≥5	163 (76.9)	57 (35.0)	8,56 (2.16-33.9)	**<0,001**
0-4	49 (23.1)	2 (4.08)	1,00	
Body Mass Index				
Underweight	31 (16.7)	7 (22.6)	1,00	
Normal weight	55 (29.6)	15 (27.3)	1,20 (0.55-2.64)	0,637
Overweight / Obese	100 (53.8)	31 (31.0)	1,37 (0.67-2.81)	0,386
Smoking				
Yes	15 (7.1)	4 (26.7)	0,92 (0.38-2.26)	0,872
No	108 (51.0)	31 (28.7)	1,00	
Ex-smoker	89 (42.0)	24 (27.0)	0,93 (0.59-1.47)	0,788
Alcohol use				
No	180 (84.9)	51 (28.3)	1,00	
Yes	32 (15.1)	8 (25.0)	0,88 (0.46-1.68)	0,698
Hospitalization in past year				
Yes	50 (23.6)	16 (32.0)	1,20 (0.74-1.94)	0,452
No	162 (76.4)	43 (26.5)	1,00	

Table 4. Association with antithrombotics use by older participants according to sociodemographic variables and health status. Goiânia, Goiás state, 2018-2019.

Variables	PR_{cru} (95%CI)	PR_{adj} (95%CI)	p-value
Age group (years)			
70 – 79	1.00	1.00	
≥80	2.28 (1.33-3.89)	2.20 (1.31-3.69)	0.003
Polypharmacy			
0-4	1.00	1.00	
≥5	8.56 (2.16-33.9)	8.30 (2.12-32.46)	0.002

PR_{cru} (crude Prevalence Ratio); PR_{adj} (adjusted Prevalence Ratio); adjusted for sex, age and polypharmacy, R^2=0.0962

DISCUSSION

This study assessed the use of antithrombotic agents in older users (>70 years) of Primary Care services. In addition, factors associated with this use, such as age 70-79 years and polypharmacy, were identified. The findings underscore the need for health professionals to monitor and intervene in cases of antithrombotic drugs use toward improving the safety of drug-based treatment by lowering the health risks. This is the first study in the region of older users of Primary Care services assessing the use of these medications and their associated factors.

The rate of antithrombotic use (27.8%) identified was similar to that detected by an earlier study in Brazil, which showed that 23.8% of older individuals used antithrombotic agents[10], but higher than the rates found among people aged >40 in the UK (15.9%), Denmark (18.1%), Italy (16.6%) and Spain (13.6%)[24]. In older people, changes induced by the aging process, such as hemostatic imbalance, increased coagulation factors, platelet activation and decreased fibrinolysis, can favor both the occurrence of thrombus and thrombotic complications. These entities, together with other common conditions in older individuals, such as immobility and frailty, can lead to the prescribing of these medications[13,25]. Thus, these complications can be prevented with the use of antithrombotic agents, arresting the progression of thrombus and preventing recurrence of thrombotic diseases[13].

In a recent study on new drugs registered by the Brazilian Health Surveillance Agency (ANVISA) between 2003 and 2013, many new antithrombotic agents were incorporated[26]. The present analysis revealed that ASA (83%) and Clopidogrel (10.1%) remained the most used agents, higher rates than those reported in previous studies of 60.5% and 2.2%, respectively.[27,28]. Notably, both of these antiplatelet drugs are widely used globally, prescribed alone or combined in cases of Acute Coronary Syndrome (ACS) or patients undergoing percutaneous coronary interventions (PCI)[25]. In Brazil, these medications are dispensed free on the national health system (SUS) and feature in the National List of Essential Medications (RENAME) which, in part, explains the high prevalence of use[29].

However, is it important to point out that the use of ASA in older patients should be restricted to cases of secondary prevention of ischemic events, such as stroke and acute myocardial infarction. Use of ASA in individuals aged over 70 for primary prevention of vascular complications is inadvisable, since the risks of hemorrhagic events appear to be greater than the benefits derived from the treatment [25]. According to the Beers criteria, the risk of bleeding with chronic use of ASA in older patients is well established[30].

Further, a recent study found that 30.4% of older patients admitted to hospital after sustaining falls were in use of antithrombotic medications and that 35.9% of this group had intracranial hemorrhaging, a higher rate than in the group not taking antithrombotics (25.0%)[31].

In this context, a study assessing total costs of health treatment for 3 consecutive years in individuals diagnosed with thromboembolic diseases found that the presence of major hemorrhage complications

secondary to the use of antithrombotic agents, such as intracranial and gastrointestinal bleeding, with resultant hemodynamic imbalance and need for hospitalization, further increased total healthcare and societal costs[14].

Clopidogrel, besides presenting risk of bleeding, is an antiplatelet agent with a variable response, risk of platelet reactivity, and propensity for drug-drug interactions, in competing for the same binding site as other drug classes, such as proton pump inhibitors and calcium channel blockers which, when used concomitantly, can reduce their effect[25,32].

In the present study, only 5 (8.3%) participants were using factor Xa inhibitors, a recent class of drugs in the direct oral anticoagulant group which, compared to conventional drugs, have a more rapid onset of action, lower interaction with other drugs and foods, and appear to require less laboratory monitoring for dose adjustments[33].The new anticoagulants are designed to reduce undesirable effects in an effort to improve quality of life and treatment adherence by users [25,33]. However, these drugs have not been fully incorporated by the SUS[30]. According to the list of potentially inappropriate medications (PIM) for older adults, use of Rivaroxaban by individuals aged>75 years is not recommended because of increased risk of gastrointestinal bleeding. Likewise, Apixaban should not be used by older adults, where both these drugs lack robust evidence of efficacy and safety[30].

With regard to associated factors, the use of antithrombotic agents was greater in the 70-79 age group than those aged ≥80 years. The oldest-old may be underdiagnosed where a study involving older patients with venous thromboembolism (VTE) showed that signs and symptoms may be weak and non-specific, hampering diagnosis in this population. In addition, diagnostic techniques are less sensitive and more limited in this age group, while there are few specific recommendations for administering drugs treatment in oldest-old individuals, leading to lower use of these medications in people age 80 or older[10,34].

Polypharmacy was also shown to be associated with an increased likelihood of antithrombotics use. Polypharmacy correlates with number of diseases which, in turn, increases the use of medications. Given the high prevalence of cardiovascular diseases in this group, the use of antithrombotic drugs is expected to be greater in polymedicated older individuals. Importantly, there is an increased risk of adverse events with the presence of polypharmacy, as well as low treatment acceptance and inappropriate use[34].

Given the complexity of use of multiple medications, and aging-related changes, it is important to monitor older individuals in use of antithrombotic agents and establish protocols for the use and maintenance of these drugs and for line of care in patients that present adverse events[35].

A limitation of the present study is the method of collection of data on the medications used which, although gathered from medical prescriptions or packaging, failed to assess the clinical conditions for which antithrombotic agents were prescribed. Also, this study adopted the use of a sole means of classification, namely anatomical.

CONCLUSION

Taken together, the results revealed a high rate of use of antithrombotic agents in the older people assessed, with antiplatelet drugs proving the most commonly used. The association found for participants aged 70-79 years and for presence of polypharmacy points to the need for greater care over use of these drugs in this age group. Pharmacoepidemiology studies such as the present investigation are important for identifying the profile of antithrombotic agents used and helping promote strategies for pharmacotherapy monitoring and attention in older people. Despite the development of new agents for controlling thromboembolic conditions with lower risks of bleeding and complication, the use of these drugs is complex with advancing age. Future studies exploring actions which improve patient safety and quality of life of this older group through the use of antithrombotic agents are warranted.

AUTHORSHIP

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– First Draft, Writing – Review and Editing, Investigation, Methodology, and Securing of Funding.

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Prevalence of multimorbidity and associated factors among older people in rural Northeast Brazil

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Abstract

Objective: to identify the prevalence of multimorbidity in elderly people living in rural areas and associated sociodemographic, behavioral and clinical-therapeutic factors. *Method*: cross-sectional study, conducted with randomly selected elderly residents in the rural area of Araçagi, Paraíba, Brazil, linked to the Family Health Strategy. The dependent variable of the study was multimorbidity, understood as the presence of two or more chronic conditions in a single individual. Data were collected through a sociodemographic questionnaire and a form about self-reported health problems, addressing 32 conditions. Univariate and bivariate statistics and Poisson regression were used in the data analysis, considering significant when p-value <0.05. *Results*: 360 elderly subjects participated in the study, with a 54.2% (95%CI: 49,0–59,3) prevalence of multimorbidity. After regression, it was identified that female gender (PR=1,16; 95%CI: 1,09–1,25), age ≥70 years (PR=1,08; 95%CI: 1,01–1,15), overweight (PR=1,19; 95%CI: 1,10–1,29), access to treated and piped water (PR=1,09; 95%CI: 1,00–1,18), smoking history (PR=1,10; 95%CI: 1,03–1,17), not using alcohol (PR=1,13; 95%CI: 1,05–1,22), chronic pain (PR=1,18; 95%CI: 1,10–1,26), hospital as first choice of health service (PR=1,12; 95%CI: 1,03–1,21) and medical consultation in the last year (PR=1,19; 95%CI: 1,11–1,27) were factors associated with multimorbidity. *Conclusion*: the study revealed a high prevalence of multimorbidity and its associated factors. Finally, it becomes feasible to plan measures that improve the health condition of these individuals and think of possibilities to promote healthy aging.

Keywords: Multimorbidity. Chronic Disease. Aged. Health of the Elderly. Rural Areas. Epidemiology.

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INTRODUCTION

The aging process can be accompanied by the coexistence of two or more chronic diseases in the same individual, designated multimorbidity[1]. This condition can lead to a decline in functional capacity, reduced quality of life, higher expenditure with medical and healthcare services[1], occurrence of drug-induced adverse events[2], poor mental health[3] and higher mortality rates[1].

The emergence of multimorbidity is associated with increased life expectancy and improved sociodemographic conditions, changes in life style, advances in diagnostic ability, as well as in health services and aging, leading to an accumulation of health problems over time[4].

The prevalence of multimorbidity varies among the population, particularly in older individuals. The results of the National Health Survey (PNS) revealed that the prevalence of multimorbidity in older Brazilians was 53.1%[5]. In another study, involving rural workers from the state of Espírito Santo, the overall prevalence of multimorbidity in the local population, irrespective of age, was 41.5%, rising to 57.8% in the ≥40 years age group[6].

Given the knowledge that multimorbidity is associated with increased age, it follows that the older population is the most affected by this entity. Moreover, this scenario is even more challenging for older individuals living in rural environments because of their complex health needs[7]. The rural older population, for example, face greater difficulty accessing health services compared to their urban counterparts. This difficulty stems from the geographic remoteness and low quality of services available, with the result that these individuals delay in seeking health services[8].

Evidence shows that locale of residence constitutes a risk factor for the occurrence of multimorbidity and is exacerbated by the epidemiological and demographic transition[9]. Similarly, national epidemiological surveys have difficulties reaching more remote areas, introducing an urban bias into national surveys.

Against this backdrop, the present study is justified by the need to investigate multimorbidity in older adults in a rural setting. Thus, prevalence estimates can help track the process of the epidemiological transition in environments not well explored by national surveys. The results are fundamental to inform the development of public policies for promoting access to and utilization of health services with equality and equity[10].

Therefore, the objective of the present study was to determine the prevalence of multimorbidity in rural older adults and the associated sociodemographic, behavioral and clinical-therapeutic factors.

METHOD

A cross-sectional quantitative epidemiological study was conducted. The study was carried out in the city of Araçagi, Paraíba state, Brazil, and was based on the 6 Basic Health Units (UBS) in the rural area, providing 66.7% of the Primary Care coverage of the city.

According to the Brazilian Institute of Geography and Statistics (IBGE), Araçagi city has a rural population 10,420 individuals (around 60% of total population). Of this total, 1,901 are older individuals (≈ 75.0% of the city´s older population)[11]. The sample size was calculated based on the premise of representativeness, using the formula $n = [EDFF*Np(1-p)]/[(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$, on the Open Epi platform. The parameters employed were a 95% confidence level, maximum sampling error of 5% and multimorbidity prevalence in older individuals of 53.1%[12], yielding an initial sample size of 319 individuals.

However, the sample calculation took into account variables known to influence multimorbidity of older Brazilians[5], namely: female gender, oldest-old, widowed, separated or married marital status, holding a private health plan, no alcohol or tobacco use at time of survey and lower educational level. To factor in these variables, a comparison of proportions among these variables was performed to identify the ideal sample size, giving 384 adults, based on the proportionality of each UBS and randomly selecting participants. Lastly, after allowing for

potential losses and refusals, a further 20% was added to the estimated sample, giving a total size of 461 older adults.

The dependent variable was multimorbidity, defined as the presence of ≥2 chronic conditions in the same person[1]. For this study, self-reported clinically-diagnosed chronic health conditions was used[6], without considering complex multimorbidity. All other variables were considered independent.

Data collection was carried out between October 2021 and February 2022. For study inclusion, subjects had to be aged ≥60 years and registered users at the city´s rural UBS. Eligibility of participants was on the basis of the principle of accessibility to the first older adult at each unit assessed[13].

The data collection process entailed application of two instruments: a questionnaire gathering sociodemographic and behavioral information; and a form collecting clinical-therapeutic data. Sociodemographic data included sex, age group, color/race, marital status, religion, family income, functional literacy, employment status and receipt of retirement pension.

For functional literacy, the respondent stated the number of years of formal education received and whether they could write sentences and perform simple calculus, such as the mathematics operations of adding and subtracting. Regarding family income, the respondent gave the sum of income received by all residents sharing the household.

Behavioral variables included body mass index (BMI), engagement in physical activity, access to treated mains water, and history of tobacco and/or alcohol use. BMI was calculated by collecting anthropometric data such as weight and height.

The clinical-therapeutic variables probed were history of falls, chronic pain, access to health services, transport to health services, first choice of health service, need for companion, most recent medical consultation, and hospitalization in past year.

The semi-structured questionnaire on Self-reported Health Problems was devised based on the 2 stages of the study by the Brazilian Group of Studies on Multimorbidity (GBEM) covering 32 health problems[14,15]. In the event of mental disorders affecting the participant, a family member, guardian/caregiver or other person living with the respondent was recruited as informant to confirm the self-reported diagnosis of these conditions.

After pooling information, descriptive analysis was performed with results expressed as simple measures of absolute and relative frequency and measures of central tendency, such as mean and standard deviation.

Bivariate analysis using the chi-square test was then carried out, with a level of significance set for a p-value <0.05. Multivariate analysis using Poisson regression with robust variance was then performed. Variables attaining a p-value <0.20 on the chi-squared test were entered in the model. This procedure was done using the Backward stepwise selection model approach. Variables yielding results with p-value <0.05 were retained in the final model.

Multicollinearity was assessed using the variable inflation factor (VIF), with a cut-off point of 10. For analysis of model fit, the parameters Deviance, Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) were employed.

Data collection commenced after approval by the Research Ethics Committee of the Onofre Lopes University Hospital under permit no. 4.952.314. The investigation was carried out by the lead researcher after explaining the study to participants, each of whom then signed the Free and Informed Consent Form in duplicate. Physical contact was minimized by use of social distancing measures, face masks and cleansing gel. The study complied with the recommendations of Resolution no. 466/2012 of the National Board of Health governing ethics in research involving human subjects[16].

RESULTS

The final sample comprised 360 older individuals. Of the initial 461 participants, 23 were not found, 8 refused to take part, 11 died and 59 were situated in areas without a community health worker available at the time of the study.

Regarding sociodemographic characteristics, study participants were predominantly female (54.4%), aged 60-69 years (39.7%) with a mean age of 72.81 years, were black (brown or black)(65.0%), married or had *de facto* partnership (64.7%), lived with partner (31.7%), self-declared as Catholic (91.1%), had low literacy (around 2.18 years of education), were not working (63.6%), retired (92.2%) and had mean family income of R$ 2,047.77 (US$ 429.01).

For behavioral aspects, most participants were overweight (40.8%) or normal weight (40.8%), did not engage in physical activity (62.8%), prepared at least 3 meals a day (95.3%), had no access to treated mains water (81.4%), were non-smokers (82.5%), former smokers (51.4%), did not use alcohol (84.7%) and had no history of alcohol-use disorder (60.3%).

Regarding clinical-therapeutic profile, most participants reported use of medications (73.3%), had sustained no falls in past year (78.3%), had no chronic pain (75.8%), had access to health services (99.7%), had used some type of health service in past 6 months (59.2%), had not accessed transport to visit health service (71.9%), used the basic health unit as first choice of health service (80.3%), held no private health plan (99.4%), had attended a medical consultation in the past year (80.3%), were not hospitalized in past year (97.2%) and presented some health problem (81.4%).

The prevalence of multimorbidity was 54.2% (95%CI: 49.0-59.3). Participants had an average of 2 chronic conditions (±1.398). The relationship between multimorbidity and associated factors is shown in the tables below.

The data presented in Table 1 shows that women had an 84% higher probability of reporting multimorbidity than men. In addition, individuals aged ≥70 years had a 56% higher probability of reporting multimorbidity than their younger counterparts Also, individuals who were not working had a 91% greater probability of reporting multimorbidity than those who were working.

The results in Table 2 reveal that overweight and normal-weight individuals had a 124% and 109% greater probability of having multimorbidity, respectively, compared with underweight individuals. Current non-smokers had a 109% higher probability of reporting multimorbidity than current smokers. Former smokers had a 28% higher probability of multimorbidity than those who had never smoked. Lastly, individuals reporting no current alcohol abuse had a 234% higher probability of reporting multimorbidity than those reporting alcohol use disorder.

The results in Table 3 show that individuals with chronic pain had a 57% higher probability of having multimorbidity then those experiencing no pain. Participants that had sought health services in the past 6 months had a 67% higher probability of having multimorbidity compared to those who had not utilized these services. Individuals that sought the hospital as the first choice of health service had a 34% probability of having multimorbidity compared to those choosing other types of service.

Of the 32 morbidities listed in the form on self-reported health problems, 27 were reported by participants. Among the 360 respondents, the most reported conditions were: Systemic Arterial Hypertension (60.3%), Diabetes Mellitus (21.7%), Inflammatory Arthropathies (18.3%), Osteoporosis (11.9%), Dyslipidemias (11.7%), Urinary Incontinence (8.9%), Depression and Mood Problems (7.5%), Ischemic Heart Disease (6.9%), Dementia (6.1%) and Peripheral Vascular Disease (6.1%). The relationship between self-reported morbidities and multimorbidity is depicted in the figure below.

The relationship between the most self-reported morbidities and multimorbidity is portrayed in Figure 1. Notably, the rate of each disease represents only those reporting having the disease, irrespective of presenting multimorbidity. In this case, the dark-colored bars represent individuals that had the morbidity shown and also presented multimorbidity. The light-colored bar shows the participants that had the disease indicated but not multimorbidity.

Table 1. Association between sociodemographic variables and multimorbidity in rural older users of the Family Health Strategy (Primary Care) (n=360). Araçagi, Paraíba state, 2022.

Independent variables	Multimorbidity		PR (CI)¨	*p*-value¨
	Yes	No		
	n (%)			
Sex				
Female	134 (68.4)	62 (31.6)	1.84 (1.47 – 2.29)	<0.001*
Male	61 (37.2)	103 (62.8)		
Age group				
≥70 years	137 (63.1)	80 (36.9)	1.56 (1.24 – 1.94)	<0.001*
60-69 years	58 (40.6)	85 (59.4)		
Color/Race				
White	74 (60.2)	49 (39.8)	1.18 (0.98 – 1.43)	0.118
Black	119 (50.9)	115 (49.1)		
Marital status				
Single/Separated/Divorced/Widowed	74 (58.3)	53 (41.7)	1.12 (0.93 – 1.36)	0.297
Married/de facto partnership	121 (51.9)	112 (48.1)		
Religion				
Catholic	178 (54.3)	150 (45.7)	1.05 (0.72 – 1.53)	0.967
Evangelist/Protestant	14 (51.9)	13 (48.1)		
Functional literacy				
Yes	63 (55.8)	50 (44.2)	1.04 (0.78 – 1.17)	0.768
No	132 (53.4)	115 (46.6)		
Working				
No	150 (65.5)	79 (34.5)	1.91 (1.48 – 2.46)	<0.001*
Yes	45 (34.4)	86 (65.6)		
Receives retirement pension				
Yes	184 (55.3)	149 (44.7)	1.36 (0.85 – 2.16)	0.209
No	11 (40.7)	16 (59.3)		

Source: Data from study, 2022. PR = Prevalence Ratio; CI – Confidence Interval; ¨ Pearson´s chi-square test; *Statistical significance (*p*-value < 0.05).

Table 2. Association between behavioral variables and multimorbidity in rural older users of Family Health Strategy (Primary Care) (n=360). Araçagi, Paraíba state, 2022.

Independent variables	Multimorbidity		PR (CI)¨	*p-value*¨
	Yes	No		
	n (%)			
BMI				
>27.0 – Overweight	86 (58.5)	61 (41.5)	2.24 (1.35 – 3.72)	<0.001*
22.0-27.0 – Normal weight	80 (54.4)	67 (45.6)	2.09 (1.25 – 3.47)	0.001*
<22.0 – Underweight	12 (26.1)	34 (73.9)	1.0	
Engages in Physical Activity				
No	126 (55.8)	100 (44.2)	1.08 (0.88 – 1.32)	0.500
Yes	69 (51.5)	65 (48.5)		

to be continued

Continuation of Table 2

Independent variables	Multimorbidity		PR (CI)¨	*p-value*¨
	Yes	No		
	n (%)			
Access to treated mains water				
Yes	42 (62.7)	25 (37.3)	1.20 (0.97 – 1.49)	0.157
No	153 (52.2)	140 (47.8)		
Current smoker				
No	177 (59.6)	120 (40.4)	2.09 (1.40 – 3.12)	<0.001*
Yes	18 (28.6)	45 (71.4)		
Former smoker				
Yes	112 (60.5)	73 (39.5)	1.28 (1.05 – 1.55)	0.017*
No	83 (47.4)	92 (52.6)		
Current alcohol use				
No	185 (60.7)	120 (39.3)	3.34 (1.89 – 5.89)	<0.001*
Yes	10 (18.2)	45 (81.8)		
Former alcohol use				
Yes	81 (56.6)	62 (43.4)	1.08 (0.89 – 1.30)	0.511
No	114 (52.5)	103 (47.5)		

Source: Data from study, 2022; BMI = Body Mass Index; PR = Prevalence Ratio; CI = Confidence Interval; ¨ Pearson´s chi-square test; *Statistical significance (*p*-value < 0.05).

Table 3. Association between clinical-therapeutic variables and multimorbidity in rural older users of Family Health Strategy (Primary Care) (n=360). Araçagi, Paraíba state, 2022.

Independent variables	Multimorbidity		PR (CI)¨	*p-value*¨
	Yes	No		
	n (%)			
Sustained fall in past year				
Yes	47 (60.3)	31 (39.7)	1.15 (0.93 – 1.42)	0.275
No	148 (52.5)	134 (47.5)		
Chronic pain for ≥3 months				
Yes	65 (74.7)	22 (25.3)	1.57 (1.32 – 1.87)	<0.001*
No	130 (47.6)	143 (52.4)		
Accessed health services in past 6 months				
Yes	138 (64.8)	75 (35.2)	1.67 (1.33 – 2.09)	<0.001*
No	57 (38.8)	90 (61.2)		
Has transport to health service				
No	143 (55.2)	116 (44.8)	1.07 (1.33 – 2.09)	0.603
Yes	52 (51.5)	49 (48.5)		
Type of health service used as 1st choice				
Hospital	47 (68.1)	22 (31.9)	1.34 (1.10 – 1.63)	0.014*
Basic Health Unit	147 (50.9)	142 (49.1)		
Need for companion				
Yes	156 (61.2)	99 (38.8)	1.65 (1.26 – 2.15)	<0.001*
No	39 (37.1)	66 (62.9)		

to be continued

Continuation of Table 3

Independent variables	Multimorbidity		PR (CI)¨	*p-value*¨
	Yes	No		
	n (%)			
Last medication consultation attended				
≤ 1 year	182 (63.0)	107 (37.0)	3.20 (1.95 – 5.24)	<0.001*
> 1 year	13 (19.7)	53 (80.3)		
Hospitalization in past year				
Yes	07 (70.0)	03 (30.0)	1.30 (0.86 – 1.98)	0.486
No	188 (53.7)	162 (46.3)		

Source: Data from study, 2022; PR = Prevalence Ratio; CI – Confidence Interval; ¨ Pearson´s chi-square test; *Statistical significance (*p*-value < 0.05).

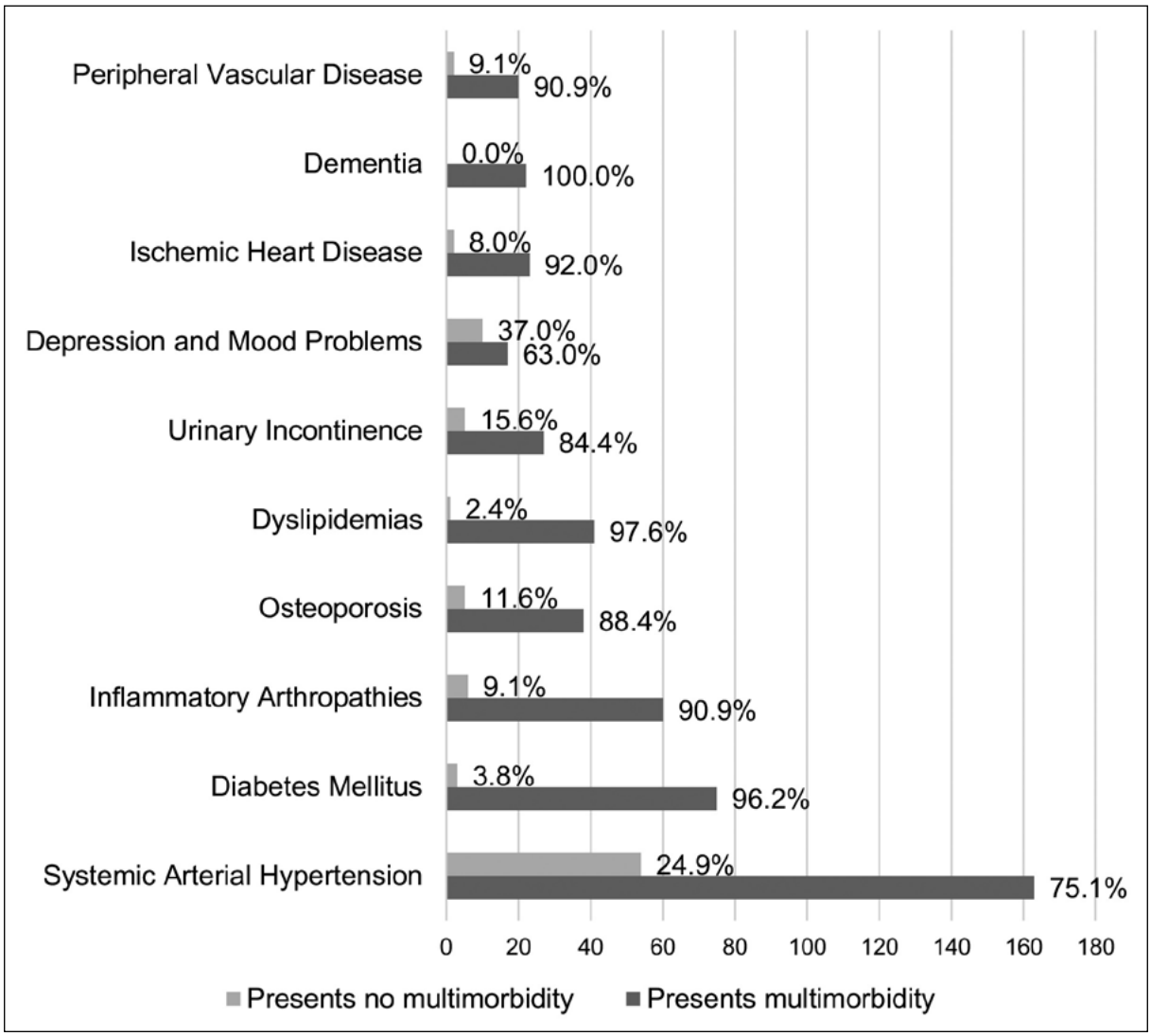

Figure 1. Relationship between self-reported morbidities and multimorbidity in rural older users of the Family Health Strategy (Primary Care) (n=360). Araçagi, Paraíba state, 2022.

Source: Data from study, 2022

Table 4. Multivariate analysis of sociodemographic, behavioral, clinical-therapeutic variables and multimorbidity in rural older users of the Family Health Strategy (Primary Care) (n=360). Araçagi, Paraíba state, 2022.

Independent variables	Multimorbidity		PR (CI) (adj)#	*p*-value (adj)#
	Yes	No		
	n (%)			
Sex				
Female	134 (68.4)	62 (31.6)	1.16 (1.09 – 1.25)	<0.001*
Male	61 (37.2)	103 (62.8)		
Age group				
≥70 years	137 (63.1)	80 (36.9)	1.08 (1.01 – 1.15)	0.018*
60-69 years	58 (40.6)	85 (59.4)		
BMI				
>27.0 – Overweight	86 (58.5)	61 (41.5)	1.19 (1.10 – 1.29)	<0.001*
22.0-27.0 – Normal weight	80 (54.4)	67 (45.6)	0.99 (0.93 – 1.06)	0.861
<22.0 – Underweight	12 (26.1)	34 (73.9)	1.0	
Access to treated mains water				
Yes	42 (62.7)	25 (37.3)	1.09 (1.00 – 1.18)	0.041*
No	153 (52.2)	140 (47.8)		
Former smoker				
Yes	112 (60.5)	73 (39.5)	1.10 (1.03 – 1.17)	0.002*
No	83 (47.4)	92 (52.6)		
Current alcohol use				
No	185 (60.7)	120 (39.3)	1.13 (1.05 – 1.22)	0.001*
Yes	10 (18.2)	45 (81.8)		
Chronic pain for >3 months				
Yes	65 (74.7)	22 (25.3)	1.18 (1.10 – 1.26)	<0.001*
No	130 (47.6)	143 (52.4)		
Type of health service used as 1st choice				
Hospital	47 (68.1)	22 (31.9)	1.12 (1.03 – 1.21)	0.005*
Basic Health Unit	147 (50.9)	142 (49.1)		
Last medical consultation attended				
≤ 1 year	182 (63.0)	107 (37.0)	1.19 (1.11 – 1.27)	<0.001*
> 1 year	13 (19.7)	53 (80.3)		

Source: Data from study, 2022; BMI = Body Mass Index; PR (adj) = adjusted Prevalence Ratio; CI (adj) = adjusted Confidence Interval; #Robust Poisson regression; *Statistical significance (*p*-value < 0.05).

The data presented in Table 4 show that women had a 16% higher probability of reporting multimorbidity than men. Participants aged ≥70 years had an 8% higher probability of having multimorbidity than individuals aged 60-69 years. Subjects that were overweight had a 19% greater probability of reporting multimorbidity than underweight individuals. Also, participants with access to treated mains water had a 9% greater probability of reporting multimorbidity than individuals who had no access.

The results also reveal that former smokers had a 10% higher probability of multimorbidity than those who had never smoked. Participants that reported not using alcohol had a 13% greater probability of having multimorbidity than those reporting alcohol

use. Individuals with chronic pain had an 18% higher probability of reporting multimorbidity than those experiencing no pain.

Lastly, participants that sought the hospital as the first choice of health service had a 12% greater probability of having multimorbidity compared to those choosing other types of service. Participants who had attended a medical consultation within the last year had a 19% greater probability of having multimorbidity than those who had a consultation over 1 year ago.

DISCUSSION

The present study found a high prevalence of multimorbidity in older rural participants and that the factors sex, age, BMI, access to treated mains water, history of tobacco use, not currently using alcohol, presenting chronic pain, use of hospital as first choice of health service, and having had a medical consultation within the past year were associated with multimorbidity in this population. To the best of our knowledge, this study is the first of its kind investigating the factors associated with multimorbidity in older individuals specifically from the rural area of the Northeast region of the country.

A previous study by Melo et al.[5] investigating multimorbidity identified a national prevalence of 53.1% in older adults based on data from the National Health Survey (PNS), consistent with the rate detected in the present study. However, although these data appear similar, it is important to bear in mind the influence of survival bias, given that those individuals with more health problems will have died, i.e. are not represented in this analysis[17].

Another explanation may lie in the fact that individuals who might have otherwise been included in the study sample for their health status, needed to move to the urban area because they needed better resources and access to health services, leisure and communication, again resulting in the non-inclusion of this group[18]. In addition, the issue of self-reporting of the information obtained should be taken into account, potentially leading to under-reporting or memory bias[6].

Similar results were found in studies of rural older adults in other countries, with the majority of participants presenting multimorbidity, such as China[19] (83.8%), India[20] (57.0%) and older American Indians[21] (57.0%). Several factors reported in the literature were found to contribute to this outcome: female gender[22,23], advanced age[20,22], better economic situation[22], low educational level[23], not smoking[23] and not engaging in physical activity[23].

A cross-sectional study of 2,400 older adults from Vietnam, of which 1,200 lived in the urban area, found that respondents with multimorbidity were predominantly female[24]. Another study involving community-dwelling older adults also reported similar results, attributing this difference to biological aspects, given that post-menopause, the female body promotes a decrease in estrogen levels, rendering these women more vulnerable to chronic non-communicable diseases (NCD)[25].

In addition, women have a longer life expectancy, more readily seek health services, and have lower exposure to occupational risks and mortality from external causes [26,27], while also exhibit a poorer health status compared to older men[24].

The results of the present analysis confirmed that the occurrence of multimorbidity is associated with age, particularly among the oldest-old. These findings corroborate the study by Nunes et al.[28], showing that multimorbidity increased with age, i.e. oldest-old individuals exhibited more multimorbidity than young-old, explained by the fact they have been exposed to stressor events for longer over the life course.

In line with the present study, an investigation involving an older rural population from India showed that most respondents were either normal weight or overweight and presented a higher level of multimorbidity compared to low-weight individuals[29], where excess weight is a factor predisposing to the development of chronic diseases[30].

Alcohol and tobacco use is one of the most important risk factors for poor mental and physical health and, consequently, for multimorbidity, especially among vulnerable populations. Supporting the findings, a previous study of older

Brazilians showed that former smokers had higher levels of multimorbidity than active smokers. This phenomenon is explained by the fact that former smokers develop diseases earlier due to their life history. Another explanation for this result is survival bias[28].

Tobacco and alcohol disorders are modifiable conditions that constitute a major cause of morbimortality and are collectively responsible for around 5 million deaths annually worldwide[31]. Consistent with this evidence, a previous study revealed that consuming alcoholic beverages in moderation was associated with a lower number of chronic conditions. Although the cited study was cross-sectional, precluding any inferences regarding cause and effect, this relationship might reflect reverse causality bias, given that those with fewer chronic conditions tend to have greater autonomy for consuming alcohol or, conversely, that users of alcohol have fewer diseases[28].

With regard to chronic pain reported, the current study findings corroborate a previous study in Germany revealing an association between chronic pain and high prevalence of multimorbidity[32]. Since pain is associated with a high burden of diseases, this group may exhibit distress with deleterious effects on health and quality of life[33].

Concerning the use or seeking of health service, participants exhibiting multimorbidity made greater use of health services within a shorter time frame compared to individuals without multimorbidity, where follow-up consultations were the most cited reason for this utilization. These findings are supported by an earlier study of data from the National Household Sample Survey (PNAD) and the National Health Survey (PNS) exploring the topic, which found similar rates of health service utilization by older people. The majority of respondents sought health services and exhibited multimorbidity, revealing an upward trend for both variables[34].

Moreover, a study of older adults in rural Australia reported an association between multimorbidity and greater health service utilization, revealing that multimorbid individuals had double the chance of needing medical and hospital services or hospitalization[6]. Thus, individuals living with multimorbidity appear to be significantly more prone to using health services[24].

Regarding the last medical consultation variable, a study of older Brazilians from Minas Gerais state identified an association between multimorbidity and medical consultations in the past 12 months, i.e. individuals with multimorbidity had more medical consultations in the past year than subjects without the condition[25]. This correlation might be explained by the fact that individuals with multiple diseases have greater needs for health care and, hence, make frequent visits and constant health service utilization[25].

For access to treated mains water, in contrast with the current study, a similar investigation of older adults from the interior of Bahia state, Brazil, showed that those without access to treated mains water had a higher prevalence of multimorbidity. This disparity might be explained by low socioeconomic level, since individuals with less purchasing power have poorer access to health services compared to more economically-advantaged groups. This higher-income group generally has greater, better access to health services, allowing them to seek care that can ultimately extend life expectancy[35].

The present study has some limitations, including the difficulty locating some participants due to poor road conditions and a lack of availability of professionals to help locate the participants. Another issue was the self-reporting of diseases, introducing potential risk of memory bias or under-reporting. Lastly, the COVID-19 pandemic hampered data collection and led to losses and refusals. However, the sample losses were minor and did not significantly impact results.

CONCLUSION

This study found a high prevalence and its associated factors multimorbidity in the older individuals investigated. The results also revealed that the participants faced barriers which make it difficult for them to achieve successful aging. The study also highlighted the apparent paucity of

health services and scientific studies aimed at this population, as well as the unpreparedness of health professionals in dealing with the aging process. Moreover, many older individuals seek hospitals instead of primary care units, demonstrating a lack of knowledge about the patient journey within the health services, underscoring the need to strengthen primary care in the rural setting.

Comparison of the profile of the rural participants versus their urban counterparts showed that the people from rural areas had greater difficulties concerning transport and accessing health services, lower educational level, poorer access to treated mains water and fewer holders of private health plans.

Thus, these results can contribute by helping inform the development of public policy to serve this population, and also to sensitize managers, health professionals, other services, the aging population, and older citizens to the opportunities for promoting active healthy aging.

Understanding the factors which lead to multimorbidity reveals the need for new approaches to monitoring, preventing and managing this condition in the older population, and to empower health professionals for delivering care to this older group in an effort to improve their health status. Lastly, the study highlights the need for further investigations, given the current lack of studies involving the rural older population.

AUTHORSHIP

- Alexandrino A – study conception, data analysis and interpretation, and writing and approval of version for publication.
- Oliveira CBS – data analysis and interpretation, and writing and approval of version for publication.
- Gomes SM – data analysis and interpretation, and writing and approval of version for publication.
- Nogueira MF – data analysis and interpretation, and writing and approval of version for publication.
- Mendes TCO – data analysis and interpretation, and writing and approval of version for publication.
- Lima KC - study conception, data analysis and interpretation, and writing and approval of version for publication.

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Nursing care in a long-term care facility for older people in the context of COVID-19: scoping review

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Abstract

Objective: To Identify the scientific evidence on nursing care for older people in a long-term care facility in the context of the COVID-19 pandemic. *Method*: This scoping review was based on the Joanna Briggs Institute Reviewers' Manual guidelines. The question was formulated from the acronym PCC, in which "P" corresponded to "older people, "C" to "nursing care" and "C" to "COVID-19". The search for scientific evidence was carried out on the LILACS, MEDLINE®, CINAHL® and Web of Science™ databases. Articles retrieved using controlled and uncontrolled descriptors, and those from gray literature, websites and repositories were analysed. Descriptive and critical analysis of statistics from the studies was performed. *Results*: The final study sample consisted of 14 scientific publications. Most of the output constituted technical reports (35.7%) published in Brazil (64.28%). Nursing care was categorized under: managerial interventions; educational interventions; care interventions, especially those forts preventing and controlling the spread of SARS-CoV-2, residents with suspected or confirmed COVID-19, and handling the corpse in the event of death; interventions facilitating communication between residents and their family/friends and between this group and the nurse; in addition to emotional support interventions for professionals/caregivers and residents. *Conclusion*: Amid the COVID-19 pandemic, nursing care is essential to prevent and control the spread of SARS-CoV-2.

Keywords: Older Adult. Gerontological Nursing. Nursing care. Long-Term Care Facility for Older Adults. Coronavirus infections.

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INTRODUCTION

COVID-19, a flu-like infectious respiratory disease, is caused by the novel coronavirus (SARS-CoV-2) and presents with dry cough, fever, dyspnea, myalgia or fatigue and, in more severe cases, with pneumonia, potentially requiring intensive care. The condition is highly transmissible and spreads easily[1,2].

The disease had a major global impact due to the large number of infected individuals and notified deaths which, in June 2023, reached 768,237,788 confirmed cases and 6,951,677 related deaths worldwide. Brazil ranks sixth in number of confirmed cases (37,693,506) and second in deaths (704,320)[3]. However, these figures may be underestimated given the low number of tests made available, coupled with under notification.

Amid this global health emergency, the older population is the most vulnerable to complications due to changes inherent to the aging process[2,4-7]. Studies show that the lethality of the disease rises with older age as a result of immunosenescence, rendering older individuals more susceptible to infectious-contagious diseases and unfavorable prognoses[8-10].

The mortality rate due to COVID-19 in 2021 led to a higher incidence of deaths among people aged >80 years (14.8%), compared to those in the 70-79 (8.0%) and 60-69 (8.8%) years age groups[11,12]. These figures were even greater among residents of Long-Term Care Facilities (LTCFs), where the lethality rate for octogenarians exceeded 15%[13].

This scenario can be explained by the LTCF setting, including in the national milieu, where residents have a profile of predominantly older individuals with chronic comorbidities, in use of polypharmacy, and with varying digress of dependence, requiring frequent contact with caregivers, health professionals and visitors[14]. Moreover, these facilities can be overcrowded, have inadequate physical infrastructure, and staff who are not adequately qualified to cater for the needs of residents[15,16].

COVID-19 serves as an alert regarding the need to provide quality safe care to older people residing in LTCFs. In this scenario, nurses play a central role in organizing and managing care in LTCFs. This group of health professionals helps reduce the spread of the virus in these environments via strategies to prevent and control infection, and through health education actions, using their close ties with older individuals to promote self-care with autonomy[10,17].

In view of the context of LTCFs, complexity of the aging process and repercussions of COVID-19 on the older adult population, particularly those residing in these facilities, implementing effective strategies to protect this high-risk group is paramount[10].

Therefore, the objective of this study was to identify the scientific evidence on nursing care for older residents of LTCFs in the context of the COVID-19 pandemic.

METHOD

A scoping review was conducted based on the recommendations from the Joanna Briggs Institute Reviewer's Manual[18] and according to the recommendations in the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation[19]. A study protocol was devised containing the following information: study type, objective, research question, inclusion and exclusion criteria, sample composition, data collection, data extraction and synthesis of information gathered.

The research question was developed using the PCC strategy, where: P (population)= older people; C (concept)= nursing care; C (context)= COVID-19; and defined as: "What is the nursing care for older residents of LTCFs amid the COVID-19 pandemic?".

In August 2022, a previous search of the Biblioteca Virtual em Saúde (BVS) – Virtual Health Library was carried out to check the uniqueness of the study and devise a search strategy. In September 2022, the bibliographic search of the literature was performed on the following databases: Literatura Latino Americana e do Caribe em Ciências da Saúde (LILACS via BVS), Medical Literature Analysis and Retrieval System Online (MEDLINE® via PubMed), Cumulative Index to Nursing and Allied Health Literature (CINAHL® - EBSCO), and Web

of Science™, accessed via the CAPES (Coordenação de Aperfeiçoamento de Pessoal de Nível Superior) journals site.

The Grey literature search included the following sites and repositories: Sociedade Brasileira de Geriatria e Gerontologia (Brazilian Society of Geriatrics and Gerontology); Associação Brasileira de Enfermagem-ABEn (Brazilian Association of Nursing), Agência Nacional de Vigilância Sanitária- ANVISA (National Health Surveillance Agency), Brazilian Ministry of Health, Portugal National Health Service, Ministry of Health - Spain, WHO, National Front for Strengthening LTCF and the Universidade Federal do Rio Grande do Norte Repository.

For selection of controlled and non-controlled descriptors, the terms were consulted in the Descritores em Ciências da Saúde - DeCS, the Medical Subject Headings (MeSH) and the List of Headings of the CINAHL. For each database, the controlled and non-controlled descriptors "aged", "aged, 80 and over", "elderly", "Nursing Care", "Coronavirus", "Covid-19" and "SARS-CoV-2" were combined using the Boolean operators AND and OR, as per the search terms (Chart 1). The LTCF descriptor was adopted as an inclusion criterion.

Data collection was performed in three stages: the first employed controlled and non-controlled descriptors adapted for the databases searched; the second applied the descriptors to other databases, sites and repositories to broaden the search; and the third and final stage entailed a search of the list of references from the sources used, including the Gray literature.

Studies involving LTCF residents aged over 60 years and that addressed the subject were included. There were no restrictions for publication date or language. Abstracts published in events annals, studies not answering the research question, and duplicate articles were excluded.

Chart 1. Search terms, sites and repositories used for study selection (n=14). Teresina, Piaui state, Brazil, 2022.

LILACS via BVS
((mh:(Idoso)) OR ("Pessoa idosa")) AND ((mh:(Enfermagem)) OR (Enfermagem)) AND (("Covid-19") OR (Coronavírus) OR ("Sars-Cov-2"))
MEDLINE® via PubMed
((((("aged"[All Fields]) OR ("aged, 80 and over"[MeSH Terms])) OR ("elderly"[All Fields])) AND ("nursing care"[MeSH Terms])) AND ("coronavirus"[MeSH Terms])
CINAHL® - EBSCO
(coronavirus OR covid-19 OR sars-cov-2) AND (aged OR (aged, 80 and over [mesh]) OR elderly AND nursing care AND coronavirus OR covid-19 OR sars-cov-2)
Web of Science™
(TS=(aged) OR TS=("aged, 80 and over") OR TS=((elderly)) AND TS=(("nursing care")) AND (TS=(Coronavirus) OR TS=("Covid-19") OR TS=("SARS-CoV-2 "))
Sites and repositories
Sociedade Brasileira de Geriatria e Gerontologia / Brazilian Society of Geriatrics and Gerontology
Associação Brasileira de Enfermagem / Brazilian Association of Nursing (ABEn)
National Health Surveillance Agency (ANVISA)
Ministry of Health
Portugal National Health Service
Ministry of Health – Spain
World Health Organization
Frente Nacional de Fortalecimento das ILPI/ National Front for Strengthening LTCIs
Universidade Federal do Rio Grande do Norte Repository

Screening was carried out by two independent reviewers, with the involvement of a third researcher in cases of disagreement. No calibration was performed. Titles and abstracts were first screened to select articles that satisfied the research question and met the inclusion and exclusion criteria. The short-listed records were retrieved and texts read in full. Ineligible articles were excluded, giving a total of 14 articles for inclusion in the review (Figure 1).

Lastly, information on title, country, study type and nursing care were extracted and compiled in a synthesis chart. A critical and descriptive analysis of the data was performed by thorough reading, with results grouped under categories.

RESULTS

The initial search led to the retrieval of 121 publications from the databases and 118 from other sources involving Gray literature for a total of 239 eligible studies. After reading of titles and abstracts, 75 duplicates were removed. Of the remaining studies (n=164), a further 150 were excluded after applying the selection criteria (off-topic). Thus, a total of 14 studies were included in the review, comprising 4 from the databases and 10 from the grey literature, as depicted in Figure 1.

The studies reviewed were from 5 different countries, predominantly Brazil[2,23-29,33] (64.28%), the United States of America (USA)[20,21] (14.28%), as well as Portugal[30], Spain[31] and Switzerland[32], with the latter 3 accounting for 1 study each (7.14%) (Chart 2).

With regard to design type, studies were predominantly technical reports[27,29,31-33] (35.7%), scientific articles[20,21,23,28] (28.5%), e-book chapters[24,25] (14.2%), technical notes[26,30] (14.2%) and a manual[22] (7.4%) (Chart 2). The profile of the interventions is outlined in Chart 3.

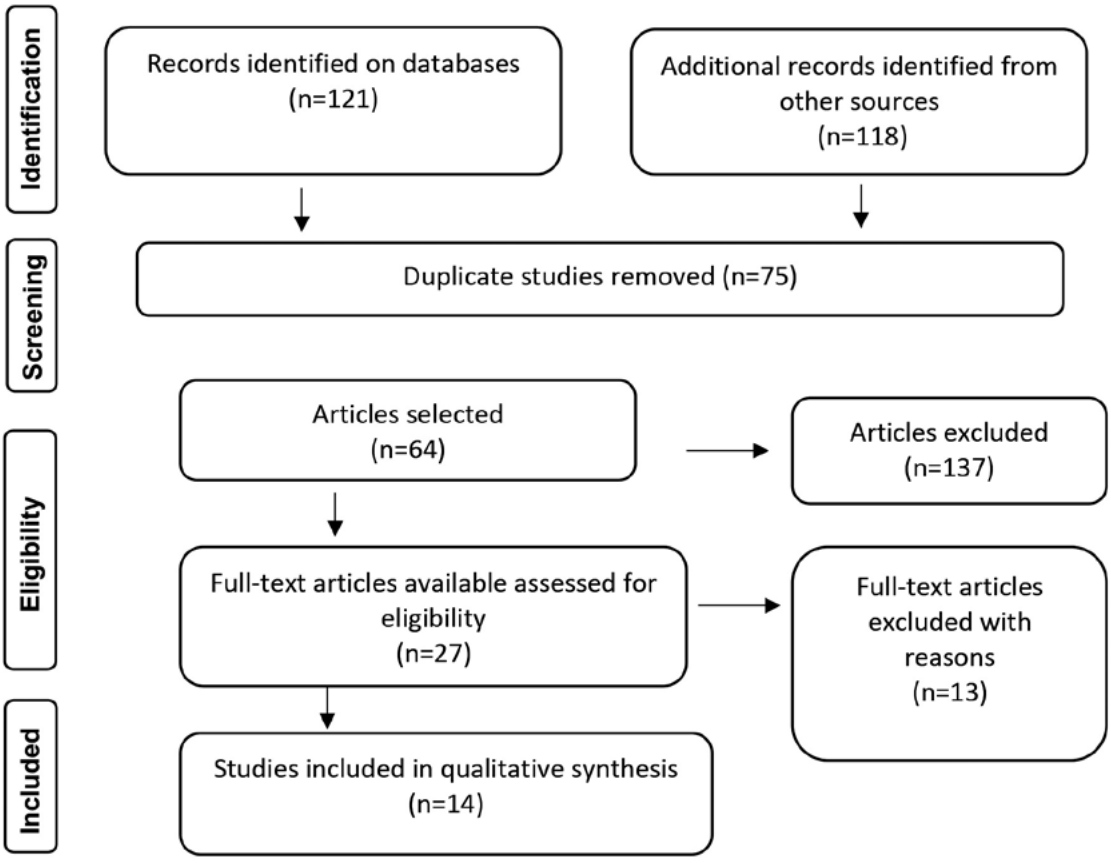

Figure 1. Flow diagram of study selection process for review, PRISMA-ScR. Teresina, Brazil, 2022.

Source: Data from search, 2022

Chart 2. Records retrieved by scoping review, according to title, type and country (n=14). Teresina, Piaui state, Brazil, 2022.

Citation	Title	Type	Country
20	Coronavirus Disease19 in Geriatrics and Long-Term Care: an update	Article	USA
21	Coronavirus Disease 2019 in Geriatrics and Long-Term Care: The ABCDs of COVID-19	Article	USA
22	COVID-19 e o cuidado de pessoa idosas: recomendações para instituições de longa permanência	Manual	Brazil
23	Recomendações para o enfrentamento da disseminação da COVID-19 em Instituições de Longa Permanência para Pessoa idosas	Article	Brazil
24	Prevenção e controle de infecções por coronavírus em Instituições de Longa Permanência para Pessoa idosas	E-BOOK Chapter	Brazil
25	Precauções nos casos de óbito por COVID-19 em Instituição de Longa Permanência para Pessoa idosas (ILPI)	E-BOOK Chapter	Brazil
26	Orientações para a prevenção e o controle de infecções pelo novo coronavírus (sars-cov-2) em Instituições de Longa Permanência para Pessoa idosas (ILPI).	Technical Note	Brazil
27	Comunicação aos trabalhadores de enfermagem das Instituições de Longa Permanência de Pessoa idosas (LTCF) para o enfrentamento da disseminação do COVID-19	Technical Report	Brazil
28	Telemonitoramento a instituições de longa permanência para pessoa idosas frente às infecções por coronavírus e COVID-19	Article	Brazil
29	Prevenção e controle de infecções pelo novo coronavírus (SARS-CoV-2) a serem adotadas nas Instituições de Longa Permanência de Pessoa idosas (ILPI).	Technical Report	Brazil
30	Orientação nº 009/2020	Technical Note	Portugal
31	Recomendaciones a residencias de mayores y centros sociosanitarios para el COVID-19	Technical Report	Spain
32	Infection Prevention and Control guidance for Long-Term Care Facilities in the context of COVID-19	Technical Report	Switzerland
33	Relatório Técnico da Frente Nacional de Fortalecimento às Instituições de Longa Permanência para Pessoa idosas	Technical Report	Brazil

Source: Data from search, 2022

Chart 3. Characteristics of publications according to nursing care interventions in long-term care facilities amid COVID-19 (n=14). Teresina, Piaui state, Brazil, 2022.

NURSING CARE
Managerial Interventions
Describe facility standards and routines in a dedicated protocol for prevention and treatment made readily available to team[20,22,23,26].
Replan care routines, distributing activities throughout working day so as to avoid crowding among older people and staff[23,27].
Allocate dedicated staff to care for residents placed in isolation[23,27,30].
Establish flow diagram showing identification, assessment, precautionary measures and procedures for suspected and confirmed cases in the facility[27].
Develop and implement measures for preventing and controlling spread of virus within the facility[21,22,26].
Ensure provision of PPE for team and residents[23,27,33].
Provide means for hand-washing with water and liquid soap; toilet/basin with liquid soap dispenser; paper towel holders; paper towels; rubbish bins with lids and operated without hand contact[22].

to be continued

Continuation of Chart 3

NURSING CARE
Managerial Interventions
Provide dispensers containing 70% alcohol-based hand sanitizer gel in LTCF entrance, busy indoor spaces, bedrooms and bathrooms[23,27,31].
Supervise hand sanitizing and use of surgical masks by staff when delivering direct care to older people[22,23,30,33].
Tele-monitor those without nurse, aiding caregivers in recognizing the main routes of transmission and measures to prevent spread of the infection, and also help in early detection of suspected cases of the virus in professionals and residents[21,28].
Assess the vaccination cards of residents and professionals/caregivers to ensure these are up-to-date with all available vaccines [22,23,26,27,33].
Oversee and reinforce cleansing and disinfection of surfaces and utensils used by residents (plates, cups, cutlery etc.)[21-24,31,33], besides cleaning of indoor spaces, including final cleaning in rooms[22,25,26], keeping the spaces well-ventilated[26,31,33].
Educational Interventions
Train LTCF professionals in the use, removal and disposal of PPE, hand cleansing and on measures to be implemented in virus prevention and control[21-23,26,27,29,30,32,33].
Guide residents on measures for preventing and controlling spread of virus[23,26,27,29,30,32,33].
Advise residents to refrain from sharing personal use items (hair brushes, nail clippers, towels, bedding etc.)[26,29,31-33].
Display posters with guidance on hand cleansing measures, respiratory hygiene and coughing etiquette in strategic locations of the facility[22,24-26,29,31-33].
Affix notices to bedroom doors describing the precautions and PPE necessary for use in the event of a suspected or confirmed case[23].
Care Interventions
• Prevention and control of spread of SARS-CoV-2 • Carry out a clinical nursing assessment and regular monitoring of all residents for fever, respiratory symptoms and other signs and symptoms (onset or worsening of cough, difficulty breathing, shivers, repeated shivering, muscle pain, headache, sore throat and loss of taste or smell)[20-23,26,27]. • Assess/monitor signs and symptoms of respiratory infection in residents at time of admission or upon return to the facility and implement appropriate infection prevention practices for residents arriving with symptoms[22,23,26,27,30-32]. • Perform active screening of all professionals/caregivers[20,24,31,32], immediately placing workers with respiratory symptoms or fever on sick leave for at least 14 days[20,22,23,27,30-33]. • Encourage residents, professionals/caregivers and visitors to perform hand-washing [20,22,23,26,29,30,32,33]. • Assist older individuals unable to perform hand-washing[21,25,32]. • Use surgical masks when delivering direct care to older individuals[19,22,25,26,30]. • Restrict or suspend visits for an indeterminate period, encouraging family members to stay home[20,22,23,27,29,32]. • Restrict residents from going out, whether for short trips or external medical appointments[20,22,23,29,33]. • Restrict group activities and reduce time residents spend in communal areas of the facility (TV rooms, canteen, games rooms) to prevent crowding, ensuring minimum physical distancing of 1 meter between residents[20-23,26,27,29,30,32,33]. • Set up a rota schedule for residents leaving rooms, moving through communal areas, sunbathing, having meals etc[22]. • Perform cleaning and disinfecting of equipment for clinical use (stethoscopes, sphygmomanometers, thermometers etc.)[22,33].
• Residents with suspected or confirmed COVID-19 condition. • Notify all suspected or confirmed cases to epidemiological surveillance and perform follow-up via telemedicine center[22,23,27,32]. • Place residents with suspected or diagnosed infection in private well-ventilated rooms with own bathroom, keeping doors closed and windows open at all times. When individual rooms cannot be provided, ensure distancing of at least 1 meter between beds[22,23,26,30,31,33]. • Recommend use of surgical mask by residents with symptoms of respiratory infection if needing to leave room[22,23,26,27,32,33]. • Establish different times for resident with suspected or confirmed infection to leave room[23,26,27,32,33]. • Provide the PPE needed to deliver care to resident in isolation (surgical mask, eye protection, cape or tunic and surgical gloves)[23-27,32]. • Use a N95/PFF2 mask or equivalent when performing procedures that produce aerosols[23,26]. • Offer emotional and practical support through informal networks (family) and health professionals to residents with suspected or diagnosed COVID-19[23,25].

to be continued

Continuation of Chart 3

NURSING CARE
Care Interventions
• Handling corpse in event of death • Wash hands before and after contact with the corpse and environment, using skullcap, protective glasses and face shield, surgical mask (use N95, PFF2 or equivalent), cape or gown (use impermeable cape or gown, in case of risk of contact with volumes of body fluids or secretions), pair of gloves (nitrile gloves for handling throughout procedure) and impermeable boots[23,25,31]. • Block natural orifices of the body (oral, nasal, rectal) to prevent leakage of bodily fluids, moving the body as little as possible[23,25]. • Store the body in an impermeable sealed leak-proof bag[23,25], • Disinfect the outer surface of the bag (70% liquid alcohol can be used, chlorine solution (0.5%-1%) or another sanitary disinfectant approved by ANVISA), ensuring that contaminated gloves are not used to perform this procedure[24,25]. • Label the bag containing body, including information on biological risk: Hazard Group 3 biological agent[23,25]. • Dispose of garments worn by the deceased in a labeled sealed bag[23,25]. • Immediately dispose of perforating/cutting waste in rigid recipients that are puncture and leak-proof bearing the infectious waste symbol[25]. • Hand over, after disinfecting, personal belongings of the deceased (jewelry, items with sentimental value) to the family members[23,25]. • Carry out final cleaning of objects, furniture and physical infrastructure[23,25,27].
Interventions for Communication with Family
Encourage the use of alternative mechanisms for interaction between residents and family or friends during the period of restricted visiting[23,26,27,29,32,33].
Set up times for contact with the family within the nursing routine[23].
Provide family members with reports on the general health status of residents by telephone or internet[23,27].
Interventions for Psychological Support
Promote psychological and physical wellbeing of professionals/caregivers[23,32,33].
Implement measures stimulating workers on actions favoring awareness and attention level at stressing times and emotional support[22,23].
Assess signs of Burnout Syndrome in professionals/caregivers, implementing strategies for decompressing the professional to reduce safety risks of residents, offering channel for emotional support and clearing up doubts around the disease[20,23,27].
Foster measures to minimize deleterious emotional issues arising from lockdowns, attenuating feelings of missing loved ones among residents and family members/friends[22,33].
Offer emotional and practical support through informal networks (family) and health professionals to residents with suspected or diagnosed COVID-19[22,32].

Source: Data from search, 2022

Overall, managerial interventions featured in 11 studies and educational interventions in 10, followed by care and care subdivisions into: control and prevention (=12), residents with suspected condition (n=9), dealing with corpse in the event of death (n=4); and also interventions involving the family (n=6); and psychological support interventions (n=6), as outlined in Chart 3.

DISCUSSION

The majority of the studies reviewed in the present investigation were derived from Grey literature (technical reports, technical notes, manual and E-BOOK chapters), content which has not been screened by reviewers or an Editorial board and, thus, with lower visibility[34]. This scenario points to the need for more national and international scientific output on the subject.

Brazil ranked highest in number of publications on nursing care in LTCFs amid the COVID-19[22-28,33], although this is a global discussion. In Brazil, LTCF are linked to the welfare system, dispensing with need for a compulsory nurse, despite the key role of this professional in care settings, irrespective of whether this is stipulated by law. Consequently, in

2019, the Federal Nursing Board recommended the deployment of nurses in LTCF, in a move to ensure risk-free quality care[35].

Of the different care initiatives found in the studies of older people in LTCF amid the pandemic, managerial actions highlight education, the essence of nursing, as the key component for preventing and controlling spread of the disease[20,22,23,26,27,29,30,32,33].

Of the variety of duties of nurses, educating contributes as an incentive for self-care, fostering autonomy and co-participation, besides improving adherence to the health measures proposed. Amid the pandemic, this role proved challenging because of the barrage of unreliable information disseminated, detracting focus from the pertinent effective measures for preventing contamination by the novel coronavirus[38,39].

Concerning the managerial care of residents with suspected or confirmed diagnosis of COVID-19[20-24,26,27,29-33], the most notable actions were management of waste, cleaning and disinfecting of spaces within the LTCF[20-24,26,31,33], as well as handling corpses of deceased individuals who had succumbed to the disease[21,25,27,31].

Nursing care integrates actions of managing waste, the care environment, and care of the individual, from conception to death, coordinating efforts with the other professionals toward implementing interventions tailored to each situation[40].

Communication with the family, including using technology as a collaborative tool, proved an element of the interventions which was essential for allowing loved ones, kept at a distance due to the suspension of visits, to stay in closer touch with the residents[23,26,27,29,32,33], while also providing residents, family members and workers with psychological support[22,23,32,33].

Nurses are responsible for care management at LTCFs, in charge of strategies for training of collaborators (both professionals and non-professionals, besides family members)[27], essential in managing care of residents who have tested positive for COVID-19, those suspected of having the disease, and uninfected individuals. The underlying goal of these interventions is to prevent spread, through proper use of Personal Protective Equipment (PPE), hand-washing, and safe observation of recommendations, protocols and health guidance, in a bid to contain the chain of transmission of the disease[21-23,26,27,29,30,32,33].

It is clear that, within these facilities, the staff and caregivers of the older residents represent the main vehicle of transmission of SARS-CoV-2, since they typically work at more than one service and sometimes, although asymptomatic, carry the virus, readily spreading it to high-risk populations[20,21]. This was illustrated in 2019 by an inspection report by the Federal Board of Nursing which indicated that 500,161 professionals from the category worked more than one job[41].

These findings point to the need for daily monitoring of signs of symptoms of respiratory infection within LTCFs[20-23,26,27]. This assessment should be carried out, especially in newly admitted or readmitted residents, with a focus on prevention practices so as to avoid the spread of the virus among other residents [22,23,26,27,30-32].

To this end, it is recommended that symptomatic professionals/caregivers take sick leave from the LTCF for up to 14 days from the onset of symptoms, even after vaccination and the presence of new variants of the virus[20,22,23,27,30-33,41]. Residents suspected of having the virus or with a confirmed diagnosis of COVID-19 and that do not require hospital admission, should be placed in isolation within well-ventilated private rooms with own bathroom, keeping all doors closed and windows open[22,23,26,30-33].

However, given the fact that most national facilities are overcrowded, with shared environments that increase the risk of transmission[33], physical distancing of at least 1 meter between beds should be adopted[22,23,26,30,31,33].

Moreover, nurses need to manage the headcount in order to minimize staff shortages caused by absenteeism as a result of symptomatic professionals being placed on sick leave, and also to dedicate professionals to delivering care to residents who are suspected or confirmed COVID-19 cases[23,27,30,31].

Also within the scope of nursing interventions is preparing the corpse in the event of death in the LTCF, a procedure requiring the use of all PPEs (head covering, protective glasses and face shield, N95 mask or equivalent, impermeable cape or gown, gloves and boots) and hand-washing[23,25,31]. Natural body orifices must also be blocked to prevent leakage of bodily fluids[23,25], given that the COVID-19 virus survives in fluids after death of the individual[36].

With regard to visits to the LTCFs, it is recommended these be suspended during the pandemic[20,22,23,27,29,32]. Therefore, nurses need to incorporate strategies to maintain closer ties between residents and family into their care plan to keep the social support network active, with the use of communication tools such as smartphones, tablets, computers, social media and others[23,26,27,29,33].

Providing patient care during the pandemic poses a challenge for health professionals, who must deal with, on a daily basis, intense psychic anguish, manifesting as generalized anxiety disorders, sleep disturbances, fear of becoming sick and contaminating colleagues and family members[37]. This scenario is no different in LTCFs, where the pandemic further exacerbates preexisting mental and physical burnout of the carer. Thus, an important intervention is the promotion of physical and mental wellbeing of these professionals/caregivers[22,23,32,33].

Regarding unfavorable outcomes, evidence shows that older residents with higher level of dependence and greater number of comorbidities are more likely to have a poorer prognosis[35]. Therefore, quality humanized integral nursing interventions are essential for this age group residing in LTCF during pandemics, because this approach can help control and prevent the spread of the COVID-19 virus in these services[21,22,26,27,31,33].

A limitation of this study was the lack of solid evidence on nursing care for older individuals in LTCF amid the pandemic, given that most of the publications were derived from the Grey literature. It should be noted that these recommendations are subject to changes given the constant updating of information on this novel virus.

CONCLUSION

The present study revealed that the scope regarding nursing care for older people in LTCF amid the COVID-19 pandemic needs expanding.

The nursing care was categorized under the categories: managerial, educational and care interventions, related to the prevention and control of the spread of SARS-Cov-2, in addition to suspected and confirmed cases and handling corpses in the event of death, with communication and health education proving the stand out categories.

Taken together, the results reiterate the importance of having a nurse on the LTCF team, because this professional is involved on all fronts, not only the COVID-19 pandemic, but other conditions affecting the older population.

AUTHOR CONTRIBUTIONS

- Rutielle F. Silva – responsible for all aspects of the study, vouching for any issues related to the accuracy or integrity of any part of the study,
- Silvia M. C. Gallo – responsible for all aspects of the study, vouching for any issues related to the accuracy or integrity of any part of the study.
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Edentulism and frailty in domiciled older adults: a cross-sectional study

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Abstract

Objective: To investigate the association between frailty and edentulism in community-dwelling older adults and determine the individual, sociodemographic, and clinical factors associated. *Method:* A total of 333 older adults aged 65 years or more participated in this study; they responded to the Edmonton Frail Scale instrument (EFS). Data on socioeconomic factors, oral health, and use of and need for dentures were also collected. Those with cognitive difficulties were excluded. Hierarchical multivariable logistic regression models were performed using the *stepwise* and backward procedure, which tested the relationship of edentulism and covariates with EFS results. Variables with p<0,20 in the unadjusted analyzes were included in the adjusted logistic regression. *Results:* The prevalence of moderate to severe frailty was 12.3%. Edentulism was related to frailty (OR 3,45; IC 95%: 1,45 – 8,25; p=0,01), age (OR 2,19; IC 95%: 1,07 – 4.46; p=0,03), female sex (OR 2,75; IC 95%: 1,23 – 6,15; p=0,01), the need of lower dental prosthesis (OR 3,19; IC 95%: 1,27 – 8,05; p=0,01) and toothache perception (OR 2,74; IC 95%: 1,15 – 6,15; p=0,02). *Conclusions:* Frailty was associated with edentulism, age, female sex, the need for lower dental prosthesis and toothache perception. These oral conditions are highly prevalent among older adults and can be prevented by multiprofessional actions supported by public policies. Oral examinations should be considered in pre-frail and frail patients' assessments as oral health indicators were associated of older adults' frailty.

Keywords: Frail Elderly. Oral Health. Frailty. Health Of The Elderly.

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INTRODUCTION

Frailty is a multifactorial geriatric syndrome, characterized by a multidimensional state of vulnerability resulting from a complex interaction of biological, cognitive, and social factors[1]. Brazil is aging very fast. In 2010, 39 Brazilians were 65 years or older for each 100 young ones, and this proportion of older adults will jump to 153 for the same number of younger ones, in 2040[2]. The prevalence of edentulism over the world from 50 years older adults was near 10% between 1990 and 2015[3] and 54% among Brazilians 64-75 years old persons, in 2010[4]. This is a huge public problem because edentulism affects not only the quality of life[5], but it has been associated to all cause of mortality among older adults[6]. The number of individuals classified as frail is expected to increase with the aging of the world population; hence, the aging population requires increased attention regarding healthcare, given the high risk of mortality in this group[7].

The oral health of older adults is influenced by sociodemographic characteristics[5]. Age is the first factor to be considerate because important oral health conditions such as the dental caries and the periodontal diseases tend to be more severe over the years leading to the toothache perception, tooth loss and edentulism, use and need of dental prosthesis. Other important concern regards upon impoverishment of the oral condition perception of the aging older adults which might increase the frailty risk in this group[5]. The adult females are more sensitive over the years to oral conditions tending to be over treated compared to men later in life[5]. Other individual social characteristics, such as the family income and education attainment also influence the oral health. The association of lower family income with in older adults[5]. Despite this group to be less formally educated, the fewer school years frequented is also associated with the fewer natural teeth[8]. These characteristics must be considered in a frailty study regarding oral health status because of its potential to be confounders over the analyses.

Frailty represents a challenge for the oral health demands of older adults, since they postpone appointments due to poor perception of oral health needs[9]. Compromised oral health status contributes to frailty, owing to difficulties with oral hygiene and chewing problems[5]. Many people still consider the edentulism as a natural condition for older adults and this belief underpins the historical lack of public policies on oral health for the adult population[10]. Nevertheless, tooth loss has been related to frailty as the remaining of natural teeth has been associated to robust older adults[11]. Naturally, if there is tooth loss or even edentulism the use of dental prosthesis is present or in need, but the oral rehabilitation in its several possibilities still lacks evidence regarding the frail syndrome over older adults. The complex relationship between oral health and frailty needs to be better understood.

Considering that poor oral health is a predictor of frailty and that frailty is associated with the quality of life and oral health in older adults[9], and that both the prevalence of frailty and oral health problems are high in low- and middle-income countries[12], such as Brazil, the present study aimed to investigate the association between frailty and edentulism in community-dwelling older adults and determine the individual, sociodemographic, and clinical factors associated.

METHOD

A cross-sectional home-based study was conducted in 2015 in the city of Bauru, State of São Paulo, Brazil, with a total estimated population of 31,376 older adults aged ≥65 years, according to the Brazilian Institute of Geography and Statistics[13]. The two examiners discussed the dental indexes with pictures first, then they examined five dentate and five edentulous older adults twice times each. The last round was considered approved because Kappa statistics achieved. (>0.80)[5]. A pilot study was carried out with 35 older adults aged 65 years or more who were living at the Vila Dutra Public Health Clinic area, to evaluate the data collection methods and estimate the sample size. The pilot study was successful, and its data was incorporated to the main research[14] with the Edmonton Frail Scale (EFS)[15] assessment completed twice within a 14-day interval, the frequency of moderate-to-severe frailty was found to be 16.2%. The sample size was

333 older adults, with a confidence interval of 95%, a margin of error of 5%, and design effect of 1.1.

The city was divided for this research in 5 regions (north, east, west, south and central) to participate with 3 Primary Attention Public Clinic. The Family Health Strategy is only used as a model for Primary Health Attention in Bauru at North and West areas. The group started searching for older adults walking from and around the blocks of each Public Clinic as in a spiral until completed the adscripted blocks ended[5]. The dental exams were realized with the older adult seated in a chair at their homes in a place with natural light sheltered by sun. Before the exams started the examiner kindly asked to remove dental prosthesis, and then the questionaries were completed by interview. All the older adults were invited to participate in and the ones without minimal understanding of the research parameters, questions and nature of the oral exams were excluded for cognitive reasons.

The EFS validated for the Brazilian population was used to assess the frailty of the participants[16]. This instrument consists of 11 items grouped into the following nine domains: a) Cognition – placing the numbers in the correct position in a pre-drawn circle to represent a clock, and then placing the hands to indicate the time "ten and eleven" (0 = no errors, 1 = small spacing errors, 2 = other errors); b) general health status, number of hospitalizations in the last year (0, 1–2 and ≥2), and self-rated general health (0 = excellent/very good/good, 1 = fair, 2 = poor); c) functional independence – number of daily activities the respondent needs assistance with, including meal preparation, shopping, transportation, telephone, cleaning, laundry, money management, and medication use (0 = 0-1, 1 = 2- 4, 2 = 5–8); d) social support – person they can count on when they need help to meet their needs (0 = always, 1 = sometimes, 2 = never); e) use of medication – five or more different prescriptions on a regular basis (0 = no, 1 = yes) and forgetting to use medication (0 = no, 1 = yes); f) nutrition – weight loss that caused the clothing to become loose (0 = no, 1 = yes); g) mood – often feeling sad or depressed (0=no, 1=yes); h) continence – loss of urine control (0 = no, 1 = yes); i) functional performance – time taken to sit on a chair (knee joint angle usually > 90° of flexion) with back and arms at rest, stand, walking about 3 m, return to chair, and sit (0 = 0–10 s, 1 = 11–20 s, 2 = >20 s). Two categories were used in this study: "0" - no frailty/apparently vulnerable/mild (0–8 points) and "1" - moderate to severe frailty (≥9).

The following sociodemographic characteristics were included as covariates: age (0 = 65 to 74 years old, 1 = 75 years old and over), sex (0 = male, 1 = female), monthly family income (0 = ≤ 2 minimum wages [MW], 1 = > 2 MW; MW in Brazil in 2015 was R$ 788.00 [US$ 203.61]), and educational level (0 = up to 3 years of schooling, 1 = 4 or more years of schooling). To assess the oral condition, the Caries Assessment Spectrum and Treatment (CAST) instrument was used[17] the use of and need for dentures was assessed[18]. Edentulism was recorded using the CAST instrument; code 8, referring to edentulism, was used to categorize the sample into the group with total loss of teeth, i.e., edentulous, and presence of natural teeth, i.e., non-edentulous. Self-perceived pain was categorized as follows: 0 = absent and 1 = present.

The clinical status of the oral condition was assessed according to the use of and need for upper and lower dentures[18]. The types of dentures used were coded as follows: 0 = no denture, 1 = bridge, 2 = more than one bridge, 3 = partial denture, 4 = both bridges and partial dentures, and 5 = full removable denture. Use of dentures was categorized as follows: 0 = does not use dentures and 1 = uses one or more dentures. The need for a dental prosthesis was coded as follows: 0 = no need for a dental prosthesis, 1 = needs a single dental prosthesis (replacement of one tooth), 2 = needs a multi-unit dental prosthesis (more than one tooth replacement), 3 = needs a combination of single and/or multi-unit dentures, and 4 = needs complete denture (replacement of all teeth). The need for a dental prosthesis was categorized as follows: 0 = no need for a dental prosthesis and 1 = needs one or more dental prostheses.

Those who could not understand the questions in the questionnaires owing to cognitive difficulties were excluded. Data were collected at the participants' homes through individual interviews and oral examinations, performed by trained researchers. The frequencies of edentulism, sociodemographic

characteristics, dental/clinical measures, and self-perceived dental pain were presented in absolute and relative frequencies. The data of edentulism, covariates, and EFS results were subjected to crude logistic regression. Hierarchical multivariable logistic regression models with stepwise backward elimination were used to test the relationship of edentulism with the covariates and EFS results. The variables with a p-value <0.20 in the unadjusted analyzes were included in the adjusted logistic regression.

Cronbach's alpha coefficient was calculated to determine the internal consistency of the EFS questionnaire[9]. The quality of the logistic regression models was evaluated by testing the multicollinearity of the independent variables according to the variance inflation factor (VIF) using the linear regression procedure and by the Hosmer and Lemeshow test concomitantly with the logistic regression to evaluate the observed and predicted frequencies (p>0.05).

This study was approved by the Research Ethics Committee of the Faculty of Dentistry of Bauru, University of São Paulo (CAAE 37043414.2.0000.5417; Approved Report 1.604.600) and complied with the principles and guidelines indicated in Resolution No. 466 of 2012 of the National Health Council and with the Declaration of Helsinki of 1975.

RESULTS

Initially, 335 community-dwelling older adults agreed to participate; the sample represented the following areas: central (69, 20.60%), south (41, 12.24%), west (105, 31.34%), east (18, 5.37%), and north (102, 30.45%). The interviews of two participants were excluded due to incomplete information; hence, the final sample consisted of 333 older adults. Among them, 58.6% were 65–74 years old and 41.4% were 75 years or above. Women represented 56.5% (188) of the sample, and most participants (54.05%) had up to 3 years of educational attainment. Most participants needed lower dentures (64.9%). The characterization of the sample according to sociodemographic variables is presented in Table 1.

The prevalence of moderate-to-severe frailty was 12.3%. Participants with moderate-to-severe frailty were mostly adults aged 75 years or older (58.5%), women (78.0%), and from low-income families (95.1%). The prevalence rates of the need for upper and lower dentures among those with moderate-to-severe frailty were 75.6% and 85.4%, respectively. Of the participants with moderate-to-severe frailty, 80.5% were edentulous and 26.8% reported the presence of dental pain.

Table 2 presents the unadjusted bivariate analysis of the relationship between frailty, edentulism, age, sex, family income, need for upper and lower dentures, and self-perceived toothache, noting that moderate-to-severe frailty was statistically and significantly associated with all studied variables. Nevertheless, the adjusted logistic regression remained without the need for upper denture variable only, as all the others were still in the final model (Table 3).

Table 1. Sample characterization according to clinical and sociodemographic variables (N=292). Bauru, SP, 2015.

	EFS	
	0 (%)	1 (%)
Edentulism		
Not edentulous n (%)	135 (94.41)	8 (5.59)
Edentulous n (%)	157 (82.63)	33 (17.37)
Age		
65-74 n (%)	178 (91.28)	17 (8.72)
75 or older n (%)	114 (82.61)	24 (17.39)
Sex		
Male n (%)	136 (93.79)	9 (6.21)
Female n (%)	156 (82.98)	32 (17.02)
Family income (MW)		
≤ 2 n (%)	239 (85.97)	39 (14.03)
> 2 n (%)	53 (96.36)	2 (3.64)
Education attainment (in years)		
≤ 3 n (%)	151 (83.89)	29 (16.11)
> 3 n (%)	141 (92.21)	12 (7.79)
Upper denture use		
No n (%)	104 (88.03)	14 (11.97)
Yes n (%)	188 (87.38)	27 (12.62)
Lower denture use		
No n (%)	196 (87.84)	27 (12.16)
Yes n (%)	96 (87.16)	14 (12.84)
Need for upper denture		
No n (%)	131 (92.91)	10 (7.09)
Yes n (%)	161 (83.85)	31 (16.15)
Need for lower denture		
No n (%)	111 (94.87)	6 (5.13)
Yes n (%)	181 (83.8)	35 (16.2)
Toothache		
No n (%)	246 (89.13)	30 (10.87)
Yes n (%)	46 (80.70)	11 (19.30)

"0"- no frailty/apparently vulnerable/mild (0-8 scores) and "1" - moderate to severe frailty (≥ 9).

Table 2. Crude logistic regression analysis between frailty and clinical and sociodemographic variables (N=292). Bauru, SP, 2015.

	Moderate/severe frailty OR (95% CI; p)
Edentulism	
Not edentulous	-
Edentulous	3.54 (1.58: 7.94; 0.01)
Age	
65-74	-
75 or older	2.20 (1.13: 4.28; 0.02)
Sex	
Male	-
Female	3.10 (1.43: 6.72; 0.01)
Family income (MW)	
≤ 2	-
> 2	0.23 (0.05: 0.99; 0.04)
Education attainment (in years)	
≤ 3	-
> 3	0.23 (0.05: 0.99; 0.04)
Upper denture use	
No	-
Yes	1.06 (0.53: 2.11; 0.86)
Lower denture use	
No	-
Yes	1.06 (0.53: 2.12; 0.86)
Need for upper denture	
No	-
Yes	2.52 (1.19: 5.34; 0.02)
Need for lower denture	
No	-
Yes	3.58 (1.46: 8.78; 0.01)
Toothache	
No	-
Yes	1.96 (0.92: 4.19; 0.08)

Table 3. Logistic regression adjusted analysis between frailty and clinical and sociodemographic variables (N=292). Bauru, SP, 2015.

	Moderate/severe frailty OR adjusted (95% CI; p)
Edentulism	
Not edentulous	
Edentulous	3.45 (1.45: 8.25; 0.01)
Age	
65-74	
75 or older	2.19 (1.07: 4.46; 0.03)
Sex	
Male	
Female	2.75 (1.23: 6.15; 0.01)
Need for lower denture	
No	
Yes	3.19 (1.27: 8.05; 0.01)
Toothache	
No	
Yes	2.73 (1.15: 6.51; 0.02)
Constant	0.01 (-: -; 0.01)

No differences were observed between the observed and predicted frequencies by the Hosmer–Lemeshow test in the adjusted logistic regressions (p>0.05). Furthermore, VIF values lower than 10 suggested the absence of multicollinearity.

DISCUSSION

The association between edentulism and moderate to severe frailty was confirmed for older adults in our study. The demographic characteristics was also associated corroborating previous studies which associated frailty with aging and females[19]. The need for lower dentures was already observed[19], nevertheless the reason for this association regarding frail older adults is still not plainly discussed, and the toothache associated to frail older adults highlight the need for a special primary health attention for older adults and the frail ones.

The prevalence of moderate-to-severe frailty in our study was 12.3%, among participants aged ≥75 years and women, in line with the results of previous studies[19]. A systematic review showed that the prevalence of frailty ranged from 4.0% to 59.1% in older adults, and the overall weighted prevalence was 10.7%. The severity of frailty increased with age[20] and was more common in females[21]. Despite frailty might be observed in younger older adults ages, its prevalence is often observed in the aging older adults[20,21]. Statistically significant associations were observed between women and frailty. Women tend to have a greater level of exposure to health treatments over the course of their lives, furthermore, women are more affected by chronic diseases that can impact quality of life[22]. The connections between these associations can be attributed to the natural decline in muscle mass that occurs with aging and the increased susceptibility of women to sarcopenia, which is an inherent risk factor for developing frailty[23].

Most of the older adults with moderate-to-severe frailty were completely edentulous, however, in a previous study it was found that the loss of masticatory function in edentulous older adults without masticatory difficulties did not pose a high risk of frailty[24]. The tooth loss *per se* might not be the reason for an increase of frailty risk in older adults, especially if the rehabilitation is rapidly present,

but the continuous loss of teeth might lead to bad changes in diet, such as the reduction of fiber and protein consumption in favor of soft foods with fat and carbohydrates more easily swallowed, especially in edentulous older adults without oral rehabilitation.

The need for lower dentures was significantly associated with moderate-to-severe frailty. This may be attributed to factors such as the physical effort and coordination required for denture wearing, as well as complaints related to masticatory capacity, retention, and comfort[24]. Dissatisfaction with these factors is a primary reason why individuals do not use their lower dentures, which can lead to malnutrition, weight loss, and other complications that contribute to frailty in the elderly[25]. The anatomy of superior maxilla remains retentive even after the alveolar bone loss in several cases favoring the superior denture retention. Nonetheless, the use of lower denture is harder because of the stability difficulties regarding the natural alveolar bone loss after many years of extracted inferior teeth. Plus, the inferior denture is not as aesthetic as the superior one. Aging older adults and the frail ones are less worried to aesthetics, their focus regards the maintenance of function without any pain, thus the common effort to use the lower denture with any difficulty is not the priority of a frail older adult. In any case regardless of the number of the remaining teeth, the use of functional dentures poses a low risk of frailty[24].

The toothache was associated with moderate to severe frailty in older adults. Pain impacts the quality of life in physical and emotional dimensions[26]. Toothache interferes in several daily activities[27], sleeping[28], socialization[29], and the work productivity diminishes[28], plus this is the reason number one for dental appointments[30]. Older adults are severely impacted by tooth loss and the remaining teeth are commonly found with clinical needs which causes pain and discomfort[5], and despite the general quality of life perception perishes with aging[5] the toothache still maintain impact which contributes to the extraction of the remaining teeth, due to the fast solution of the pain reinforcing the oral rehabilitation needs. This logic applies for the frail older adults with one aspect to be highlighted, this behavior happens earlier in life when a person starts to show the first signs of frailty.

Frailty must be faced as an important dental public health problem. The demographic parameters are changing very fast in Brazil and worldwide towards the grow of the aged group[31], but the public policies are not answering for this call in the same intensity. Three main aspects must be the focus of policymakers: the first one regards on the adult population which is not reaching the primary health attention as other age groups, mainly because of the labor ours conflicting with the open ours of public clinics, but also because of the necessary oral health education perhaps not attained earlier in life[32]; secondly, because there is a huge need for secondary oral health attention in Brazil. The Brazilian Unified Health System (SUS) is truly under construction permanently and the primary oral health attention is spread over the municipalities, nevertheless the secondary oral health attention has not reached the similar population covered as in the primary health attention causing important wait lines for dental treatment[33]. Recently, a new dental public policy[34] was introduced to enlarge the access for the 3770 Brazilian municipalities until 20,000 inhabitants (68%), an important step towards universality due to the federal financing support for the oral health specialties attendance towards the integrality of SUS. Third, there is a loss of interest in the dental selfcare and its treatments by frail older adults[9], therefore the geriatric theme must be included in the university curriculum with frailty included, also there is a lack of public health services toward the frail older adult because the current laws regarding the aged population rights[35] in Brazil does not reach entirely the frail ones which could be equally included in the rights of the 80 years or more persons, per example. Frailty syndrome must be known of every health professional in public and private sectors, in Dentistry and over the other professions, in Brazil and abroad, because this is a vulnerable condition reaching silently an important part of the aging population.

As a cross-sectional study, we were not able to establish the causality between exposure and outcome, and the findings might be extrapolated cautiously to institutionalized older adults. Plus, time might be considered a limitation since the survey occurred in 2015. However, this study has some strengths, namely the use of probabilistic sampling and validated questionnaires to assess frailty. Promotion of oral health and preventive dental care

through primary healthcare services can prevent oral diseases throughout life and improve the oral health of older adults, especially among those who are frail. It is necessary to develop longitudinal studies that can determine the factors associated with frailty in older adults.

CONCLUSION

This study is relevant because edentulism, the need for dental prostheses, and self-perceived toothache was associated with moderate-to-severe frailty in community-dwelling older adults. Although these characteristics are highly prevalent among the elderly population, they can be preventable through multiprofessional actions at various levels of healthcare attention targeting adults and older adults, therefore these measures must be included in the public health policies locally and abroad. Furthermore, frailty assessments should include oral examinations as edentulism are associated to frailty.

AUTHORSHIP

- Rubens Boschetto Melo - analysis and interpretation of data, writing of the article, and approval of the version to be published, and responsible for all aspects of the work, ensuring that issues related to the accuracy or integrity of any part of the work are resolved.
- Liliane Cristina Barbosa - writing the article; approval of the version to be published, and responsible for all aspects of the work, ensuring that questions relating to the accuracy or integrity of any part of the work are addressed.
- Thais de Moraes Souza - writing the article; approval of the version to be published, and responsible for all aspects of the work, ensuring that questions relating to the accuracy or integrity of any part of the work are addressed.
- Roosevelt Silva Bastos - conception and design, critical review, approval of the version to be published, responsible for all aspects of the work, ensuring that issues related to the accuracy or integrity of any part of the work are resolved.

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Nursing Workload and care required by older adults in intensive care

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Abstract

Objective: To analyze the workload and nursing care requirements of elderly people admitted to the intensive care unit (ICU) compared to adults. *Method*: Cross-sectional study carried out in two ICUs of two hospitals (public and private) in the metropolitan region of São Paulo. The following variables were extracted from the electronic medical records of patients admitted to the units in 2019: age, gender, length of ICU stay, Simplified Acute Physiology Score (SAPS 3) and Nursing Activities Score (NAS). The data was analyzed using descriptive statistics. Means were compared using Student's t-test and the association between the frequencies of interventions required by the participants using Fischer's exact test. *Results*: The study included 495 patients, 56.6% of whom were elderly with a mean age of 74.9± 9.5 years. The length of stay of the elderly in the ICU was 6.0±7.7 days. It was found that the average SAPS3 score on admission was 48.3±13.7 points and the NAS score, also on admission, was 71.0±10.4 points, being higher among older people than adults, both for severity (p<0.001) and workload (p=0.007). *Conclusion*: Older age is associated with a greater workload for intensive care unit nurses and a greater chance of interventions, associated with greater severity on admission and longer ICU stays for this population compared to adults.

Keywords: Intensive Care Unit. Aged. Nursing Care of Hospitalized Elderly. Workload.

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INTRODUCTION

The global demographic dynamic directly impacts health systems because population aging is accompanied by an increasing incidence and prevalence of comorbidities which, in turn, are associated with greater hospitalization and mortality in the older population[1].

Data collected up to late March 2023 show that the mean age of patients admitted to the Intensive Care Unit (ICU) in Brazil was 62.63 years, with a median of 65 years. Moreover, by age group, the older population aged 60-80 years occupy the majority of ICU beds (39.90%), followed by younger adults (39.05%), and the oldest-old aged >80 (21.06%)[2].

In addition to the worsening of chronic diseases, particularly for cardiovascular causes - responsible for increasing admissions of older individuals in the ICU[3] - the aging process, even when healthy, is typically accompanied by specific physiological changes involving functional loss and requiring different care support from that of younger adults, irrespective of severity[4].

Evidence confirms that providing care to older ICU patients is associated with a higher nursing workload compared to young adults, with age representing a factor associated with greater care demands.[5] In this respect, treatment of individuals aged over 60 years in ICU beds requires qualified nurses that are aware of the specificities inherent to senescence and senility[3]. In this context, the Nursing Activities Score (NAS) serves as a tool for measuring nursing workload and gauging level of staffing[6].

Although the characteristics of nursing associated with workload have been described in the literature comparing public and private care facilities[7], no studies analyzing this association in older versus younger adults were found. The nursing activities most required by older patients, and the odds of their occurrence in this population, remains unclear. This knowledge can help inform planning of specialized care in ICUs.

Therefore, the objective of the present study was to analyze the workload of the nursing team and the activities required by older adults compared with younger adults in the ICU.

METHOD

A cross-sectional study based on a previous investigation (*The impact of Nursing Activities Score on predictive ability of the Simplified Acute Physiology Score 3: a comparative cohort study of public and private ICUs*) between June and September 2020 in two ICUs of 2 large hospitals (1 public and 1 private) located in the metropolitan region of São Paulo was conducted. The public hospital assessed is a referral center for urgent and emergency care of medium-to-high complexity with 24 active ICU beds, whereas the private facility is a general hospital with around 50 active intensive care beds. Both of these hospitals are administrated by the Sociedade Beneficente de Senhoras – Hospital Sírio Libanês.

For the present study, the sample size calculation was performed using the following parameters: α error of 0.05; β of 0.20; and effect size of 0.30. This calculation yielded an estimated sample of 220 individuals per age group for a total of 440 participants. This total was increased by 10% to allow for potential losses, giving a final estimated sample of 484 participants. Post-hoc analysis for determining power attained revealed a study power (probability 1 – β error) of 0.999, calculated for an effect size of 0.30 in a sample of 495 participants.

The study population consisted of all patients admitted to the general ICUs of the facilities assessed, between January and December 2019, aged ≥18 years, with an ICU stay of ≥24 hours. Individuals with missing information on the variables related to the outcome (nursing workload) in electronic medical records, and the charts of patients who required readmission during the data collection period, were excluded.

The data were collected retrospectively via a search of the electronic medical records held on the EPIMED system. Sociodemographic data were collected (sex, age, length of ICU stay), together with scores for severity on admission determined within 1 hour of admission using the prognostic index Simplified Acute Physiology Score (SAPS 3)[8], and nursing workload (Nursing Activities Score - NAS) measured during the first 24 hours of ICU care[6].

The SAPS 3 individually measures the severity of ICU patients based on 20 variables split into 3 groups: patient chronic health status and previous therapy; circumstances related to ICU admission; and presence and degree of physiological derangement. The assessment yields a score ranging from 16 to 217, where score and patient severity are directly proportional. This instrument uses as parameters, data collected at the time of ICU admission or within 1 hour of this process, increasing its sensitivity relative to other models given that the physiological data are less distorted by the therapy delivered after admission[8].

The NAS is designed to measure workload of the nursing team, comprising 23 nursing interventions grouped into 7 categories: Basic activities, Ventilatory support, Cardiovascular support, Renal support, Neurologic support, Metabolic support, and ICU-specific interventions. Thus, each item measured is attributed a score of 1.2-32.0 for a total maximum score of 176,8%. A score of 100 indicates the patient required 100% care from a nursing professional within the last 24 hours. Scores exceeding 100 show that the patient required the care of more than 1 full-time professional[6].

In order to reduce data collection bias, the marking and summing of NAS item scores were carried out retrospectively by the leading author of the present study at the 2 participating facilities by analyzing the medical records. This was achieved by examining the medical notes, progress reports and multi-professional assessments, as well as both medical and nursing prescriptions.

For data analysis, the final sample was divided into 2 groups: G1 - comprising young adults (18-59 years); and G2 - older adults (≥60 years). Data normalness was checked using the Kolmogorov-Smirnov test. Continuous variables were expressed as mean ± standard deviations, while categorical variables were expressed as absolute and relative frequencies. The means of the groups were compared using Student´s *t*-test with analysis of variance performed by the Levene test. Fisher´s exact test was used to investigate the association between the frequency of interventions required by the participants in the two groups.

To analyze the odds of older age (≥60 years) impacting the occurrence of each of the NAS interventions, logistic regression models were built (with stepwise forward entry method), defining age as the independent variable and each intervention as the dependent variables. To this end, a model was constructed for each intervention with results pooled into a single table. The models were presented without adjustment of covariables, presenting the measure of association (odds ratio of the occurrence), together with their respective confidence interval and p-value. In cross-sectional studies, odds ratio can be employed as a method for estimating the chance of occurrence of a condition in one group relative to another[9].

All statistical data were analyzed using the software SPSS v.22 and the level of significance adopted in two-tailed tests was 0.05.

The study was approved by the research ethics committee of the Sírio Libanês institute under permit no. 4.084.423.and observed the prevailing regulations for studies in humans performed in Brazil (Resolution 466/2012). The study also complied with the clauses stipulated in the General Data Protection Law (Law no. 13.709 of 2018).

RESULTS

Of the 495 participants included, 280 were men (56.6%) and 215 women (43.4%). Of the overall sample, 56.6% (n=280) of participants were older adults. Mean age in the older group was 74.9± 9.5 years. By gender, average age was slightly higher for females (75.7±9.8 years) than males (74.3±9.1 years). The difference in mean age between genders was not statistically significant (p=0.253).

No group difference in length of ICU stay (5.0±6.2 days *vs.* 6.0±7.7 days, p=0.117) was found between older and young adults. However, severity on the SAPS3 (36.5±13.4 *vs.* 48.3±13.7, p<0.001) and workload on the NAS (68.3±11.6 *vs.* 71.0±10.4, p=0.007) were both higher in older adults than young adults (Table 1).

Table 1. Mean length of stay, severity, and admission workload of young and older adult ICU patients. São Paulo city, São Paulo state, 2020.

	Total (mean±SD))	Young Adult (mean±SD)	Older Adults (mean±SD)	*p*-value*
Length of ICU stay	5.6±7.1	5.0±6.2	6.0±7.7	0.117
SAPS3	44.3±14.7	36.5±13.4	48.3±13.7	<0.001
NAS	69.8±11.0	68.3±11.6	71.0±10.4	0.007

SD – standard deviation; SAPS3 – Simplified Acute Physiological Score 3; NAS – Nursing Activities Score. *Student´s *t*-test with Levene´s correction of equality of variances.

Comparison of NAS score items revealed a significant difference in frequency of interventions for the items: Monitoring and titration (66.5% *vs.* 33.5%, $p<0.001$; Mobilization and positioning (59.2% v*s.* 40.8%, $p=0.009$); Support and care of relatives or patient (67.0% *vs.* 33.0%, $p<0.001$); Treatment for improving lung function (62.9% *vs.* 37.1%, $p=0.005$); Quantitative urine output measurement (57.9% *vs.* 42.1%, $p=0.012$); and Specific ICU interventions (62.0% *vs.*38.0%, $p=0.018$), in the older adult versus the young adult group (Table 2).

The results of the assessment of the distribution of older patients according to frequency of activities required shows that administration of medications, hygiene care and urinary output procedures were the most frequently performed activities in this group (Figure 1).

The multivariate analysis revealed that age >60 years influenced the interventions performed and almost doubled the odds of Monitoring and titration (item 1a) (OR: 1.970, 95CI%: 1.360-2.850, $p<0.001$) and of Mobilization and positioning (item 6b) (OR: 1.926, 95%CI: 1.178-3.149, $p=0.009$). The odds of Support and care of relatives and patient (7a) more than doubled in the older adults group (OR: 2.210, 95CI%: 1.535-3.182, p<0.001), while the chances of Quantitative urine output measurement more than tripled in the older group (OR: 3.425 95%CI: 1.306-8.982, p= 0.012). Moreover, the odds of Specific ICU interventions (item 22) was 1.5 times greater in the older group (OR: 1.546, 95%CI: 1.081-2.211, $p=0.007$) (Table 3).

Table 2. Frequency of NAS item scores in first 24hs after ICU admission, by age group. São Paulo city, São Paulo state, 2020.

NAS Item at Admission	Total	Older Adults	Young Adults	*p*-value*
	n (%)	n (%)	n (%)	
1a. Hourly vital signs, registration, and calculation of fluid balance.	203 (100.0)	135 (66.5)	68 (33.5)	**<0.001**
1b. Present at bedside and continuous observation or active for 2 hrs or more in any shift.	292 (100.0)	145 (49.7)	147 (50.3)	**<0.001**
1c. Present at bedside and active for 4 hrs or more in any shift.	-	-	-	-
2. Laboratory, biochemical and microbiological investigations.	459 (100.0)	261 (56.9)	198 (43.1)	0.860
3. Medication, vasoactive drugs excluded.	490 (100.0)	275 (56.1)	215 (43.9)	1.000
4a. Performing hygiene procedures.	481 (100.0)	271 (56.3)	210 (43.7)	0.409
4b. Performance of hygiene procedures took >2 hrs in any shift.	11 (100.0)	6 (54.5)	5 (45.5)	1.000
4c. Performance of hygiene procedures took >4 hrs in any shift.	-	-	-	-

to be continued

Continuation of Table 2

NAS Item at Admission	Total	Older Adults	Young Adults	*p*-value*
	n (%)	n (%)	n (%)	
5. Care of drains, all (except gastric tube).	84 (100.0)	46 (54.8)	38 (45.2)	0.717
6a. Performing mobilization and positioning procedure(s) up to three times per 24 hrs.	69 (100.0)	29 (42.0)	40 (58.0)	**0.009**
6b. Performing mobilization and positioning procedure(s) more frequently than 3 times per 24 hrs, or with two nurses, any frequency.	417 (100.0)	247 (59.2)	170 (40.8)	**0.009**
6c. Performing mobilization and positioning procedure(s) with three or more nurses, any frequency.	4 (100.0)	1 (25.0)	3 (75.9)	0.321
7a. Support and care of either relatives or patient requiring full dedication for about 1 hr in any shift.	233 (100.0)	156 (67.0)	77 (33.0)	**<0.001**
7b. Support and care of either relatives or patient requiring full dedication for 3 hrs or more in any shift.	3 (100.0)	1 (33.3)	2 (66.7)	0.581
8a. Performing routine administrative and managerial tasks.	76 (100.0)	38 (50.0)	38 (50.0)	0.210
8b. Performing administrative and managerial tasks requiring full dedication for about 2 hrs in any shift.	419 (100.0)	242 (57.8)	177 (42.2)	0.258
8c. Performing administrative and managerial tasks requiring full dedication for about 4 hrs or more of the time in any shift.	4 (100.0)	2 (50.0)	2 (50.0)	1.000
9. Respiratory support: any form of mechanical ventilation/assisted ventilation; spontaneous breathing; supplementary oxygen by any method.	295 (100.0)	168 (56.9)	127 (43.1)	0.926
10. Care of artificial airways: endotracheal tube or tracheostomy cannula.	140 (100.0)	67 (47.9)	73 (52.1)	**0.016**
11. Treatment for improving lung function: thorax physiotherapy, incentive spirometry, inhalation therapy, intratracheal suctioning.	256 (100.0)	161 (62.9)	95 (37.1)	**0.005**
12. Vasoactive medication, disregard type and dose.	185 (100.0)	109 (58.9)	76 (41.1)	0.454
13. Intravenous replacement of large fluid losses. Fluid administration >3 L/m^2/day, irrespective of type of fluid administered.	3 (100.0)	1 (33.3)	2 (66.7)	0.582
14. Left atrium monitoring: pulmonary artery catheter with or without cardiac output measurement.	-	-	-	-
15.Cardiopulmonary resuscitation after arrest, in the past period of 24 hrs (single precordial thump not included).	1 (100.0)	0 (0.0)	1 (100.0)	0.433
16. Hemofiltration techniques, dialysis techniques.	36 (100.0)	13 (36.1)	23 (63.9)	**0.014**
17. Quantitative urine output measurement (e.g., by indwelling urinary catheter).	473 (100.0)	274 (57.9)	199 (42.1)	**0.012**
18. Measurement of intracranial pressure	6 (100.0)	3 (50.0)	3 (50.0)	1.000
19. Treatment of complicated metabolic acidosis/alkalosis.	6 (100.0)	2 (33.3)	4 (66.7)	0.410
20. Intravenous hyperalimentation.	8 (100.0)	6 (75.0)	2 (25.0)	0.476
21. Enteral feeding through gastric tube or other gastrointestinal route (e.g., jejunostomy).	45 (100.0)	26 (57.8)	19 (42.2)	1.000
22. Specific intervention(s) in the intensive care unit.	155 (100.0)	158 (62.0)	97 (38.0)	**0.018**
23. Specific interventions outside the intensive care unit: surgery or diagnostic procedures.	85 (100.0)	44 (51.8)	41 (48.2)	0.337

*Fisher´s exact test

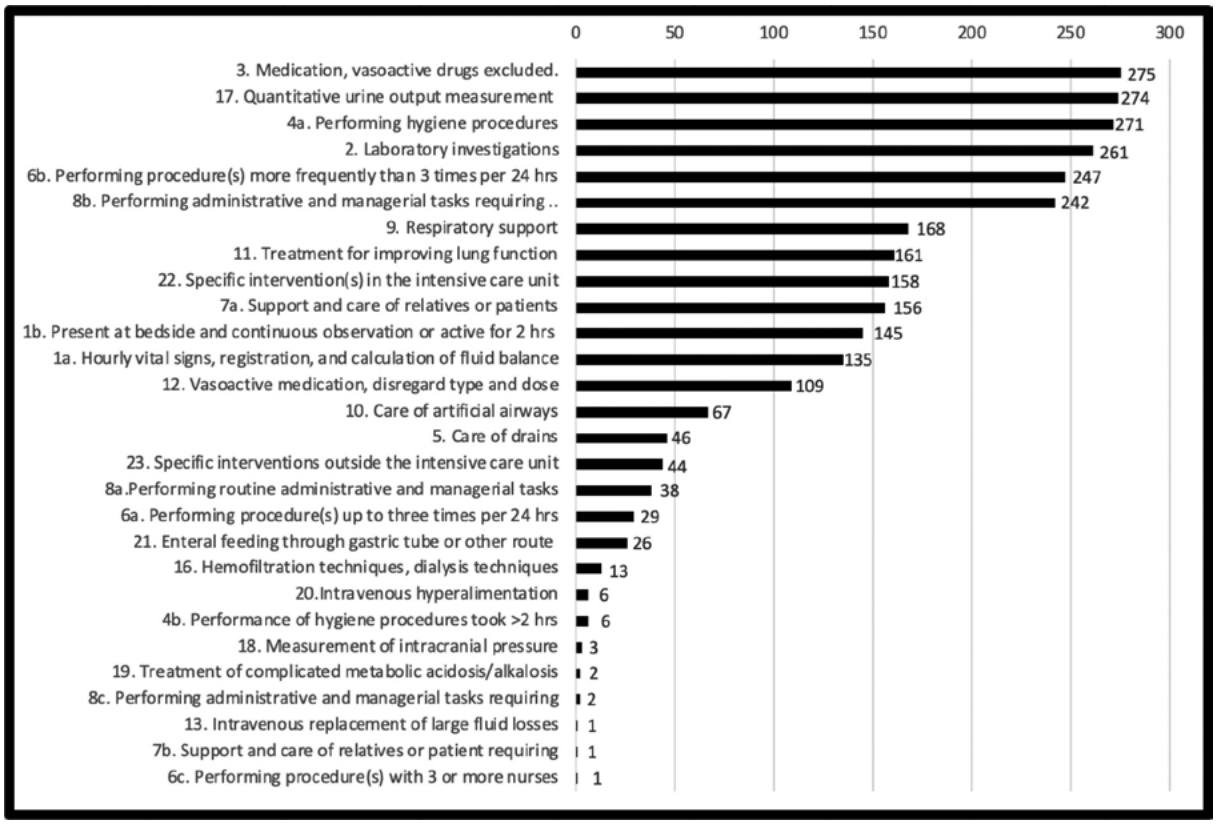

Figure 1. Distribution of frequency of activities required by older adult group. São Paulo, 2020.

Table 3. Multivariate analysis of chance of occurrence of NAS interventions in older adult ICU patients – São Paulo city, São Paulo state, 2020.

NAS Category	Activity		OR	95%CI	*p*-value
Basic Activity	1a	Hourly vital signs, registration, and calculation of fluid balance	1.970	1.360-2.850	**<0.001**
	1b	Present at bedside and continuous observation or active for 2 hrs or more in any shift.	0.497	0.343-0.720	0.720
	1c	Present at bedside and active for 4 hrs or more in any shift.	-	-	-
	2	Laboratory, biochemical and microbiological investigations.	1.104	0.554-2.202	0.778
	3	Medication, vasoactive drugs excluded.	1.043	0.277 – 3.930	0.951
	4a	Performing hygiene procedures.	0.571	0.173-1.879	0.356
	4b	Performance of hygiene procedures took >2 hrs in any shift.	0.923	0.278-3.066	0.896
	4c	Performance of hygiene procedures took >4 hrs in any shift.	-	-	-
	5	Care of drains, all (except gastric tube).	0.882	0.552-1.411	0.600
	6a	Performing mobilization and positioning procedure(s) up to three times per 24 hrs.	0.505	0.302-0.846	**0.009**
	6b	Performing procedure(s) more frequently than 3 times per 24 hrs, or with two nurses, any frequency.	1.926	1.178-3.149	**0.009**
	6c	Performing procedure(s) with three or more nurses, any frequency	0.253	0.026-2.452	0.236

to be continued

Continuation of Table 3

NAS Category	Activity		OR	95%CI	*p*-value
Basic Activity	7a	Support and care of either relatives or patient requiring full dedication for about 1 hr in any shift.	2.210	1.535-3.182	**<0.001**
	7b	Support and care of either relatives or patient requiring full dedication for 3 hrs or more in any shift.	0.382	0.340-4.238	0.433
	8a	Performing routine administrative and managerial tasks.	0.731	0.448-1.193	0.211
	8b	Performing administrative and managerial tasks requiring full dedication for about 2 hrs in any shift.	1.324	0.809-2.166	0.264
	8c	Performing administrative and managerial tasks requiring full dedication for about 4 hrs or more of the time in any shift.	0.766	0.107-5.484	0.791
Ventilatory Support	9	Respiratory support: any form of mechanical ventilation/assisted ventilation; spontaneous breathing; supplementary oxygen by any method.	1.039	0.724-1.493	0.834
	10	Care of artificial airways: endotracheal tube or tracheostomy cannula.	0.615	0.415-0.912	0.015
	11	Treatment for improving lung function: thorax physiotherapy, incentive spirometry, inhalation therapy, intratracheal suctioning.	1.709	1.194-2.446	**0.003**
Cardiovascular Support	12	Vasoactive medication, disregard type and dose.	1.166	0.806-1.685	0.415
	13	Intravenous replacement of large fluid losses. Fluid administration >3 L/m2/day, irrespective of type of fluid administered.	0.383	0.035-4.253	0.435
	14	Left atrium monitoring: pulmonary artery catheter with or without cardiac output measurement.	-	-	-
	15	Cardiopulmonary resuscitation in past period of 24 hrs (single precordial thump not included).	0.000	0.000	0.995
Renal Support	16	Hemofiltration techniques, dialysis techniques.	0.406	0.201-0.823	**0.012**
	17	Quantitative urine output measurement (e.g., by indwelling urinary catheter).	3.425	1.306-8.982	**0.012**
Neurologic Support	18	Measurement of intracranial pressure.	0.765	0.153-3.830	0.745
Metabolic Support	19	Treatment of complicated metabolic acidosis/alkalosis.	0.379	0.069-2.091	0.266
	20	Intravenous hyperalimentation.	2.332	0.466-11.670	0.303
	21	Enteral feeding through gastric tube or other gastrointestinal route (e.g., jejunostomy).	1.056	0.568-1.963	0.863
Specific Interventions	22	Specific intervention(s) in the intensive care unit.	1.546	1.081-2.211	**0.017**
	23	Specific interventions outside the intensive care unit: surgery or diagnostic procedures.	0.791	0.495-1.264	0.327

Independent variable entered into model (age ≥ 60 years). # items not required by older participants in the sample

DISCUSSION

The present study compared the workload of the nursing team in older adult versus young adult patients in the intensive care unit (ICU), identifying the care activities most required by the group of older patients, together with the odds ratio of the occurrence of these activities in this group.

The results revealed that severity on the SAPS3 and workload on the NAS were significantly greater in the group of older adults compared to the group of young adults. No difference in length of ICU stay between the two age groups was found.

For NAS items, a significant group difference in frequency of interventions was identified for the items: Monitoring and titration; Mobility and positioning; Support and care of relatives or patient; Treatment for improving lung function; Quantitative urine output measurement; and Specific intervention in the intensive care unit. The interventions involving medications, hygiene care and urinary output procedures were more frequently required by the older adults group.

Given that prognostic indexes measure the severity of the population treated at a given unit, identifying acute and chronic physiological disarrangement on admission, coupled with the greater physical frailty of the older population which has specificities inherent to senescence and senility that contribute to higher disease severity, it follows that older individuals will typically have higher SAPS3 scores.

In the present study, a positive correlation between disease severity and consequent increased nursing workload was found, impacting length of ICU stay in the group of older adults. Similar SAPS 3 results were found in previous studies of older populations, reporting mean severity scores of 48.9[10] and 50.9[11], respectively. However, earlier studies investigating the relationship between workload and patient severity employed the SAPS2,[5,7,12], precluding meaningful comparison of results.

The NAS items (1a) measuring vital signs and (2) laboratory, biochemical and microbiological investigations, were more frequent in the older adult group than the young adult group. It is important to bear in mind that the aging process is accompanied by morphological and physiological changes in all systems of the body, with progressive loss of functioning. Thus, performing more targeted monitoring of biochemical and microbiological tests in older people can show lower levels of decline in the clinical condition[13].

The item administration of Medication, vasoactive drugs excluded, was performed more frequently in the older group. These findings were similar to those of another casuistic, in which the most frequently scored activities among the NAS categories were Medications use, Quantitative urine output measurement, and Hygiene procedures[14]. The role of medications in hospitalized older people regarding the aspects cited can be explained by the fact that polypharmacy is common in these individuals[15].

The greater frequency of performing Hygiene procedures in older patients is explained by the multimorbidity commonly seen in this population and contributing to progressive loss of autonomy in performing basic and instrument activities of daily living. Consequently, when older individuals are hospitalized in ICUs, they have higher demand for Hygiene procedure and Care of drains and catheters[13].

The greater consumption of nursing time for Care of relatives by older patients is explained by the previous dependence on care provided by caregivers and relatives, corroborating the results of a previous study showing this NAS item was required by 100% of the participants assessed[16].

A similar result was found for items related to Mobilization and Ventilatory support. This situation can be attributed to the growing global burden of disability in older people due to biological decline, posing major care challenges[13] . These conclusions are supported by other studies. A study performed at a university hospital in the city of São Paulo investigating the correlation of nursing workload with body mass index in critical patients, found probabilities of $p<0.007$ and $p<0.047$ for Mobilization and Ventilatory support, respectively. In another study, the item Ventilatory support was cited by 90% of the total study sample[14,17,18].

The statistically significant group difference in Specific interventions in the ICU between the older and young adult patients can be explained by advancements in technology, with a broader therapeutic arsenal available for care delivery, particularly with regard to monitoring vital signs and replacement therapies administered, ultimately extending life expectancy. A study comparing workload using the NAS in a sample of critical older patients who experienced adverse events during the hospital stay found that 73.4% of all participants underwent these same interventions[19].

Regarding renal support care, there is generally a higher prevalence of renal injury in ICU patients, as demonstrated in a study conducted at a university hospital in Rio de Janeiro, where 87% of participants required renal support interventions. This evidence highlights age as a risk factor for development of acute renal injury, with a major impact on morbidity-mortality in this patient group[20].

Patients presenting with greater severity, comorbidities and organ dysfunctions at admission tended to have longer ICU stays and were more prone to readmission, according to associated clinical conditions and risk factors identified. Older age proved a relevant factor predicting higher nursing workload. The use of the NAS score provides an analysis of care indicators which helps promote effective targeted quality nursing care while also safeguarding the health of staff[21].

To achieve this, it is important to maintain nursing team staffing levels in the ICU so as to ensure quality and safety in care delivery, tailored to the specificities of each age group. This is especially the case In meeting the demands arising from the aging process, with its specificities in terms of autonomy and independence.

Many studies are underway to help control the demands placed on the nursing team for more targeted intervention-based procedures where, in the not-so-distant future, technologies such as Humanoid Nursing Robot (HNRs) will become available, reducing nursing workloads as measured by the NAS. Currently, technology providers are developing robots that can meet the universal demands for health technology, making way for human care that centers on human relations allied with technological care that provides measurements, such as vital signs, rehabilitation and exercises, alert to the ethical and safety issues of the individual as critical factors involved in the new precepts being researched[22].

Thus, the results of the present study add to the body of evidence, showing that nursing workload was high for care delivered to older patients compared to younger individuals. Moreover, as measured by the NAS, there was no statistical group difference in the use of therapeutic resources between older and younger patients. This suggests that calibrating the nurse team both qualitatively and quantitatively, using the NAS as an indicator of workload, is key to providing healthcare that is both safe and beneficial for patients.

Assuring quality care requires knowledge of the profile of the patient and the main risks and complications, particularly in the older population, given the high probability of this group presenting significant physiological changes in a short timeframe within ICUs[23]. Consistent with this observation, the present analysis of these probabilities revealed that nursing workload for the items Basic activities, Support of relatives and other activities commonly associated with a greater level of dependence, were more likely to be performed in the older patient group.

This study has some limitations, such as not controlling for covariables in the results of the multivariate analysis, the retrospective approach for NAS completion, and involvement of a patient population with a mixed disease profile, potentially leading to selection bias. Nevertheless, this factor was minimized by the multi-center nature of the study and uniform data collection by the same researcher.

Lastly, study strengths include the results and discussion sections, which add to the knowledge in clinical practice and research, providing evidence on the nursing workload dedicated to ICU patients of different age groups in hospitals from both public and private sectors. This evidence can help inform health care management, provide continued Improvement in services, and promote care delivery with an emphasis on patient safety through adequate nursing team staffing, underpinning the practice of evidence-based nursing.

CONCLUSION

Taken together, the study results show that the older patient population is associated with a higher workload for nursing teams in ICUs. This correlation is evidenced by scores on the NAS items, with significantly higher care requirements in the Basic activities category, associated with greater severity at admission and longer ICU stay in the older population compared with young adults. A similar profile was identified in the calculation of odds of occurrence of nursing activities in this older population group, with emphasis on Quantitative urine output measurement and Intravenous hyperalimentation. Studies analyzing the care requirements and workload in older individuals stratified into different age groups are important to validate the quality of care and to implement improvements in the care delivered.

AUTHOR CONTRIBUTIONS

- Joathan B. Ribeiro – conception and design; data analysis and interpretation; writing of article or its critical review; approval of final draft for publication; overseeing all aspects of the study; and vouching for any issues related to the accuracy or integrity of any part of the study.
- Francine J. Lopes – conception and design; data analysis and interpretation; and writing of article or its critical review.
- Ana Carolina de L. Barbosa – data analysis and interpretation; and writing of article or its critical review.
- Cristiane H. Gallasch – critical review and approval of final draft for publication.
- Eduesley Santana Santos – critical review and approval of final draft for publication.
- Renata E. de L. Ferretti-Rebustini – conception and design; data analysis and interpretation; writing of article and critical review; approval of final draft for publication; overseeing of all aspects of the study; and vouching for any issues related to the accuracy or integrity of any part of the study.

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Health conditions and workload burden among informal caregivers of elderly individuals with dementia syndromes

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Abstract

Objective: To estimate the prevalence of caregiver burden and identify associated factors among informal caregivers of elderly individuals with dementia. *Method:* Cross-sectional and analytical study with a sample of caregivers of elderly individuals receiving care at a reference center for elderly health. Caregiver burden was assessed using the Zarit scale. Sociodemographic characteristics and factors related to the health and care of the elderly person were investigated. Data analysis was performed using Poisson regression with robust variance, based on a hierarchical model, with a significance level of 5%. *Results:* A total of 436 caregivers participated in the study, the majority of whom were female (88.1%). The prevalence of caregiver burden was 32.8%. In the multiple model, the following factors were associated with a higher prevalence of caregiver burden: age between 40 and 59 years (PR=1.20; 95% CI=1.02-1.39), being in a marital relationship (PR=1.18; 95% CI=1.02-1.36), being a child or spouse of the elderly person (PR=1.16; 95% CI=1.01-1.33), having a negative self-perception of health (PR=1.30; 95% CI=1.10-1.52), using medication (PR=1.24; 95% CI=1.06-1.45), not practicing self-care measures (PR=1.49; 95% CI=1.17-1.89), providing support to the elderly person in family integration activities (PR=1.41; 95% CI=1.05-1.89), cultural activities (PR=1.36; 95% CI=1.08-1.72), and medication administration (PR=1.13; 95% CI=1.01-1.25). *Conclusion:* The high prevalence of caregiver burden among caregivers of elderly individuals highlights the need for specific policies for this group and represents an aspect to be regularly evaluated by healthcare professionals who work directly with people with dementia and their families.

Keywords: Workload. Caregivers. Aged. Dementia.

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INTRODUCTION

Dementia syndromes (DS) are characterized by impairment in memory, intellect, behavior, and the ability to perform activities of daily living, and have shown a growing prevalence in recent years, paralleling the rapid aging of the population[1]. After being neglected for several decades, DS have come to be recognized as the primary cause of disability and functional dependence among elderly individuals worldwide, and should be considered a public health priority[2].

The chronic, progressive, and unpredictable nature of DS has a significant physical, emotional, psychological, and social impact on the affected elderly individual and their families[3]. It is in this context that families seek to identify an elderly caregiver, an essential figure in providing support to patients with DS who, whether paid or unpaid, undertake the care of the elderly person in their daily activities. This is by no means a simple task. Caring for someone is a complex endeavor, as it demands numerous adjustments and profound changes in the family dynamics, both for the caregiver and the care recipient[4]. In most cases, care is provided by family members or individuals with a close relationship to the patient, known as a family or informal caregiver. This individual, due to familial ties, directly or indirectly assumes responsibility for the unpaid care of a sick or dependent family member[5].

The provision of care often arises more from circumstantial necessity than from the individual's choice. Whether due to a family agreement or a lack of alternatives, the caregiver assumes their role, almost always in a sudden manner, without prior consultation or consent, and without psychological preparation or technical training for this new responsibility[6]. The caregiver, typically the sole person responsible for the care of elderly individuals, often reduces their own activities and may compromise their social life to dedicate themselves exclusively to the dependent individual. Consequently, the constant and uninterrupted care of individuals with DS and the moments of tension experienced by the caregiver can lead to detrimental effects on their health and result in high levels of caregiver burden[6,7].

Caregiver burden can be defined as a complex and multidimensional construct that encompasses the perceived and experienced physical, psychological or emotional, social, and financial consequences faced by individuals, whether they are family members or not, who provide care to patients with DS[8,9]. This excessive strain arising from prolonged stress can lead to caregiver self-neglect, as they may disregard their own needs, result in the onset of illnesses, and even lead to death among caregivers, ultimately resulting in inadequate care for the person being cared for[4].

It is essential to have a clear understanding of the triggering conditions of excessive stress among caregivers in order to develop an appropriate therapeutic plan that includes the elderly person, the caregiver, and the family. This approach enables the prevention of health complications and an improvement in the quality of life for all involved parties[4]. There are still gaps in the literature concerning the factors associated with caregivers' health conditions and workload when caring for individuals with DS. Recognizing these conditions will facilitate the implementation of public policies within healthcare services that provide support to caregivers of individuals with DS, promote self-care among them, and enhance the quality of care they provide.

This study aims to estimate the prevalence of caregiver burden and identify associated factors among informal caregivers of elderly individuals with DS.

METHOD

This was a cross-sectional, analytical study conducted in Montes Claros, located in the northern region of the state of Minas Gerais, Brazil. The municipality has a population of approximately 413,000 inhabitants and serves as a regional reference for the provision of services, including healthcare. The target population for this research consisted of informal caregivers of elderly individuals with dementia syndromes (DS) who were being assisted at the Center for Elderly Healthcare Reference (*Centro de Referência em Assistência à saúde do Idoso* - CRASI). This outpatient unit is affiliated with the State

University of Montes Claros (*Universidade Estadual de Montes Claros* - Unimontes) and the Clemente de Faria University Hospital (*Hospital Universitário Clemente de Faria* - HUCF). It is staffed by a multi- and interdisciplinary team, and all procedures are exclusively provided through the Unified Health System (*Sistema Único de Saúde* - SUS). This Center is considered a reference point for the entire frail elderly population in the northern macro-region of the state, including those with dementia.

The sample size was obtained proportionally to the number of elderly individuals with dementia who had undergone medical consultation at the aforementioned service in the previous year. An estimated prevalence of 50% was assumed for the studied event (as it provides the largest sample size and considering the investigation of other variables for the study), with a confidence level of 95% and a margin of error of 5%. The minimum number of elderly individuals to be selected for the study based on these parameters was 434, including a 20% addition for potential losses. The selection of participants was carried out by physicians at CRASI, who, after consulting with the elderly individuals, identified and referred those who met the inclusion criteria. Subsequently, the caregivers were approached by the researchers and invited to participate in the study, with data collection conducted consecutively until the predetermined sample size was achieved.

Inclusion criteria for the study were as follows: being a family caregiver of an elderly person with a medical diagnosis (recorded in medical records) of irreversible dementia (Alzheimer's Disease, Vascular Dementia, Lewy Body Dementia, Frontotemporal Dementia, and Mixed Dementia) of mild, moderate, or severe severity, who had been under care within the last 12 months; being at least 18 years old; having a caregiving duration of at least six months; and being an informal caregiver responsible for the direct care of the elderly individual. Exclusion criteria included being a caregiver for more than one elderly person and being on Sick Leave (*Licença para Tratamento de Saúde* - LTS) at the time of data collection.

Data collection was carried out by a team composed of nurses and undergraduate students in Scientific Initiation (IC), who received specialized training through meetings with the research coordination and a pilot project aimed at equipping the team with the skills required to administer the questionnaire. Calibration was achieved through repetitions of data collection in the pilot project until a consensus was reached among the interviewers. Data were collected in both morning and afternoon shifts, in the reception area of the CRASI outpatient clinic, from August to December 2019, while elderly individuals, accompanied by their caregivers, awaited various assessments or procedures.

As a data collection instrument, a questionnaire was developed by the researchers, comprising three sections: caregiver socio-economic variables, clinical variables and caregiver self-care, and variables related to caregiving. The socio-economic variables included age, gender, marital status, education level, relationship with the elderly person, and family income. The clinical and self-care variables encompassed self-perceived health, medication usage, self-care practices (defined as any actions the individual undertakes to promote their physical and mental well-being and enhance their quality of life, such as accessing healthcare, leisure, physical activity, or health-promotion procedures), nutritional status (derived from self-reported weight and height), and self-reported morbidities, which included depression, hypertension, diabetes, arthritis/osteoarthritis, and insomnia.

Regarding the variables related to caregiving: time spent working as a caregiver for the elderly person, daily hours dedicated to caregiving, assistance from someone else in caregiving activities for the elderly, provision of support to the elderly person in activities such as feeding, hygiene, ambulation, physical activities, cultural activities (civic, cultural, or religious celebrations), family integration activities (family celebrations or gatherings), and medication administration (defined as either supervision or direct provision of medications).

The outcome variable was caregiver burden, assessed using the Zarit Burden Interview (ZBI), which has been adapted and validated in Brazil[10]. This scale evaluates the burden reported by informal caregivers across various domains, including health, social life, economic situation, mood, and the nature of the relationship with the elderly person. It consists

of 22 items, each categorized from zero (never) to four (always) points, yielding a total score of 88 points that reflects the level of caregiver stress or burden. A higher score indicates a greater perceived burden[10].

As there is no established cutoff point for the Brazilian population that has been validated, terciles were used for classification, following a previous study[4]. Initially, the normality of the burden variable distribution was tested, and no normal distribution was detected ($p<0,001$) by the Kolmogorov-Smirnov test. Subsequently, caregiver burden among family caregivers was divided into terciles: 1st tercile: up to 9 points; 2nd tercile: between 10 and 17 points; and 3rd tercile: >18 points. Participants classified in the third tercile (presence of burden) were considered to have associated caregiving burden, while those in the first two terciles were considered to have no burden[7]. The association between caregiver burden and caregiver socio-economic, clinical, self-care, and caregiving-related variables was investigated.

Initially, descriptive analyses of all investigated variables were conducted using simple and relative frequencies. The association between the presence of burden and the independent variables was assessed through the chi-square test. Variables that were associated at a significance level of up to 20% ($p\leq0,20$) were selected for multiple analysis using a hierarchical Poisson regression model. The model followed a scheme composed of blocks of variables at distal, intermediate, and proximal levels (Figure 1).

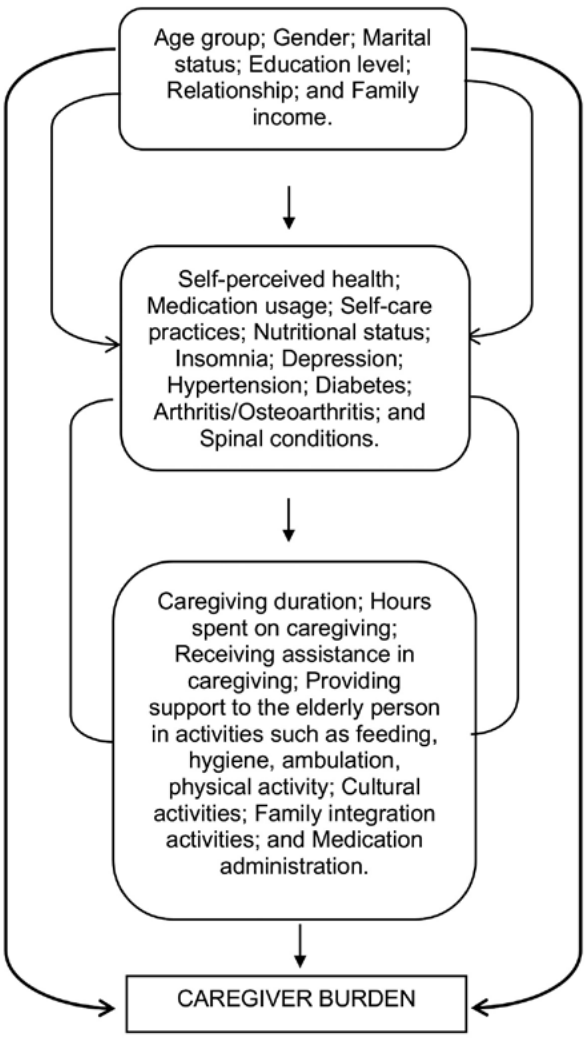

Figure 1. Hierarchical theoretical model of potential factors associated with caregiver burden among elderly individuals with dementia. Montes Claros, MG, 2019.

The hierarchical modeling began with the inclusion of distal-level variables. Variables in this model that exhibited a significance level of up to 5% (*p<0.05*) were included in the subsequent model along with intermediate-level variables. The same methodological approach was followed for the final model, which included proximal-level variables. In the final model, only variables with a significance level of up to 5% (*p<0.05*) were retained. The quality of the model fit was assessed using the Deviance test.

The study project was approved by the Research Ethics Committee of the State University of Montes Claros (*Parecer* Nº. 3.377.246). The Informed Consent Form was signed by all participants as a prerequisite for data collection. The Informed Consent Form was signed by all participants, as a prerequisite for data collection. The research is in accordance with Resolution No. 466/2012 and Resolution No. 510/2016.

RESULTS

A total of 436 caregivers of elderly individuals participated in the study, with the majority being female (88.1%), aged between 40 and 59 years (55.2%), and either a child or spouse of the elderly person (79.6%). Other demographic, socioeconomic, and clinical characteristics of caregivers of elderly individuals with dementia are presented in Table 1.

Table 1. Socioeconomic and Clinical Characteristics of Caregivers of Elderly Individuals with Dementia (N=436). Montes Claros, MG, 2019.

Variables	n (%)
Age Group (years)	
<40	119 (27.4)
40 a 59	240 (55.2)
≥60	76 (17.5)
Gender	
Female	384 (88.1)
Male	52 (11.9)
Marial status	
With a partner	271 (62.2)
Without a partner	165 (37.8)
Education (years of study)	
>12	79 (18.1)
5 a 12	285 (65.4)
≤4	72 (16.5)
Relationship	
Child/Spouse	347 (79.6)
Other (son-in-law, daughter-in-law, grandchild)	89 (20.4)
Family Income (in minimum wages)	
>1	244 (56.0)
≤1	165 (37.8)
No information	27 (6.2)
Perceived Health	
Good/Excellent	271 (62.3)
Regular/Poor/Bad	164 (37.7)

to be continued

Continuation of Table 1

Variables	n (%)
Medication Usage	
No	229 (52.5)
Yes	207 (47.5)
Nutritional Status	
Normal	177 (40.6)
Overweight	163 (37.4)
Obesity	86 (19.7)
No Information	10 (2.3)
Depression	
No	375 (86.0)
Yes	61 (14.0)
Hypertension	
No	303 (69.5)
Yes	133 (30.5)
Diabetes mellitus	
No	405 (92.9)
Yes	31 (7.1)
Arthritis/Osteoarthritis	
No	397 (91.1)
Yes	39 (8.9)
Insomnia	
No	320 (73.4)
Yes	116 (26.6)

Table 2 presents the characteristics of self-care and caregiving among caregivers of elderly individuals with dementia. It is noteworthy that the majority had been engaged in this activity for more than two years (68.8%) and received assistance in providing care (69.0%). Nearly half of them dedicated more than 8 hours per day to caring for the elderly individual (49.5%).

Regarding the prevalence of caregiver burden according to the ZBI scale, 143 (32.8%) of the caregivers scored higher than 18 points, thus indicating a higher level of burden. The absence of burden was observed among 153 (35.1%) and 140 (32.1%) participants in the 1st and 2nd terciles, respectively.

Table 3 shows the association between caregiver burden and the studied variables in a bivariate analysis, recording the crude prevalence ratio and the respective level of significance. Variables with a significance level of up to 20% (p-value ≤ 0.20) were selected for multivariate analysis.

Table 4 presents the results of the hierarchical multiple analysis. A higher prevalence of caregiver burden was associated with individuals aged 40 to 59, those in a conjugal situation with a partner, being a child or spouse, having a negative self-perception of health, using medications, not engaging in self-care measures, and providing support to the elderly individual in cultural activities, family integration, and medication administration tasks.

Table 2. Characteristics related to self-care and caregiving among caregivers of elderly individuals with dementia (N=436). Montes Claros, MG, 2019.

Variables	n (%)
Self-Care	
Yes	356 (81.7)
No	80 (18.3)
Care time for the elderly	
Up to 2 years	136 (31.2)
More than 2 years	300 (68.8)
Daily hours spent on caregiving	
≤8	220 (50.5)
>8	216 (49.5)
Receives assistance in caregiving	
Yes	301 (69.0)
No	135 (31.0)
Supports the elderly in feeding	
No	228 (52.3)
Yes	208 (47.7)
Supports the elderly in hygiene	
No	247 (56.7)
Yes	189 (43.3)
Supports the elderly in ambulation	
No	275 (63.1)
Yes	161 (36.9)
Supports the elderly in physical activities	
No	308 (70.6)
Yes	128 (29.4)
Supports the elderly in cultural activities	
No	327 (75.0)
Yes	109 (25.0)
Supports the elderly in Family integration activities	
No	318 (72.9)
Yes	118 (27.1)
Supports the elderly in medication administration	
Yes	359 (82.3)
No	77 (17.7)

Table 3. Bivariate association between caregiver burden and characteristics of caregivers of elderly people with dementia (N = 436). Montes Claros, MG, 2019.

Independent variables	Burden		PR_{crude}	p-value
	No n (%)	Yes n (%)		
Distal level				
Age group				
60 years or older	51 (67.1)	25 (32.9)	1.59	0.008
40 a 59 years	151 (62.9)	89 (37.1)	1.91	0.010
< 40 years	91 (76.5)	28 (23.5)	1.00	
Gender				
Female	253 (65.9)	131 (34.1)	1.48	
Male	40 (76.9)	12 (23.1)	1.00	0.112
Marital Status				
Without a partner	102 (61.8)	63 (38.2)	1.29	
With partner	191 (70.5)	80 (29.5)	1.00	0.062
Education				
Up 4 years of study	39 (54.2)	33 (45.8)	2.50	0.008
5 a 12 years of study	195 (68.4)	90 (31.6)	1.36	0.284
Over 12 years of study	59 (74.7)	20 (25.3)	1.00	
Relationship				
Child/Spouse	224 (64.6)	123 (35.4)	1.58	0.020
Other	69 (77.5)	20 (22.5)	1.00	
Family income (n=409)				
Up to 1 minimum wage	107 (64.8)	58 (35.2)	1.19	0.229
More than 1 minimum wage	172 (70.5)	72 (29.5)	1.00	
Intermediate level				
Perception of Health				
Regular/poor/bad	86 (52.4)	78 (47.6)	2.01	<0.001
Good/excellent	207 (76.4)	64 (23.6)	1.00	
Medication Use				
Yes	120 (58.0)	87 (42.0)	1.72	<0.001
No	173 (75.5)	56 (24.5)	1.00	
Self-care				
No	35 (43.8)	45 (56.3)	2.04	<0.001
Yes	258 (72.5)	98 (27.5)	1.00	
Nutritional status				
Obesisity	51 (59.3)	35 (40.7)	1.65	0.092
Overweight	113 (69.3)	50 (30.7)	1.06	0.794
Normal	125 (70.6)	52 (29.4)	1.00	
Depression				
Yes	29 (47.5)	32 (52.5)	1.77	< 0.001
No	264 (70.4)	111 (29.6)	1.00	
Hypertenssion				
Yes	79 (59.4)	54 (40.6)	1.38	0.021
No	214 (70.6)	89 (29.4)	1.00	

to be continued

Continuation of Table 3

Independent variables	Burden		PR_{crude}	p-value
	No n (%)	Yes n (%)		
Diabetes mellitus				
Yes	14 (45.2)	17 (54.8)	1.76	0.007
No	279 (68.9)	126 (31.1)	1.00	
Arthritis/Osteoarthritis				
Yes	20 (51.3)	19 (48.7)	1.59	0.026
No	273 (68.8)	124 (31.2)	1.00	
Insomnia				
Yes	62 (53.4)	54 (46.6)	1.67	< 0.001
No	231 (72.2)	89 (27.8)	1.00	
Proximal level				
Time spent caring for the elderly (years)				
>2	193 (64.3)	107 (35.7)	1.35	0.058
≤2	100 (73.5)	36 (26.5)	1.00	
Daily hours spent caregiving				
More than 8 hours	127 (58.8)	89 (41.2)	1.68	< 0.001
Up to 8 hours	166 (75,5)	54 (24.5)	1.00	
Receives help in caring for the elderly				
No	81 (60.0)	54 (40.0)	1.35	0.032
Yes	212 (70.4)	89 (29.6)	1.00	
Support for the elderly in feeding activities				
Yes	142 (68.3)	66 (31.7)	0.94	0.650
No	151 (66.2)	77 (33.8)	1.00	
Support for the elderly in hygiene activities				
Yes	110 (58.2)	79 (41.8)	1.61	< 0.001
No	183 (74.1)	64 (25.9)	1.00	
Support for the elderly in ambulation				
Yes	96 (59.6)	65 (40.4)	1.42	0.010
No	197 (71.6)	78 (28.4)	1.00	
Support for the elderly in physical activities				
Yes	63 (49.2)	65 (50.8)	2.01	< 0.001
No	230 (74.7)	78 (25.3)	1.00	
Support for the elderly in cultural activities				
Yes	38 (34.9)	71 (65.1)	2.96	< 0.001
No	255 (78.0)	72 (22.0)	1.00	
Support for the elderly in family integration activities				
Yes	43 (36.4)	75 (63.6)	2.97	< 0.001
No	250 (78.6)	68 (21.4)	1.00	
Support for the elderly in medication administration				
Yes	228 (63.5)	131 (36.5)	2.34	< 0.001
No	65 (84.4)	12 (15.6)	1.00	

PR_{crude}: Crude prevalence ratio

Table 4. Factors associated with caregiver burden in family caregivers of elderly individuals with dementia. Hierarchical Poisson regression model (N=436). Montes Claros, MG, 2019.

Variables	$PR_{Ajusted}$	C.I 95%	p-value
Distal level			
Caregiver's Age (years)			
60 years or older	1.16	0.96-1.25	0.122
40 to 59 years	1.20	1.02-1.39	0.013
<40 years	1.00		
Marital Status			
With partner	1.18	1.02-1.36	0.025
Without partner	1.00		
Relationship			
Child/Spouse	1.16	1.01-1.33	0.040
Other	1.00	1.06-1.28	
Intermediate level			
Self-Perceived Health			
Regular/poor/bad	1.30	1.10-1.52	0.001
Good/excellent	1.00		
Medication Use			
Yes	1.24	1.06-1.45	0.008
No	1.00		
Proximal level			
Self-Care			
No	1.49	1.17-1.89	0.001
Yes	1.00		
Support for cultural activities			
Yes	1.36	1.08-1.72	0.012
No	1.00		
Support for family integration			
Yes	1.41	1.05-1.89	0.023
No	1.00		
Supports the elderly in medication administration			
Yes	1.13	1.01-1.25	0.027
No	1.00		

$PR_{Ajusted}$: Adjusted prevalence ratio; IC: confidence interval; Deviance:188; 759 p= 0.446

DISCUSSIONS

Among caregivers, a high prevalence of work overload was observed. This finding is similar when compared to the results of a nationwide study involving caregivers of elderly individuals with dementia, which used the same ZBI classification[4], and it differs only slightly from an international investigation involving 340 caregivers that also utilized the same instrument[11].

Considering that cases of dementia have been increasing worldwide, a high prevalence of caregiver burden becomes a significant and concerning issue that deserves attention for this population, as they are at risk of developing health issues. Prolonged stress

caused by the continuous provision of care leads caregivers to devalue their own needs and neglect self-care, resulting in illnesses and ultimately in neglect in providing care[4,12,13] and early institutionalization of the care recipient[14].

In this study, various factors were associated with caregiver burden, ranging from demographic characteristics and the caregiver's health conditions to the support provided to the elderly person. Regarding health conditions, it was observed that caregivers who reported not engaging in self-care, those with a perception of regular or poor health, and those who used medications had a significantly higher prevalence of caregiver burden compared to those in better health. Other studies also demonstrate a close relationship between the caregiver's health and caregiver burden. Family caregivers with a more negative self-perception of health showed a high caregiver burden[3,15]. Another study that assessed caregiving associated with caregiver burden found that the caregiver's perception of their health was strongly associated with burden, being higher in individuals who reported a poor perception of their health compared to those who reported good or fair health[11].

To provide proper care for the elderly person, it is expected that the caregiver is in good health. However, more than one-third of the caregivers reported an unsatisfactory self-perception of their health, which can compromise their ability to perform their caregiving duties. An investigation involving family caregivers of Alzheimer's patients in Andalusia, Spain, also showed that perceived health is poor and caregiver burden is high among family caregivers[3].

The caregiving activity can bring benefits and positive outcomes, but there is a high rate of burden resulting from emotional stress, physical strain, and health issues, as well as restrictions on social and leisure activities[16]. A national study revealed that chronic stress caused by the role of caring for elderly individuals with dementia exacerbates deficits in attention, working memory, and executive function, compared to non-caregivers[17].

Participants in this study who reported not engaging in self-care had a higher prevalence of burden compared to those who reported engaging in self-care. In a study conducted in Colombia, caregivers who gave up some of their sports, cultural, leisure, and even work activities had five times the burden of those who did not give up their activities to take on the caregiving role[11].

Caregivers who reported using medications had a higher prevalence of burden when compared to those who did not use medications[7]. This result also reinforces the influence of health conditions on caregiving-related burden, as it can be inferred that caregivers who use medications have compromised health, which, in turn, impacts their ability to perform work-related activities[18,19].

The association between caregiver burden and the age group of caregivers, which represents a transition from adulthood to old age, has been reported in other studies discussing the fact that individuals who should be recipients of care end up becoming caregivers for their family members[11,20]. Considering that aging comes with increased limitations and reduced functional capacity, the involvement of individuals closer to old age may hinder their ability to perform their caregiving role or make it more challenging for these caregivers[21]. The presence of caregivers in this transitional stage can negatively impact their ability to perform their duties and compromise the quality of care provided to more dependent elderly individuals4. Since caregivers of elderly people are often exposed to stressful situations, are also rights holders, and require attention in risk prevention programs related to caregiving[4], it is expected that caregivers of older elderly individuals face greater challenges in performing their caregiving role[22].

It was observed that the prevalence of caregiver burden among individuals aged 40 to 59 years was significantly higher compared to caregivers below the age of 40. However, this was not observed among caregivers aged 60 and above. A national study revealed a high level of caregiver burden among informal caregivers who were young adults caring for dependent elderly individuals[23]. Higher caregiver burden associated with a younger age of the caregiver has also been demonstrated in international studies[8,24]. This can be justified by the

accumulation of roles. Caregiver burden was higher among younger family caregivers, especially those who lived with the elderly person with dementia and had other family obligations[14].

As indicated by the results of this study, caregivers with a partner exhibited a higher caregiver burden when compared to caregivers without a partner. This finding is consistent with previous studies[16,24]. While the marital situation "with a partner" can be positive for the caregiver by representing support for their activities, on the other hand, it can have negative consequences as it overburdens the caregiver due to the accumulation of tasks[25,26]. A national study with informal caregivers of dependent elderly individuals revealed that caregiver burden was higher among spouses[15]. A population-based study conducted in Singapore with informal caregivers of elderly individuals with dementia found a 2.4 times higher risk of caregiver burden among married caregivers compared to those who were single. According to the authors, a possible explanation for the association of caregiver burden among married individuals is that spouses often express more distress and feelings of burden when they are solely responsible for caregiving[16].

Another finding of this study was the association between the caregiver's degree of kinship (spouse, child) and the presence of higher caregiver burden. One possible explanation for this result is that both spouses and children may perceive caregiving as an "obligation," a responsibility, which in turn makes caregiving more exhausting. In a similar manner to this study, previous research has demonstrated this association, which also included elderly individuals with dementia[16,27,28].

While not the focus of this study, it is relevant to highlight that the literature records differences in caregiver burden between children and spouses. Spouses and adult children experience dementia caregiving differently, which can be explained by the younger age of adult caregivers, the frequency of contact with the care recipient, differences in the characteristics of the care recipient, the frequency of neuropsychiatric symptoms, and the severity of the disease[29]. Research on differences between spouse caregivers and adult children has shown that spouse caregivers are more likely to report more depressive symptoms, overall health deficits, greater financial burden, and physical difficulty managing their responsibilities. This difference can be attributed to the older age and reduced physical health of spouse caregivers (who may be more affected by health problems), as well as the possibility of a spouse residing in the same household as the person with dementia and the greater burden of continuous caregiving that another adult caregiver would typically not experience[30].

Adult child caregivers and spouses also respond differently to the presence of various types of social support[31]. Support for adult children caregivers should aim to provide psychoeducation for complicated neuropsychiatric symptoms in the care recipient. Spouses may benefit from interventions that focus on increasing social support, while adult child caregivers may benefit from interventions aimed at alleviating caregiver burden and improving quality of life[29]. Adult child caregivers reported more rewards from their caregiving role than spouse caregivers[30].

Regarding the finding of caregiver burden and their support for the dementia patient in family integration and cultural activities, no studies addressing such associations were identified. One important aspect to consider is the family bonds with the elderly person. It's essential to recognize that these bonds are developed over years of living together, and the way these relationships have evolved throughout life can have an impact on how the support network is established when the individual becomes dependent[32]. Providing support for them in cultural and family integration activities can be challenging and very draining for the caregiver because they not only have to provide care for the person under their responsibility but also manage the complex interactions of family and social bonds for that individual, along with other more practical aspects like transportation, among others. Additionally, these activities can cause discomfort and disrupt the caregiving routine[33]. In this regard, offering support in family integration and cultural activities are complex caregiving tasks that require more mental effort from the caregiver as they involve planning and constant supervision.

Further related to this situation, often hidden within families, there are other factors that may be associated with caregiver burden in supporting the elderly person with dementia in family and cultural integration activities. The following considerations can be outlined: the absence of shared responsibility among family members in caregiving, lack of financial support from other relatives, and the presence of illness and/or comorbidities among other family members. Since these considerations were not addressed in this study, they should be the subject of future investigations.

The caregiver burden associated with support in medication administration for the elderly person with dementia can be explained by the fact that medication administration is one of the caregiver's ongoing responsibilities, meaning it's another task they cannot delegate and one that requires a lot of attention and precision. Elderly individuals often have multiple chronic diseases, require various medications, have more difficulty adhering to therapeutic regimens, and are more vulnerable to the adverse effects of drugs. Therefore, managing these patients is much more complex[34]. The caregiver's high demand, coupled with a limited support network, can lead to difficulties in adequately supporting the caregiver in medication administration, potentially leading to forgetting to administer the medication, confusion, and overmedication of the elderly person.

Some limitations of this study should be considered. It is a cross-sectional investigation, which does not allow for causal inferences between caregiver burden and the evaluated independent variables. Some aspects related to caregivers were not assessed but may be relevant in the context of burden, such as their functionality. Similarly, there was no distinct evaluation considering the types of dementia or its severity (mild, moderate, and severe) because the classification of dementia severity was not a systematic practice for all medical professionals in the institution. Additionally, the selection of the evaluated group was made based on the elderly care service, utilizing the appointments for medical consultations, which could represent a significant difference compared to caregivers randomly allocated in their own homes.

Despite these limitations, this study has the merit of assessing a large sample thoroughly, considering socioeconomic, clinical, self-care, and caregiving aspects and their implications for burden among caregivers of elderly individuals with dementia. There are few national studies on this topic. All instruments used for data collection were validated and adapted to Brazilian culture and administered by a specially trained team.

CONCLUSION

This study revealed a significant prevalence of workload burden among caregivers of elderly individuals with dementia. The factors associated with burden were age, marital status, the degree of kinship with the elderly individuals, self-perceived health, medication use, self-care, and support for cultural activities, family integration, and medication administration in the elderly individuals.

This high prevalence of burden among caregivers of elderly individuals highlights the need for specific policies for this group and represents an aspect that should be regularly assessed by healthcare professionals who work directly with people with dementia and their families.

It is essential to recognize that the importance of caring for elderly individuals with dementia should not be limited to the family environment but should extend to society as a whole. Society should encourage the government to implement specific public policies that operate in a coordinated, integrated, and intersectoral manner, including informal caregivers as key players in the care assistance model. This model should primarily ensure human dignity for those providing care.

AUTHORSHIP

- Mariza Alves Barbosa Teles – Conception and design, data analysis and interpretation, article writing, critical review, and approval of the final version to be published.

- Mirna Rossi Barbosa-Medeiros – Data analysis and interpretation, article writing, critical review, and approval of the final version to be published.

- Lucineia de Pinho – Conception and design, data analysis and interpretation, critical review, and approval of the final version to be published.
- Antônio Prates Caldeira – Conception and design, data analysis and interpretation, critical review, and approval of the final version to be published.

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Health-related behaviors and associated factors among working older people within a Brazilian public university

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Abstract

Objective: To analyze health-related behaviors and associated factors in older people working at a Brazilian public university. *Method:* A cross-sectional, descriptive, inferential study adopting a quantitative approach was conducted. The sample comprised 113 individuals and data were collected between May/2021 and September/2022 either remotely by telephone and/or video calls, and/or in person. Descriptive and cluster analysis were performed and the Chi-square or Fisher's Exact Tests were applied for a significance level of 95%. *Results:* Respondents were predominantly male (n=70, 61.9%), had a mean age of 65 (±3.20) years, and were of white (n=39, 34.5%) or brown (n=38, 33.6%) ethnicity. Two clusters were identified: Cluster01-fair, comprising 31 (27.4%) individuals; and Cluster02-excellent, comprising 82 (72.6%) participants, based on health-related behavior variables. A significant association was found between gender and clusters ($p<0.04$). Cluster02 contained more males and individuals with better health-related behaviors. *Conclusion:* Although the results revealed that, overall, study participants had good/excellent behaviors, there was a contingent that reported health risk behaviors, highlighting the challenges surrounding self-care in the working older population. It is important to raise awareness of older individuals about health risk behaviors and their impact on health and quality of life, especially given that many older people are providers for the family and that working influences the health of older individuals.

Keywords: Elderly. Health-related behavior. Employment.

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INTRODUCTION

The study of health-related behaviors in older people is pivotal for public health because greater knowledge and understanding of these behaviors, together with regional and cultural specificities, contributes to the development of key markers of healthy aging with quality of life[1,2].

The older population has grown significantly worldwide as a result of declining fertility rates and increased longevity of the population as a whole[3]. This growth has a led to a greater contingent of older individuals in the economically active population (EAP). This situation has created the need for changes within organizations to accommodate older workers, and the Brazilian labor market is not well prepared to effectively embrace the older EAP[4].

Although the group of older workers is proportionally smaller than that of younger and adult workers, this older group has been growing steadily. This scenario of older Brazilians staying on in the workplace is not only due to financial reasons, but also as a means of remaining active and for socialization through work. Moreover, recent changes in the Brazilian welfare and pensions system has led to raising of the minimum retirement age of workers, representing another factor encouraging older individuals to carry on working[5].

Thus, there is a real need to address the aging Brazilian work force and the need to adapt workplaces to cater for the specificities of these older workers. Older workers are the center of this process, which focuses on their physical and mental health, and can aid the planning and development of actions plans. This approach can help improve existing public policies or the devising of new policies that cater for the needs of older people and their well-being in the workplace while promoting active aging with quality of life[5,6].

Therefore, the objective of the present study was to analyze health-related behaviors and associated factors in older individuals working at a Brazilian public university. This knowledge can help inform health care policies for older economically active people, providing guidance to the research venue on organizing and planning its actions to meet the needs identified. This is particularly relevant in the light of the new Brazilian public welfare and pension rules which, in many cases, have lengthened the time working before retirement. Health policies should help ensure that more older individuals reach late life in the best possible health.

METHOD

A cross-sectional, descriptive, inferential study with a quantitative approach involving older workers at a Brazilian public university was conducted. The contingent of older staff at the study venue in December 2020 was 845, comprising 504 administration technicians and 341 faculty teachers. In accordance with the methodological design, sample size was calculated based on a confidence interval of 95%, estimated proportion of 50%, and sampling error of 5%. The calculation yielded a final sample size of 265 participants, comprising both administration technicians and faculty teachers, subsequently stratified by sex and professional category. Inclusion criteria were older individuals who held permanent positions as administration technicians or faculty staff member at the target study venue. Subjects who were hospitalized, on sick leave, retired, or on vacation at the time of data collection were excluded.

Data were collected using the health, wellbeing and aging questionnaire (SABE)[7] – Fortaleza version. The SABE questionnaire collects information on the following dimensions: personal details, cognitive status, health status, functional status, medications, health services use and access, work history, income sources, living arrangements and ill-treatment.

Health-related behaviors were defined as dependent variables and included sexual intercourse in past year, health service use in past year, last dental appointment, consumption of meat, fish or chicken at least 3 times a week, consumption of fruit or legumes at least twice a day, failure to take a prescribed medication in past year, daily engagement in physical activity, consumption of alcohol in past 3 months, smoking status, receipt of latest influenza and covid-19 vaccines, and reason for carrying on working. Sociodemographic characteristics were defined as independent variables and included sex, age group,

color/race, marital status, living arrangement, religion, income, educational level, and job position.

Recruitment and data collection were performed by 12 students (10 undergraduates and 2 graduates) selected via an application and shortlisting process, and duly trained. The collection instrument underwent review prior to commencement of interviews, entailing discussion of each question followed by pilot interviews and final review of the questionnaire for calibration of interviewers. Data collection began in May 2021 and concluded in September 2022. Questionnaires were applied either virtually (via telephone/video call) or in person. All participants signed the Free and Informed Consent Form before interview.

Descriptive analyses were carried out of the study variables. Additionally, multivariate cluster (interdependence) analysis was performed to identify groupings according to similarities or dissimilarities among participants for the dependent variables assessed. The hierarchical technique was employed and the agglomeration measure was the mean connection between observations. Regarding cluster quality, the cohesion and separation silhouette measure proved within the reasonable range, with a mean silhouette value of 0.4, yielding 2 clusters denoted Cluster01-fair and Cluster02-excellent.

The resultant clusters were used to determine significant associations between independent variables for a 95% significance level. Inferential statistics were determined using the chi-square or Fisher exact tests for a 95% significance level.

The project was approved by the Research Ethics Committees of the Universidade Federal do Rio Grande do Norte on 04 March 2020 under permit number 3.898.077 and registered on the Brazil/Health Ministry Platform under C.A.A.E 27248619.1.0000.5292.

The complete dataset for the results of the present study are available from the corresponding authors upon request.

RESULTS

A sample size of 265 individuals was calculated. A total of 201 (75.8%) individuals from the initial sample were contacted by telephone. Of the 201 contacted, 123 (61.2%) were administration technicians and 78 (38,8%) faculty teachers; 52 (25.8%) refused to take part in the study, of which 28 (53.8%) were administration technicians and 24 (46.2%) faculty teachers. Application of the exclusion criteria led to the exclusion of 36 (17.9%) participants, comprising 21 (58.3%) administration technicians and 15 (41.7%) faculty teachers. Reasons for exclusion were being retired (32 cases; 88.9%), due to death (3 cases; 30%) and because the worker had been seconded to another post (1 case; 2.80%).

Overall, 64 (24.2%) individuals could not be contacted due to situations which arose during the course of the study, such as the covid-19 pandemic and lockdown, outdated information on staff members at the service where the study was performed, and skepticism as to whether the study was bona fide.

Data for 113 respondents, or 42.6%, are presented. Of the overall sample, participants not contacted represented 24.2%, refusals 19.6%, and exclusions 13.6%.

The results of the descriptive analysis, with absolute frequencies and percentages of the categorical variables, are given in Tables 1 and 2.

The information in Table 1 shows that the sample consisted predominantly of individuals that were male, had a mean age of 65 (±3.20) years, and were white or brown. Two of the participants failed to declare their color/race.

With respect to marital status, most participants were married, whereas for religion, the majority reported being Catholic. Regarding income, mean amount received was 9 (±6,3).minimum wages. A significant number of respondents did not answer the question probing income.

Table 1. Characteristics of sample according to sociodemographic variables. Natal/Rio Grande do Norte state - Brazil, 2022.

Sociodemographic variables	n(%)
Sex	
Male	70(61.9)
Female	43(38.1)
Age group (years)	
60-64	55(48.7)
65-69	46(40.7)
≥70	12(10.6)
Color/Race	
White	39(34.5)
Brown	38(33.6)
Black	22(19.5)
Indigenous	04(3.50)
Yellow	03(2.70)
Other	03(2.70)
Not declared	04(3.50)
Marital status	
Divorced	15(13.3)
Separated	05(4.40)
Widowed	06(5.30)
Married	64(56.6)
Civil union	12(10.6)
Single	10(8.80)
Answer not given	01(0.90)
Religion	
Catholic	74(65.5)
Non-Catholic	28(24.8)
No religion	10(8.80)
Answer not given	01(0.90)
Income*	
1-3 minimum wages	05(4.40)
3.1-6 minimum wages	25(22.1)
≥6.1 minimum wages	34(30.1)
Answer not given	49(43.4)
Educational level:	
First grade (primary)	10(8.80)
Second grade (secondary)	14(15.9)
Higher education	18(15.9)
Graduate education	70(61.9)
Answer not given	01(0.90)
Living arrangement	
Alone	16(14.2)
With other(s)	97(85.8)

to be continued

Continuation of Table 1

Sociodemographic variables	n(%)
Position	
Faculty teacher	39(34.5)
Administration technician	74(65.5)

*Reference value for minimum wage in 2021.

Table 2. Characteristics of sample according to health-related behavior variables, Natal/Rio Grande do Norte - Brazil, 2022.

Health-related behavior variables	n(%)
Alcohol consumption in past 3 months	
None	46(40.7)
Less than 1 day per week	17(15.0)
1 day per week	13(11.5)
2-3 days per week	15(13.3)
4-6 days per week	01(0.90)
Every day	04(3.50)
Answer not given	17(15.0)
Smoking status	
Current smoker	07(6.20)
Ex-smoker	29(25.7)
Never smoked	48(42.5)
Answer not given	29(25.7)
Daily physical activity	
Yes	79(69.9)
No	27(23.9)
Answer not given	07(6.20)
Latest vaccine against influenza	
Yes	89(78.8)
No	16(14.2)
Answer not given	08(7.10)
Latest vaccine against covid-19	
Yes	101(89.4)
No	04(3.50)
Answer not given	08(7.10)
Sexual intercourse in past year	
Yes	71(62.8)
No	28(24.8)
Answer not given	14(12.4)
Last dental appointment	
<1 year ago	36(31.9)
1-2 years	25(22.1)
≥3 years	20(17.7)
Does not remember	32(28.3)

to be continued

Continuation of Table 2

Health-related behavior variables	n(%)
Other medical consultation in past year	
Yes	58(51.3)
No	46(40.7)
Answer not given	09(8.00)
Failed to take prescribed medication in past year	
Yes	15(14.2)
No	87(77.0)
Answer not given	10(8.80)
Consumption of fruit, legumes or vegetables (twice daily)	
Yes	75(66.4)
No	38(33.6)
Consumption of meat, fish or chicken (3 times/week)	
Yes	106(93.8)
No	07(6.20)
Reason for working	
Needs the money	35(31.0)
Wishes to help family	04(3.50)
Wants to keep busy	08(7.10)
Needs to feel useful	09(8.00)
Likes working	45(39.8)
Other	03(2.70)
Answer not given	09(8.00)

The results in Table 2 reveal that a quarter of individuals reported not having sexual intercourse. The rate of smoking was low, with the majority reporting never having smoked. Most engaged in weekly physical activity, over 70% were vaccinated against influenza and most against covid-19.

When probed about time since last dental appointment, most reported having seen a dentist within the past year, although a relatively large number of participants could not remember the date of their last visit.

Regarding failure to take a medication prescribed by a doctor in the past year, most stated this was not the case. Concerning the reason for carrying on working, most respondents reported that they enjoyed their work.

Significant associations among variables were explored by grouping individuals by similarity in responses for health-related behavior variables using cluster analysis. This analysis resulted in the identification of 2 clusters: Cluster01-fair containing 31 (27.4%) individuals; and Cluster02-excellent with 82 (72.6%) participants. Some variables were dichotomized, such as health-related behaviors (dependent variables) and socioeconomic aspects (independent) to determine bivariate association.

The clusters are described in Table 3 according to smoking status, last dental appointment and consumption of fruit, legumes or vegetables (twice daily), where these were the only characteristics that distinguished the clusters.

In Cluster01-fair, all individuals were current smokers, reported not consuming fruit, legumes or vegetables at least twice daily, and most reported last dental appointment was over a year ago, characterizing poor/fair health-related behaviors. In Cluster02-excellent, most individuals never smoked or were ex-smokers, had last dental appointment within past year and consumed fruit, legumes or vegetables at least twice daily, characterizing good/excellent health-related behaviors.

Table 3. Bivariate association of clusters with health-related behaviors. Natal/Rio Grande do Norte state - Brazil, 2022.

Health-related behavior variables	Cluster01-fair n(%)	Cluster02-excellent n(%)	*p*
Alcohol consumption in past 3 months			
None or <1 day per week	06(13.0)	40(87.0)	0.68[1]
≥1 day per week	08(16.0)	42(84.0)	
Smoking status			
Current smoker	04(57.1)	03(42.9)	<0.001[1]
Never smoked / Ex-smoker	00(0.00)	77(100.0)	
Daily physical activity			
Yes	21(26.6)	58(73.4)	0.08[1]
No	03(11.1)	24(88.9)	
Latest vaccine against influenza			
Yes	23(25.8)	66(74.2)	0.35[2]
No	02(12.5)	14(87.5)	
Latest vaccine against covid-19			
Yes	22(21.8)	79(78.2)	1.00[2]
No	01(25.0)	03(75.0)	
Last dental appointment			
<1 year ago	04(11.1)	32(88.9)	<0.001[1]
≥1 year ago	26(57.8)	19(42.2)	
Other medical consultation in past year			
Yes	09(15.5)	49(84.5)	0.11[1]
No	13(28.3)	33(71.7)	
Consumption of fruit, legumes or vegetables (twice daily)			
Yes	00(0.00)	75(100.0)	<0.001[1]
No	31(81.6)	07(18.4)	
Consumption of meat, fish or chicken (3 times/week)			
Yes	27(25.5)	79(74.5)	0.09[2]
No	04(57.1)	03(42.9)	
Sexual intercourse in past year			
Yes	12(16.9)	59(83.1)	0.60[2]
No	06(21.4)	22(78.6)	
Failed to take prescribed medication in past year			
Yes	06(37.5)	10(62.5)	0.20[2]
No	18(20.7)	69(79.3)	
Reason for working			
Needs the money/Wishes to help family	26(32.5)	54(67.5)	0.06[1]
Wants to keep busy/Needs to feel useful/Likes the work	03(12.5)	21(87.5)	

[1]Chi-square; [2]Fisher Exact

Table 4. Bivariate association of clusters with independent (sociodemographic) variables. Natal/Rio Grande do Norte state - Brazil, 2022.

Independent variables	Cluster01-fair	Cluster02-excellent	*p*
Sex	n(%)	n(%)	
Male	24(34.3)	46(65.7)	<0.04[1]
Female	07(16.3)	36(83.7)	
Age group (years)			
60-65	20(29.0)	49(71.0)	<0.64[1]
≥66	11(25.0)	33(75.0)	
Color/Race			
White	07(17.9)	32(82.1)	<0.08[1]
Brown/Black	24(33.8)	47(66.2)	
Marital status			
Single/divorced/separated/widowed	09(25.0)	27(75.0)	<0.63[1]
Married/civil union	22(28.9)	54(71.1)	
Religion			
Catholic	21(28.4)	53(71.6)	<0.60[1]
Non-Catholic	09(23.7)	29(76.3)	
Income			
≤6 minimum wages	07(23.3)	23(76.7)	<0.79[1]
>6.1 minimum wages	07(20.6)	27(79.4)	
Educational level:			
Primary/secondary	07(30.4)	16(69.6)	<0.72[1]
Higher/Graduate education	24(26.7)	66(73.3)	
Living arrangement			
Alone	04(25.0)	12(75.0)	<1.00[2]
With other(s)	27(27.8)	70(72.2)	
Position			
Faculty teacher	23(31.1)	51(68.9)	<0.23[1]
Administration Technician	08(20.5)	31(79.5)	

[1]Chi-square; [2]Fisher Exact

A significant association between sex and the clusters is evident in Table 4, where more men belong to Cluster-02-excellent (prevalence ratio (PR): 0.79; confidence interval (CI) 0.69-0.97). This is an inverse association of protection showing that men from Cluster02-excellent, the cluster with good/excellent health-related behaviors, has a lower probability of developing poor/fair health-related behaviors.

DISCUSSION

Studying the health-related behaviors of older people working at a Brazilian public university can inform policies that can improve the quality of life of these individuals. Such efforts can promote a retirement without major losses, such as aging-related declines associated with the aging process that involve natural physiological changes inherent to human biology and physiology. These alterations can also be pathological as a consequence of diseases, result from changes in health-related behaviors or through adaptation in response to excess free time[8].

With regard to the present study, analysis of the profile of the older participants revealed a predominance of males in the sample. Administration technicians and faculty teachers

tend to be male[9] and so a predominance of men in the sample was expected.

It is public knowledge that, traditionally, women were always expected to remain in the home, with the role of the woman as carer and the man as provider. Amid shifts in family structures and advances in women´s rights, females now make up a large contingent of the paid work force outside the home, although gender inequality persists in the labor market in Brazil[10,11].

With regard to age, although the study venue had a large contingent of older workers, these were generally younger old who, in developed countries, would not be considered old because they have not reached 65 years of age. A similar age was found among civil servants investigated in the study by Amorim et al.[12].

Although the study involved mainly younger old adults, given the recent changes in the labor market and retirement rules to reflect longer life expectancy, there is a greater need to promote health among this group of older workers who continue working beyond the age of 60[12].

The sample contained individuals who were predominantly white or brown. The socioeconomic data showed this to be a population with financial and marital stability and graduate level education. This profile was expected given the study venue of an institute of higher education, where the administration and faculty staff were incentivized to improve their qualifications, with concomitantly higher salary according to educational level attained. The majority of the participants were administration technicians.

Regarding the profile of health-related behaviors, most participants engaged in regular physical activity. In 2017, the study venue implemented a quality of life at work program providing individual and group work practices, organizational management and health promotion for staff administration and teaching staff[13].

For vaccination status, most of the sample was vaccinated against both influenza and covid-19. Despite fake news and anti-vaccine campaigns which peaked during the last government, the vaccination rate proved satisfactory. The study by Santos[14] found that 96.5% of the older people interviewed were getting vaccinated and 100% believed the vaccine to be effective.

The adult population was the worst hit by covid-19 early in the pandemic, with greater lethality among the older population[15]. The study by Araújo et al.[16] found that over half of the older individuals interviewed wished to receive the vaccine against covid-19. Given the vulnerability of this group, the high level of acceptance of the vaccine against covid-19 might be explained by fears of becoming infected by the disease and also by the greater knowledge and faith in science, since part of this group worked directly in the academic milieu.

Regarding the question on last dental appointment, a relatively high number of respondents stated they could not recall when they last saw a dentist. This suggests it may have been some time since their last visit to the dentist, highlighting the importance of health education on the need for oral health care.

For consumption of fruit, legumes or vegetables (twice weekly) and consumption of meat, fish or chicken (3 times/week), most participants confirmed this level of intake. According to the 2017-2018 household budget survey, older individuals consume more fruit, legumes and vegetables compared with adolescents and younger adults, despite a fall in levels relative to the previous survey in 2008-2009[18].

Concerning the reason for carrying on working, most respondents reported they liked working, but a notable proportion reported needing the money as a reason. A growing number of older individuals decide to carry on working despite having reached retirement age. This phenomenon is due to several factors, such as the need to remain in the labor market and feel useful and valued, besides the financial motive.

The study by Pazos & Ferreira[19] shows that the desire of many to carry on working is due to the income, being the breadwinner of the family, the social roles imposed, and also for reasons related to pensions. In agreement with the study by Mocelin et al.[20], there are also the consequences of biological

changes in the body and declines in health which force many older workers to give up their jobs.

In the case of the participants of the present study, these would receive less income upon retirement compared to the salary while working. This leads many of the administration and teaching staff to remain in the job so as not to have to lower their standard of living, despite aging-related biological changes.

Active aging and its relationship with work remains a fertile area of investigation and more in-depth continuous studies are warranted. The results of these studies can serve to support planning of new social initiatives, including the related legislation, culminating in enhanced quality of life in older age[21].

In the cluster analysis, respondents were characterized for the variables smoking status, last dental appointment and consumption of fruit, legumes or vegetables (twice daily).

Based on the results, the individuals belonging to Cluster01-fair were deemed to exhibit poor/fair health-related behaviors given they reported being current smokers, having last dental appointment over a year ago, and not consuming fruit, legumes or vegetables (twice daily). Conversely, the participants in Cluster02-excellent were considered to display good/excellent health-related behaviors, having reported non-smoker/ex-smoker status, visiting the dentist within the last year, and consuming fruit, legumes or vegetables (twice daily).

Data from the Brazilian Institute of Geography and Statistics (IBGE)[22] on tobacco use in the population show that 11.9% are smokers and 42.2% ex-smokers. Smoking is one of the leading causes of chronic non-communicable diseases (NCDs). Regarding dental appointments, these took place in private offices, with no stratification by age or length of time since last visit to the dentist. Consumption of fruit, legumes or vegetables (twice daily) was found to increase with age and education, where 17.9% of individuals aged ≥60 years had the recommended intake.

For the relationship between clusters and independent variables, a significant association was detected between gender and the clusters. Male gender was associated with Cluster02-excellent, which exhibits good/excellent health-related behaviors. This finding contradicts the results of the studies by Assumpção et al.[23], Magalhães et al.[24], and Rocha et al.[25], which found feminization of aging and that women had better health-related behaviors.

Amid this paradox, the study by Fernandes & Burnay[26] showed that women have a greater probability of worse self-rated health, with worse overall health compared to men, irrespective of socioeconomic differences.

This phenomenon might be related to the fact that, historically and socially, women are more burdened with tasks involving the home, caregiving for children and spouse, besides holding down a job, thereby performing a "double work shift" [24,27]. Due to this overload, these women are unable to practice good health-behaviors that allow disease prevention and health promotion.

Study strengths include the fact that it is an epidemiological investigation of working older individuals that analyzed health-related behaviors in this population, with few studies on the topic involving this age group.

Study limitations include the number of respondents, which fell short of the ideal sample size. This was due to multiple factors including non-receipt of up-to-date information on staff members, the interview having been conducted in a virtual environment, and numerous refusals to take part or answer calls owing to the high prevalence of telephone scams. The lack of previous studies addressing the specific topic in the older population also hampered comparisons.

Another limitation was that, owing to the covid-19 pandemic, the method of data collection had to be switched from in-person to virtual, hindering contact with participants. The fact that the study had to be conducted remotely may have introduced some information bias. Lastly, the cross-sectional design of the study precluded any inferences regarding causality.

CONCLUSION

As discussed throughout the text, more care needs to be dedicated to the health of the older population than currently, in view of the epidemiological and demographic changes taking place in Brazil that have led to shifts in sociodemographic, labor, behavioral and health profiles in the country.

Although the results show that, overall, most study participants exhibited good health-related behaviors, a contingent reported health risk behaviors, highlighting the challenges surrounding self-care in the older population.

These findings underscore the importance of raising the awareness of these older individuals about high risk behaviors and their impacts on health and quality of life. This is especially relevant given that many older workers are the main providers for their family and that working beyond the age of 60 is often a necessity as opposed to a choice in this stage of life.

Older people are remaining an active part of the workforce for longer. It is crucial that carrying on working, whether by choice or necessity, be supported while promoting the health of this group. Therefore, public actions and policies that contribute to healthy aging and also ensure the well-being of older individuals in the workplace are necessary.

The results of the present study serve not only to provide scientific evidence supporting the topic, but also to improve existing or develop new policies and actions for health promotion and disease prevention targeting the older population. Lastly, these findings can also help implement collective strategies addressing the actual needs of older workers at the Universidade Federal do Rio Grande do Norte which, together with existing occupational health services, can enable monitoring of the health and work activity of these civil servants.

AUTHORSHIP

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Zinc deficiency in alzheimer's disease: a cross-sectional study with a control group

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Abstract

Objective: To identify whether there is a difference in plasma and erythrocyte zinc concentration in older adults with and without Alzheimer's disease. *Methods:* Cross-sectional study with a comparative group, conducted with older adults with and without Alzheimer's disease, matched by sex, education, and age. Zinc concentration was measured by atomic absorption spectrophotometry in a graphite furnace. *Results:* There were 102 people, 68 in the healthy group (NDA-g) and 34 in the group with disease (AD-g). The AD-g group had lower plasma zinc concentrations and higher frequency in the first quartile for intraerythrocyte zinc concentrations. Plasma and erythrocyte concentrations did not correlate with the time of diagnosis and age in both groups. In the logistic regression analysis, plasma concentration was associated with AD-g (OR=0.964; p=0.028). *Conclusion:* Older people with Alzheimer's disease have lower plasma and erythrocyte zinc concentrations.

Keywords: Zinc.
Alzheimer's disease.
Cognitive Dysfunction.

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The authors declare that there is no conflict in the conception of this work.

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INTRODUCTION

Alzheimer's disease (AD) is a complex pathological process since environmental, metabolic, genetic, dietary, and vascular factors are associated with its development. There is a trend of increasing the prevalence of AD and a potential decrease in the quality of life of older adults because they are an important risk group for this disease[1].

Although age is the main associated factor, other factors pose an indirect risk for AD, such as hypertension, diabetes, and stroke. Physical activity, mentally demanding activities, and ingesting of certain foods establish a protective relationship against the disease[2]. In Brazil, epidemiological studies on AD are still advancing slowly[3].

Despite several recognized causes, the exact etiology of AD development and progression still needs to be established. Oxidative stress is an early process that favors its development and is sustained over the years, promoting the more rapid progression of AD[4].

The homeostasis of some metals, such as zinc (Zn), can increase reactive oxygen and nitrogen species (RONS) and the accumulation of β-amyloid (Aβ) plaques. Aβ is an extracellular deposit of insoluble aggregates of a beta-amyloid protein capable of promoting neuronal dysfunction, oxidation, excitotoxicity, and neuroinflammation, responsible for apoptosis in central nervous system (CNS) cells, contributing to AD in a feedback loop[4,5].

The Aβ peptide accumulation seems to induce oxidative stress in the CNS, causing neurodegeneration and contributing to AD[4,5]. In addition, low plasma concentrations of Zn were observed in older adults with cognitive impairment or dementia compared with healthy older adults. However, there is no consensus on Zn homeostasis and the development or progression of AD[6,7].

Zn is essential for the maintaining of several metabolic pathways and functions as an enzyme cofactor for more than 300 enzymes, especially those related to energy metabolism and oxidative stress in the CNS. Thus, it is suggested that the deficiency in the concentrations of this nutrient may cause the onset of chronic diseases in older adults, promote oxidative stress, and contribute to AD progression[8].

Zn accumulation has been observed in AD patients' brains and is linked to Aβ plaques, responsible for the synaptic dysfunction seen in these patients. This dyshomeostasis may play a critical role in AD progression[1].

If, on the one hand, the low metal concentration can favor oxidative stress, increase the production of RONS, and favor Aβ plaques formation, on the other hand, the accumulation of Aβ peptides can cause Zn retention in the CNS and contribute to the impairment of Zn homeostasis and promote AD[4,9].

Given the above, it is important to note that regions where social inequalities are evident and many older people live in food insecurity, such as the north and northeast of Brazil, have relevant rates of micronutrient deficiencies that favor the onset of various diseases and cognitive impairment, such as zinc, iron, and selenium[10]. It should also be noted that these regions have shown an increasing frequency and greater annual percentage variation in mortality rates due to AD over the last 20 years[3], factors which justify this research.

Thus, Zn deficiency and excess may be associated with impaired neuronal cellular activities. The results of this research may contribute to the understanding of factors that can trigger the development of AD or to its evolution, helping researchers and professionals in geriatrics and gerontology in the result of actions to prevent the onset of the disease and contributing to science to the elucidation of pathophysiological processes that favor AD.

The present study aims to determine possible differences in Zn concentrations in plasma and erythrocytes in older adults with and without AD and understand Zn homeostasis in older adults with and without AD.

METHODS

Cross-sectional study with a comparison group and hospital-based, with a sample composed of older adults aged ≥60 years, seen at the Gerontology

Nutrition Outpatient Clinic of the Nutrition School of the Federal University of Alagoas - Brazil, from April 5, 2017, to July 30, 2018, using the STROBE tool as a guide (*Strengthening the Reporting of Observational Studies in Epidemiology*).

For the sample size calculation, it was observed the mean value ± standard deviation of plasma Zn concentrations observed in a pilot project, in addition to significant mean differences of serum Zn concentrations in original published studies with Alzheimer's patients[7]. Thus, considering the significance level of 5% and power of 90%, the expected sample size for comparison of the two proportions of 34 patients for the Alzheimer's disease group (AD-g) and 68 for the comparison group without the AD (NAD-g) was defined (two controls for each case - 1:2 ratio).

After evaluating and diagnosing the disease, The AD-g group met the study's inclusion criteria, referred by a geriatrician. The NAD-g was composed of healthy older adults, preferably referred by the patient or caregiver, or by older adults already seen by the same geriatrician, provided they did not present criteria for AD-g, were evaluated by the same professional, and met the pairing criteria (age ± five years). The study included older adult subjects of both genders, over 60 years, and residents of Maceió and the metropolitan region - Alagoas.

The inclusion criteria for the study were: no nutritional Zn supplementation; no metabolic diseases known to compromise the metabolism of this mineral; and a probable diagnosis of Alzheimer's disease as defined by a medical specialist for the AD-g, and no cognitive impairment, also evaluated by a geriatrician, for the NAD-g.

All data was collected using a previously established questionnaire applied during the first consultation. All the information on older adults with AD was provided with the help of the caregiver or family member, while in the NAD-g, the individual answered the research questions.

The sociodemographic variables collected were age, education, income, housing conditions, marital status, and occupation. Age was categorized as 60 to 69 years, 70 to 79 years, and ≥80 years; education as <5 years and ≥5 years of study; and family income stratified by the Brazilian minimum wage (BMW) in effect in 2018, categorized as ≤1BMW and >1BMW. The occupation was classified as retired/with fixed monthly income or unemployed/without income.

The participant's body mass was determined using a digital scale (200 kg capacity and 50g precision)[11]. Height was obtained using a portable stadiometer (Seca®), graduated in tenths of centimeters, and affixed on a flat surface[12].

The Body Mass Index (BMI), calculated by the ratio between body mass and the square of height, was used to classify the individual's nutritional status. The nutritional status classification followed criteria considering eutrophic the BMI values between 22 and 27kg/m^2; lean, BMI < 22kg/m^2; and overweight, BMI >27kg/m^2[13].

A geriatrician made the diagnosis of probable Alzheimer's disease based on the criteria of the *National Institute of Neurological and Communicative Disorders and Stroke and the Alzheimer's Disease and Related Disorders Association* (NINCDS - ADRDA) and the *National Institute on Aging-Alzheimer's Association*[14,15]. The time of diagnosis of the disease was counted from the first day of recording the diagnosis in medical records.

The cognitive ability assessment in both groups was performed using the *Mini Mental State Examination* (MMSE)[16] on the first day of admission to this research by a trained researcher.

For analysis of hemoglobin (Hb), plasma, and erythrocyte Zn concentrations, 6 mL of blood were collected in vacuum tubes (Vacutainer® BD) with EDTA after a minimum fasting period of 8 hours. The aliquots were centrifuged at 3,000 rpm for 15 minutes to obtain the erythrocyte mass and plasma. After plasma removal, the red cell mass was washed with 0.9% saline solution and centrifuged in triplicate at 10,000 rpm for 10 minutes. Plasma and erythrocyte concentrations were fractionated and stored at -22 °C until analysis.

Zn concentrations were determined by atomic absorption spectrophotometry in a graphite furnace, with Zeeman background correction, in Spectra

AA 240Z (Varian®), following the manufacturer's recommendations. Measurements were performed in three readings with an integration time of 3 seconds. The plasma Zn concentration was determined according to Rodriguez and collaborators[17], and the erythrocyte count was performed after plasma separation according to Whitehouse and collaborators[18]. The Zn standard used was 1g/L of Titrisol ® (Merck). Values lower than 65 µg/dL were considered indicative of Zn deficiency[19].

For the absence of a previously established cutoff point, intracellular Zn concentrations were stratified by quartile of the study population itself; the 1st quartile value, used for deficiency determination, was 32 µgZn/gHb. To express the results, in terms of the mass of Zn/hemoglobin, a 20 µL aliquot of red cell lysate was used to determine hemoglobin concentration using the cyanmethemoglobin method of the Labtest Diagnostica *kit*[20].

The statistical analyses were performed considering the nature of the probability distribution of the variables studied, verified by applying the Kolmogorov-Smirnov Test with Lilliefors correction and their classification and experimental design. The level of rejection of the null hypothesis was set at 5%.

For discrete/count variables, absolute (n) and relative (%) frequencies were calculated, and proportions were compared using Pearson's Chi-square Test or Fisher's exact Test. For continuous variables, measures of central tendency (mean or median) and dispersion/position (standard deviation or interquartile ranges) were used; differences in means between the two groups were evaluated by Student's T-Test and the respective nonparametric Mann-Whitney Test. The magnitude of the association between exposure and outcome was assessed using the odds ratio (OR) or its respective confidence interval (CI 95%).

To model the association of Alzheimer's disease as a function of body Zn stores (plasma and erythrocyte concentrations) and other possible confounding variables, the GLM (generalized linear models; binomial family) method adjusted for the variables gender, age, and education was adopted.

To choose the multiple linear regression model that suitably fits the relationship between zinc (plasma and erythrocyte) and cognitive impairment assessed by the MMSE, the method of ordinary least squares (MQO) in the backward option was adopted. Thus, a model composed of all explanatory variables for the outcome AD was adopted until a best-fit model was obtained, respecting the assumptions of normality of residuals, homoscedasticity, and absence of multicollinearity, in addition to the quality of adjustment by the adjusted determination coefficient (R_{adj}^2).

A logistic regression model was proposed to investigate probable associations between AD diagnosis and the independent variables. AD diagnosis was the dependent variable in these analyses, while plasma and erythrocyte Zn concentrations were the independent variables. A p-value <0.05 was considered significant in all tests.

The study was developed following the recommendations of Resolution 466/2012 of the National Health Council of Brazil and Resolution No. 510/2016. The Research Ethics Committee approved the opinion of the Federal University of Alagoas, Brazil with CAAE no. 19199013.3.0000.5013. Eligible patients and study participants signed the Informed Consent Form.

RESULTS

The sample was composed of 102 older adults, 34 AD-g, and 68 NAD-g. The mean age in the NAD-g was 71.46 +5.1 years, and in the AD-g was 74.41 +7.1 years, with a higher frequency between 70 and 79 years in both groups (p >0.05). The number of years of education (<5 years) was associated with the presence of AD, increasing by approximately 3.2 times the chance that older adults had the disease (table 1**).**

The mean time diagnosis of AD was approximately 11.4 months. None of the older adults were classified as having a severe level of disease, 15 (44.1%) were classified as having mild AD, and 19 (63.9%) as having moderate cases.

As for plasma Zn, the AD-g had the lowest concentrations compared to the NAD-g (88.49 ± 15.95 µg/dL vs. 101.79 ± 16.53 µg/dL; p < 0.001). When stratifying each group by gender, this result was also observed among women but not among men. Similarly, the frequency of older adults classified with deficiency of this mineral was higher in the AD-g (14.7% vs. 1.47%; p = 0.015) (table 2).

Table 1. Sociodemographic characterization and health conditions of older adults with and without Alzheimer's disease, Maceió – Alagoas, 2018.

	NAD-g n (%)	AD-g n (%)	OR	*p-value*
Gender				
Male	15 (22.1)	12 (35.3)	0.51	0.153*
Female	53 (77.9)	22 (64.7)		
Age (Years)				
60 – 69 years	30 (44.2)	12 (35.3)	-	0.585*
70 – 79 years	36 (52.9)	20 (58.8)		
80 or more	2 (2.9)	2 (5.9)		
Marital status				
Married/ stable union	40 (58.8)	24 (70.6)	0.59	0.247*
Single/ divorced/ widowed	28 (41.2)	10 (29.4)		
Labor situation				
Retired or with income	64 (94.1)	32 (94.1)	1.00	1.00**
Unemployed / No income	4 (5.9)	2 (5.9)		
Income				
≥ 1 BMW	39 (57.3)	24 (70.6)	0.56	0.195*
< 1 BMW	29 (42.7)	10 (29.4)		
Housing Conditions				
Alone	1 (1.5)	1 (2.9)	2.03	0.614**
Family or caregiver	67 (98.5)	33 (97.1)		
Education				
> 5 years of study	39 (57.4)	10 (29.4)	3.23	0.008*
≤ 5 years of study	29 (42.6)	24 (70.6)		
BMI				
Underweight	4 (5.9)	3 (8.8)	1.10	0.625**
Eutrophic/ Overweight	64 (94.1)	31 (81.2)		
Hypertension				
Yes	42 (61.8)	20 (58.8)	0.85	0.706*
No	26 (38.2)	14 (41.2)		
Diabetes				
Yes	10 (14.7)	9 (26.5)	2.09	0.150*
No	58 (85.3)	25 (73.5)		

NAD-g - No Alzheimer's disease group (comparison); AD-g - Alzheimer's disease group (case); OR - Odds ratio; BMW - Brazilian minimum wage. * Pearson Chi-square; **Fisher exact Test. Fonte: authors, 2018.

Table 2. Association between plasma and erythrocyte Zn levels with and without Alzheimer's disease. Maceió, Alagoas, 2018.

	NAD-g		AD-g			
	n	mean (SD)	n	mean (SD)	IC 95%	*p-value*
Zn Plasma						
Total	68	101.76 (16.53)	34	88.49 (15.95)	6.46 – 20.08	< 0.001***
Male	15	102.13 (15.49)	12	91.19 (12.53)	-0.44 – 22.32	0.059***
Female	53	101.65 (16.96)	22	87.02 (17.63)	5.68 – 23.59	0.002***
Zn Erythrocyte						
Total	68	36.79 (6.96)	34	36.32 (6.07)	-2.31 – 3.26	0.737***
Male	15	37.53 (5.17)	12	38.29 (7.75)	-5.89 – 4.37	0.764***
Female	53	36.59 (7.42)	22	35.25 (4.79)	-2.08 – 4.76	0.439***

NAD – No Alzheimer's disease group (comparison); AD-g - Alzheimer's disease group (case); SD - standard deviation. *** T-Test. Fonte: authors, 2018.

The frequency of older adults classified in the 1st quartile for intraerythrocytic Zn concentrations was higher in the AD-g (32.35% vs. 14.71%; p=0.038). When stratified by gender, a higher frequency of older adult women with low intraerythrocytic Zn concentrations was also observed in the AD-g. No difference was observed between men (table 3).

Plasma and erythrocyte Zn concentrations did not correlate with age (in both groups), nor with the time of diagnosis and disease intensity in the AD-g.

A linear regression analysis, adjusted by gender, age, and education, was performed to explain the effect of plasma and erythrocyte Zn concentrations on reduced cognitive ability as assessed by the MMSE. In this analysis, the plasma concentration of Zn in the AD-g was associated with older adults' cognitive ability (table 4).

Logistic regression analysis adjusted by gender, age, and education showed a significant association between plasma Zn concentration and AD (OR=0.964; p=0.028). With a 95% confidence, it was observed that for each 1µg/L increase of plasma Zn, there was a reduction of approximately 3.6% in the chance of older adults having AD.

Table 3. Association between plasma and erythrocyte zinc levels with and without Alzheimer's disease. Maceió, Alagoas, 2018.

	NAD-g		AD-g			
	N	(%)	n	(%)	IC 95%	*p-value*
Zn Plasma						
Total						
Normal	67	98.53	29	85.29	1.29 – 103.30	0.015**
Deficient	1	1.47	5	14.71		
Male						
Normal	15	100.00	11	91.67	-	0.444**
eficient	0	0.00	1	8.33		
Female						
Normal	52	98.11	18	81.82	1.21 – 110.28	0.024**
Deficient	1	1.89	4	18.18		
Zn Erythrocyte						
Total						
> 1st quartile	58	85.29	23	67.65	1.04 – 7.41	0.038*
≤ 1st quartile	10	14.71	11	32.35		
Male						
> 1st quartile	13	86.67	9	75.00	0.30 – 15.70	0.28**
≤ 1st quartile	2	3.17	3	25.00		
Female						
> 1st quartile	45	84.91	14	63.64	1.02 – 10.15	0.041*
≤ 1st quartile	8	15.09	8	36.36		

NAD-g - No Alzheimer's disease group (comparison); AD-g - Alzheimer's disease group (case); * Pearson Chi-square; **Fisher exact Test. Fonte: authors, 2018.

Table 4. Linear regression coefficients for cognitive ability assessed by the Mini Mental State Examination (MMSE) screening instrument in older adults with and without Alzheimer's disease. Maceió, Alagoas, 2018.

	Model 1		Model 2	
	β [a]	*p-value*[b]	β [a]	*p-value*[b]
NAD-g (n = 68)				
Zn plasma	-0.025	0.849	-0.027	0.837
Zn erythrocyte	-0.142	0.268	-0.144	0.259
R^2	0.051		0.048	
R^2 adjusted	-0.025		-0.012	
AD-g (n = 34)				
Zn plasma	0.358	0.016	0.411	0.008
Zn erythrocyte	0.203	0.167	0.283	0.061
R^2	0.498		0.423	
R^2 adjusted	0.404		0.343	

NAD-g - No Alzheimer's disease (comparison); AD-g - Alzheimer's disease group (case) [a] Estimated regression coefficients (Beta). [b]T-Test; $p<0,05$. Model 1: adjusted for education, age, and gender. Model 2: adjusted for education and age. Fonte: authors, 2018.

DISCUSSION

This research aimed to establish the relationship between Zn homeostasis and AD development, determining the concentrations of Zn in two distinct organic compartments of older adults with and without AD who had similar socio-economic and demographic characteristics and were assisted in a geriatric service of a public hospital in Maceió, living in the same metropolitan region. In this context, it was observed that the group with AD showed lower mean plasma Zn concentration and a higher frequency of people with low concentrations of this mineral in the two compartments evaluated, plasma and erythrocytes. It is essential to highlight that no correlation between age and Zn concentrations was observed in this research.

Additionally, among the variables studied, an association was observed between less time spent studying and higher risk for the disease. This result corroborates other studies that have shown that brain-stimulating activities, such as more time spent reading and studying, play an essential role in reducing the risk of developing dementia syndromes[21,22].

The role of circulating Zn in serum or plasma on the development of AD and cognitive decline in older adults is still poorly known and needs to be clarified since the results of studies are controversial[23]. Like the present research, Gonzalez-Domíngues and collaborators[24] found significant changes in serum Zn concentrations in older adults with mild cognitive impairment and those with AD compared to the control group.

The reduction in Zn concentrations found in studies conducted with older adults with AD is the result of the effect of age and not the disease[1] since, in the analysis of this large cohort, the authors observed that after correcting serum Zn concentrations for age decline, no significant difference was observed between cases and controls. However, in the present study, the individuals with AD were matched by age with the group of older adults without the disease, and even so, lower Zn concentrations were observed among those in the case group without any correlation of this mineral with age.

It is known that older adults have several factors that can contribute to a lower concentration of Zn, such as lower absorption capacity, use of medications, especially diuretics that increase the urinary excretion of the mineral, and use of calcium or iron supplements that compromise the bioavailability of Zn[25]. An important fraction of the older adult population presents nutritional Zn deficiency, contributing to the development of chronic diseases, cognitive deficit, and reduced immune response capacity[26,27].

Evidence suggests that some metal ions, such as Zn, are responsible for regulating neuronal activity at synapses and in various biological functions so that both excess and deficiency of this metal are involved in metabolic processes that can result in neurodegeneration and cell death[28,29].

Although not associated with disease severity in this study, Zn concentrations in both compartments assessed correlated with lower cognitive ability. Other studies have also found similar results associated with low Zn concentrations and poor cognitive ability scores[30].

Although not yet elucidated, possibly this association is related to the failure of endogenous regulatory mechanisms, which compromises metabolic functionality in some cellular compartments and the central nervous system since Zn is a regulator of neurotransmission and assumes complex and essential neurotrophic regulatory functions through the activation of *brain-derived neurotrophic factor* (BDNF)[1]. Defects in neurotrophic signaling have already been associated with neurodegenerative disorders, including AD[31,32].

In addition, low plasma Zn concentrations may compromise the immune response and favor oxidative stress in older adults. Oxidative stress is a recognized factor associated with AD and has been frequently observed in the brains of individuals in the early stages of the disease and appears to play a critical role in its severity and spread[3,33].

The total body content of Zn is labile, especially those present in plasma and body fluids, so the presence of factors that increase losses or raise the

organic demand for this mineral is rapidly reflected in its plasma concentrations. However, the body content of Zn can be rapidly controlled by dietary intake and intestinal absorption capacity[26,34,35].

Despite the absence of a specific reserve of Zn, erythrocytes' uptake and exchange of this nutrient occurs more slowly and is possibly observed in chronic processes of dietary deficiencies or high metabolic needs[34,35]. Although it has not yet been established whether the imbalance of this mineral is a cause or consequence of AD, it is believed that Zn deficiency may contribute directly and indirectly to the onset and progression of the disease[4].

Considering that AD is a chronic and progressive pathological process, the determination of zinc-related nutritional status in this context requires a multi-compartmental assessment. In this research, the highest frequency of older adults with low levels of Zn in red blood cells was observed in the AD group, and after adjusting for age, gender, and education, only the plasma concentration of Zn was associated with the diagnosis of the disease.

Thus, it is possible to admit that Zn deficiency in older adults with Alzheimer's disease may be a consequence of multiple associated chronic processes that are maintained over the years and that may assist in the perpetuation and progression of the disease.

This study presents a methodological design (cross-sectional) that did not allow researchers to identify a causal connection. To better elucidate the relationship between Zn and Alzheimer's disease and to determine whether Zn represents a candidate early biomarker for cognitive impairment, longitudinal studies are needed to identify causal and risk factors associated with impaired cognition, the development of dementia, and Zn deficiency, including assessment of metabolic and oxidative stress, dietary intake (this being an important limitation of the study that could help better to elucidate the possible association between Zn concentrations and AD), medication use, presence of other diseases, and/or use of supplements.

Therefore, some questions remain unanswered, especially about the temporality of the factors studied. In addition, the small number of older adults diagnosed with the disease is still a limiting factor not only here but in several research studies. And finally, considering the characteristics of AD, the answers to some questions about the sociodemographic variables researched here required the participation of caregivers and/or family members, which may have contributed to possible biases of memory or accuracy of information.

CONCLUSION

Low Zn concentrations in plasma, characterizing a current imbalance between organic supply and demand, and in erythrocytes, suggesting that such imbalance exists chronically, were observed in older adults with Alzheimer's disease. Although the determinants of these low concentrations are multifactorial and may contribute from age, this factor alone could not justify the low Zn concentrations in older adults with Alzheimer's disease found in the present study. After statistical adjustment, only plasma Zn was associated with the diagnosis of AD, suggesting that the deficiency of this mineral increases the chances of older adults presenting the disease.

AUTHORSHIP

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Maximum handgrip strength test in long-lived elderly people from southeastern Brazil: definition of cutoff points

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Abstract

Objective: To define cut-off points for the values of the Maximum Handgrip Strength (MGS) test in long-lived elderly people. *Method*: Cross-sectional study with a sample of long-lived elderly people, octogenarians and nonagenarians, healthy and functionally independent (robust group) and frail (fragile group). The MHS test was performed in triplicate, with the highest value obtained being considered. Sensitivity, specificity and cut-off values were calculated using the Receiver Operating Characteristic Curve (ROC). The Brazilian cut-off points and those of the European Consensus on Sarcopenia were used for the comparison study. *Results*: 121 elderly people were evaluated, with a mean age of 84.5±5.3 years, 65 (53.7%) female, 46 (38%) from the frail group and 75 (62%) from the robust group. Cut-off points for MHS of 27 kgf for men and 19 kgf for women were found. Sensitivity and specificity values for men's cutoffs were 94.44 and 65.79, respectively. For woman, they were 85.71 and 67.57. Based on these cutoff points, 23 (38.3%) individuals from the robust group were classified as having competitive strength, and therefore with probable sarcopenia, while according to the Brazilian and European cutoff points, the number is 35 (44.3%) and 14 (33.3%). *Conclusion*: The study defined cut-off points for the oldest-old population and showed that the cut-off points defined so far for the Brazilian elderly population were not adequate for the oldest-old.

Keywords: Elderly Aged 80 Years or Older. Longevity. Hand Strength. Sarcopenia. Sensitivity and Specificity. ROC Curve.

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INTRODUCTION

The independence and autonomy necessary for a healthy longevity are inherently intertwined with an individual's well-being and functionality[1]. Muscular strength stands as a pivotal predictive parameter of functionality in the elderly[2]. Advancing age represents a risk factor for diminished muscular strength and the onset of sarcopenia, a condition associated with falls, functional decline, frailty, and mortality[3].

Sarcopenia is a progressive and pervasive muscular disorder characterized by the accelerated loss of muscular mass and functionality[4]. Initially, the primary diagnostic criterion for sarcopenia was the reduction in muscular mass. Nevertheless, the definition has evolved, and in the majority of consensuses, corroborated by allied research cohorts, the focal point has shifted towards the impairment of functionality, particularly in regard to muscular strength, concomitant with a diminished muscular mass[4-8]. This is presently the most widely acknowledged definition, as proposed and recently revised by the European Working Group on Sarcopenia in Older People (EWGSOP)[4].

In the current conceptualization of sarcopenia, three core elements are present: the reduction of strength, mass, and functionality[3]. Thus, it distinguishes itself from the physiological process of age-associated muscular mass decline and is regarded as a geriatric syndrome due to its associated morbidity and mortality[4]. This syndrome also bears resemblance to the phenotype of frailty[9], primarily due to their shared central component - the reduction of muscular mass. Consequently, older individuals afflicted with sarcopenia, whether considered as a syndrome or a process, find themselves at a heightened risk of becoming frail[1].

In Brazil, the prevalence of sarcopenia among individuals aged 60 or older ranges from 13.9% to 16%, as reported in the "COMO VAI?" study and the systematic review by Diz et al. (2017)[10,11]. Within this age bracket, the highest prevalence is observed in the more advanced age groups. This is attributed to the fact that muscular strength decreases by approximately 1.5% to 5% annually after the individual surpasses 50 years of age. This underscores the significance of delving more profoundly into the study of muscular strength in the aging population[12].

For the assessment and diagnosis of sarcopenia, various validated tests for strength, muscular mass, and performance can be employed[3,4,5]. Specifically, for the evaluation of muscular strength, the most recommended test is the Maximum Handgrip Strength (MGS) test. MGS offers the advantage of relatively low cost, ease of clinical application, and a demonstrated correlation with strength in other anatomical compartments[13]. Impaired performance in this test strongly indicates adverse hospital outcomes, significant functional limitations, and a diminished quality of life[3]. Muscle weakness, as evidenced by the handgrip test, has shown robust concordance with sarcopenia, as defined by the Sarcopenia Definition and Outcomes Consortium (SDOC)[7].

For the diagnosis of probable sarcopenia, which is confirmed when the muscular mass is also low[3], the test results should fall below the defined cutoff points in kilogram-force (kgf): 27 kgf for men and 16 kgf for women up to 80 years old[14]. These cutoff points are derived from a consensus that amalgamates data from 12 population-based studies conducted in the United Kingdom to establish normative grip strength values across the lifespan (from 4 to 90 years). Notably, within this study, only 10.5% of the sample consisted of individuals aged 80 years or older, thus representing the long-lived[14].

Yet, there exists substantial evidence that normative strength values vary between populations in developed and developing countries[15]. The EWGSOP underscores the pressing need for further investigations across diverse global regions to derive improved cutoff points[3].

In Brazil, two studies provide references for the test[16,17]. The first was conducted with participants from community centers for the elderly in the southern and southeastern regions, suggesting cutoff points of 30 kgf for men and 21.7 kgf for women based on a sample of elderly individuals, of whom

8% were considered long-lived[16]. The second study, carried out on a sample comprising individuals aged 18 to 102 years and residing in Rio Branco, a city in the Northern region of Brazil, offers percentile values stratified by age groups, albeit without sensitivity and specificity testing, and includes 10.7% of long-lived individuals within the sample[17].

The utilization of non-specific cutoff points for this age group can significantly impact the diagnosis of sarcopenia, as a value falling below these thresholds in the grip strength test may merely reflect physiological aging changes rather than indicating poor performance[17]. Consequently, positing the hypothesis that normal values for the grip strength test in long-lived older adults might be lower than the currently established values applicable to all age groups, the objective of the present study was to investigate the grip strength of this specific group and establish cutoff points for the test based on a sample of long-lived elderly individuals who are functionally independent and demonstrably healthy.

METHOD

This is a cross-sectional study that assessed grip strength in two distinct groups: long-lived elderly individuals demonstrating functional independence, who were attended to at the Healthy Aging Outpatient Clinic, and long-lived elderly individuals characterized as frail, who received care at the Nutritional Care Outpatient Clinic for the Elderly, both within the Jenny de Andrade Faria Institute at the Hospital das Clínicas of the Universidade Federal de Minas Gerais, Minas Gerais, Brazil. These clinics are part of the Geriatrics Reference Center (*Centro Referência de Geriatria*). Data collection took place between March 2016 and November 2021.

The elderly individuals in the study had their functionality assessed using the Visual Analogue Scale of Frailty, which performs the Clinical-Functional Classification of the Elderly (*Classificação Clínico-Funcional dos Idosos*)[1]. Functionally independent elderly individuals were those who exhibited independence in basic, instrumental, and advanced activities of daily living (ADLs), as determined from data collected during geriatric medical consultations. This group fell within Stages 1 to 3 of this scale[1]. Those considered frail were individuals with partial or total dependence in the performance of instrumental and/or basic ADLs, falling within Strata 6 to 8[1]. In the design of this study, it was presumed that functionally independent elderly individuals exhibited age-appropriate strength[1]. Conversely, frail individuals, who demonstrated dependency in the execution of certain activities of daily living, could potentially lack age-appropriate strength. The frail elderly individuals constituted the group referred to as 'frail', while the functionally independent elderly individuals formed the 'robust' group. Inclusion criteria encompassed individuals of 80 years or older, of both genders, with available handgrip strength test data in their multidisciplinary medical records. The strength evaluation conducted in the outpatient clinic follows a standardized procedure as part of the routine care, and all healthcare professionals receive training and guidance to adhere to this standard[13]. Centenarian elderly individuals were excluded. The participant selection process for the study is depicted in Figure 1.

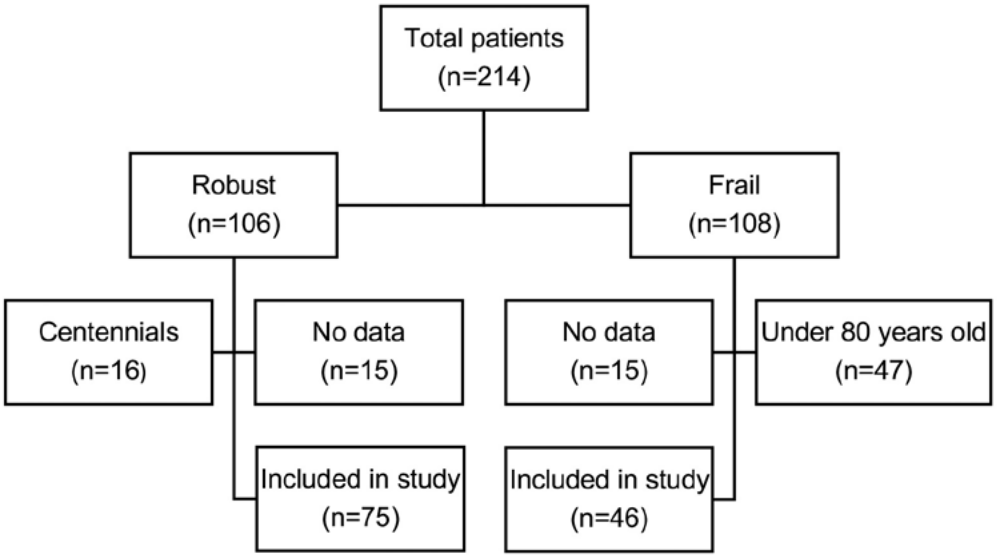

Figure 1. Participant Selection Process in the Study. Minas Gerais, 2018-2020.

All data were collected from the multidisciplinary medical records of geriatric and nutritional care, encompassing demographic information (gender and age), anthropometric measurements (weight, height, calf circumference, arm circumference, and triceps skinfold thickness), and Maximum Handgrip Strength data.

Below are described the methods employed by the professionals at the outpatient clinics to generate the collected data. It is worth emphasizing that all professionals and students within the team at these two clinics receive regular training to ensure the standardization of techniques.

Body mass was measured on a Filizola® scale (PL 200 LED, Filizola®, São Paulo, Brazil), with a precision of 100g, with the patient barefoot and without coats. Height was measured using a stadiometer incorporated into the same equipment, with the patient positioned facing away, the head in the Frankfurt Plane, and feet together[18].

Based on weight and height, the Body Mass Index (BMI) was calculated by dividing weight (in kilograms) by height squared (in meters). It was classified according to the recommended categorization for elderly individuals: underweight <23 kg/m², normal weight ≥23 kg/m² and <28 kg/m², overweight ≥28 kg/m² and <30 kg/m², and obesity ≥30 kg/m² [19].

The Maximum Handgrip Strength was measured using a Jamar® dynamometer (BL5001, Lafayette, Indiana, USA). To obtain this measurement, three readings were taken from the right hand and three from the left, alternating between hands, with the highest value achieved for each hand being recorded as the result of the test. The measurements were conducted with individuals seated, their backs and arms supported on the backrests, shoulders relaxed, and elbows flexed at 90°. Elderly individuals were instructed to exert their maximum squeezing force on the device's handle while the assessor encouraged them, observing the highest reading[13].

For comparative purposes, cutoff points for MGS adjusted for the Brazilian population[16] were employed, as well as those from the second European Sarcopenia Consensus (EWGSOP2)[3], based on the study by Dodds and colleagues[14]. The first set of cutoff points deem low strength as <30 kgf for men and <21.7 kgf for women[16]. In contrast, the second set defines low strength as results <27 kgf and <16 kgf for men and women, respectively[3]. Low strength was considered indicative of probable sarcopenia[3].

The values were presented descriptively using the mean and standard deviation for symmetric variables, and median along with the 25th and 75th percentiles for asymmetric variables. The normality test employed was the Kolmogorov-Smirnov test. Categorical values were expressed in terms of frequency.

To compare characteristics based on functional classification and gender, Student's t-tests were employed for symmetric variables, and the Mann-Whitney test for asymmetric variables. Categorical characteristics were compared using the chi-square test when more than 2 cells contained values greater than 5, and Fisher's Exact test when none of the cells had values exceeding 5.

In order to establish cutoff points in a series of continuous data values for MGS, a sensitivity and specificity study was conducted for each point, derived from Receiver Operating Characteristic (ROC) Curve based on data from robust and frail elderly individuals. This division is necessary as it entails a comparison between two groups with opposing clinical characteristics to construct the ROC Curve[20]. To assess the effectiveness of the ROC Curve in defining cutoff points in a diagnostic test, the area under the curve is employed. A value of 0.5 or less indicates a test's inability to discriminate the presence of the studied clinical condition, signifying an ineffective test[20].

The sensitivity of a statistical test corresponds to the quantity of positive results in relation to individuals who possess a certain clinical condition. Conversely, specificity corresponds to the quantity of negative results among individuals who do not have the studied clinical condition[21]. In this context, the chosen cutoff point was the one that yielded the highest value in the Youden's Index, which indicates the point with the lowest rate of false positives and false negatives simultaneously, based on sensitivity and specificity[22]. A significance level of 0.05 was adopted.

The positive predictive values (PPV) and negative predictive values (NPV), as well as the positive likelihood ratios (LR+) and negative likelihood ratios (LR-), along with other tests related to the ROC curve and cutoff points, were obtained using the MedCalc software[20,23].

The study was approved by the Research Ethics Committee of the Universidade Federal de Minas Gerais (CAAE: 80295616.1.0000.5149, Opinion Nº. 2,422,800, and CAAE 37058720.7.0000.5149, Opinion Nº. 4,329,040).

RESULTS

The sample consisted of 121 elderly individuals, comprising 46 (38%) from the frail group and 75 (62%) from the robust group. The demographic and anthropometric characteristics of the studied population are presented in Table 1. Seven individuals from the frail group were not assessed anthropometrically due to mobility issues; however, these individuals were not excluded as their strength was evaluated without any compromise in technique.

Regarding cutoff points, the analysis of sensitivities and specificities, based on the ROC Curve, identified a value of ≤27 kgf as the most suitable cutoff point for men and ≤19 kgf for women for the MGS test (Figure 2).

Table 1. Demographic and Anthropometric Characteristics of the Study Sample by Groups (N=121). Belo Horizonte, MG, 2018-2020.

Characteristics	Total (N=121)	Robust Group (n=75)	Frail Group (n=46)	*p*-Value
Sex n (%)				
Male	56 (46.3)	38 (50.7)	18 (39.1)	0.217#
Female	65 (53.7)	37 (49.3)	28 (60.9)	
Age in years Mean (SD)	85 (±4.3)	85 (±4.1)	85 (±4.6)	0.925 †
Octogenarians n (%)	101 (83.5)	63 (84.0)	38 (82.6)	0.841#
Nonagenarians n (%)	20 (16.5)	12 (16.0)	8 (17.4)	
Weight kg Mean (SD)	60.2 (±13.2)	64.4 (±11.3)	52.6 (±13.0)	<0.001†
Height cm Mean (SD)	153.6 (±8.1)	154.7 (±7.7)	151.5 (±8.4)	0.046*
BMI in kg/m² Mean (SD)	25.7 (±4.8)	26.9 (±4.0)	23.4 (±5.5)	0.001†
BMI Classification n (%)				
Underweight	31 (27.2)	12 (16.0)	19 (48.7)	<0.001#
Normal weight	50 (43.9)	37 (49.3)	13 (33.3)	
Overweight	30 (14.0)	13 (17.3)	3 (7.7)	
Obesity	17 (14.9)	13 (17.3)	4 (10.3)	
Missing data (n)	7	0	7	

kg: kilograms; p: percentile; cm: centimeters; BMI: Body Mass Index; m: meters; SD: standard deviation; CC: calf circumference; *Mann-Whitney test; †Independent samples t-test; ⸸Fisher's exact test; #Pearson's chi-square test.

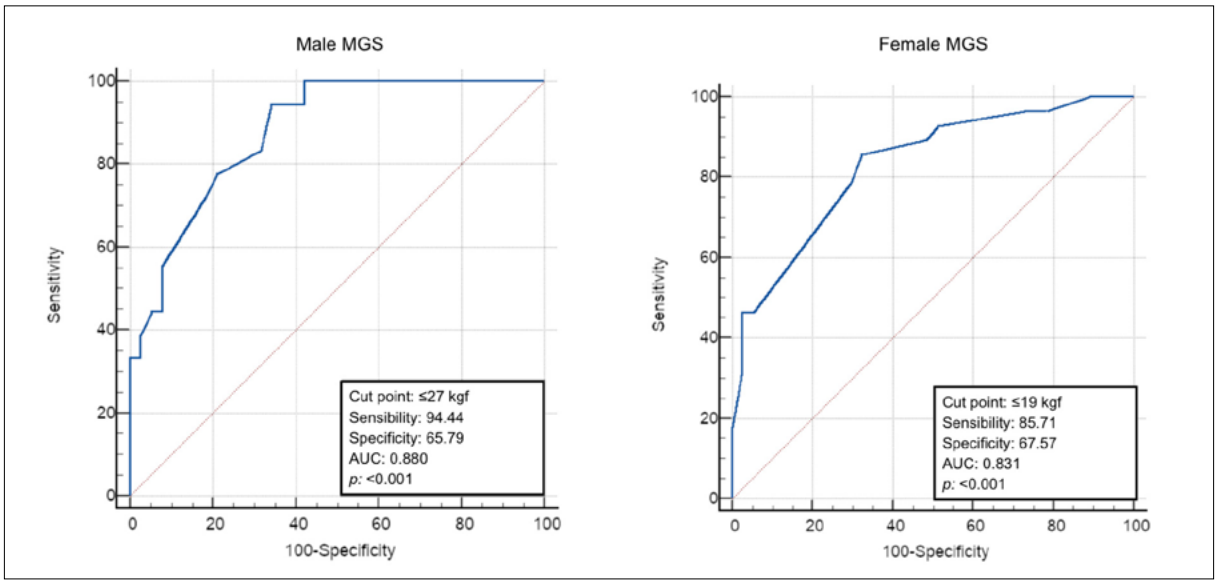

Figure 2. ROC Curves, cutoff points, and sensitivity and specificity values for males and females, respectively. Belo Horizonte, MG, 2018-2020.

The values obtained from the statistical indicators indicate that the defined cutoff points are considered effective in discriminating clinical conditions. As for the area under the curve, this characteristic is present when the values are above 0.8, and regarding the p-value, when it's <0.001, which was found in the study[20].

Furthermore, we have PPVs and NPVs of 32.8% and 98.5% for the male group and 31.8% and 96.4% for the female group, respectively. The PPV reflects the probability of an individual being frail when the MGS test value is equal to or below the established cutoff point and should be higher than the disease prevalence. The NPV reflects the probability of an individual being robust when the MGS test value is greater than the established point[23]. Thus, in practice, we see that the vast majority of individuals with a test result higher than the points found in the study will not be diagnosed with probable sarcopenia.

The RV+ and RV- were 2.76 and 0.08 for the male group and 2.64 and 0.21 for the female group, respectively. Considering that an RV+ value greater than 1.0 is more effective in indicating the presence of the disease based on a positive result, the values found reinforce the validity of the test[20]. For RV-, the closer the value is to 0, the lower the probability of disease from a negative result, and a value close to 1.0 reflects test inefficiency. In this regard, there are good RV- results, contributing to the test's effectiveness, with an emphasis on the male group.

As for the MGS test (Table 2), 65.3% of the elderly individuals in the sample showed low strength when considering the Brazilian cutoff points[16]. Among these, 44.3% were from the robust group, thus functionally independent. Regarding the EWGSOP[3] cutoff points, 34.7% of the sample was classified as having low strength, and 36.6% of these were from the robust group.

Using the cutoff points defined in this study, 60 (49.5%) individuals were classified as having inadequate strength, with 23 (38.3%) from the robust group and 37 (61.7%) from the frail group (p<0.001) (Table 2). In this classification, there is no difference between sexes (p=0.077). Applying these cutoff points, there is a 24% reduction in the classification of low muscle strength in functionally independent individuals compared to the Brazilian cutoff points.

Table 2. Maximum Handgrip Strength of the Study Sample, by Groups. Belo Horizonte, MG, 2018-2020.

Variables	Total (N=121)	Robust Group (N=75)	Frail Group (N=46)	*p*-Value
MGS (kgf) median (p25-p75)	22.0 (16.0-27.5)	26.0 (20.0-32.0)	16.0 (12.0-22.3)	<0.001*
Men	27 (24.0-32.0)	30 (26.0-34.5)	23 (14.8-25.3)	<0.001*
Women	18 (16.0-22.0)	21 (18.0-23.5)	16 (12.0-18.0)	
Strength Classification				
Inadequate Strength (Brazilian cutoff point) n (%)	79 (65.3)	35 (44.3)	44 (55.7)	0.003[£]
Men	34 (43.0)	16 (47.1)	18 (52.9)	0.326[#]
Women	45 (57.0)	19 (42.2)	26 (57.8)	
Inadequate Strength (EGWSOP2 cutoff point) n (%)	42 (34.7)	14 (33.3)	28 (66.6)	0.345[£]
Men	27 (64.3)	12 (44.4)	15 (55.56)	0.004[#]
Women	15 (35.7)	2 (13.3)	13 (86.7)	
Inadequate Strength (current study cutoff point)	60 (49.5)	23 (38.3)	37 (61.7)	<0.001[£]
Men	27 (45.0)	12 (44.4)	15 (55.6)	0.077[#]
Women	33 (55.0)	11 (33.3)	22 (77.7)	

EGWSOP2: Second European Consensus on Sarcopenia; MGS: Maximum Handgrip Strength; kgf: kilogram-force; P: Percentile; [£]Fisher's exact test; * Mann-Whitney test; [#]Pearson's chi-squared test.

DISCUSSION

The present study assessed the MGS of robust elderly individuals and proposed cutoff points of ≤27 kgf for men and ≤19 kgf for women as recommendations for clinical practice with long-lived elderly individuals. Furthermore, it was possible to conclude that these cutoff points are indeed lower than those currently used for the general Brazilian population, without age specification, indicating that normal values for long-lived elderly individuals may be lower.

The study assessed and defined cutoff points for the MGS test, exclusively focusing on a group of independent, long-lived Brazilian elderly individuals. In the statistical analysis, a group of the same age range with the opposite functional characteristic, in this case, the presence of frailty, was used. Until now, studies that analyzed MGS have used samples with different age groups, with long-lived elderly individuals being a minority among them[14,24-28].

Regional studies for defining cutoff points for the MGS test are necessary due to differences between the results in developed and developing countries[15]. In a study that compared the MGS of individuals from various regions around the world, it was clearly evident that grip strength values are significantly lower in developing countries compared to developed countries[15]. For example, in the male population at 30 years of age, the mean MGS in developed countries was 52.8 kgf, while in developing countries, it was 43.4 kgf.

Therefore, national studies to define more suitable cutoff points for our reality have been conducted. However, the design of each study is different and does not include a group with opposite clinical characteristics for comparison, a method recommended when studying sensitivity and specificity through a ROC curve[20], as presented here. In one of these studies, the comparison was made with participants' "fear of falling," while the other study only presented the test results according to age groups without evaluating sensitivity and specificity[17].

Regarding the cutoff points from our study, for men, the value of 27 kgf was lower than what was found in the Brazilian study, which was 30 kgf[16]. This result suggests that in long-lived older people studied, a lower absolute strength value does not qualify as low performance. A similar situation was found for women, with a cutoff point of 19 kgf, lower than the Brazilian study's 21.7 kgf. In practice, this shows that if the previously proposed Brazilian cutoff points were used, a long-lived older person who is known to be healthy and without functional impairment could be classified as having probable sarcopenia.

When we compare the cutoff points obtained in the present study with those established by EWGSOP2, we notice a closer match. For men, the value found of 27 kgf is exactly the same as the one established by the consensus. For women, the value of 19 kgf is higher than the consensus's 16 kgf[3]. Thus, the number of men classified as having low strength is exactly the same. However, the number of women classified as having low strength doubles when the cutoff point from our study is used.

These data reveal an important point to consider, which is the fact that the cutoff points generated from strength data of an octogenarian and nonagenarian population are very close to the points calculated in studies that included a wide age range (from 4 to 90 years)[14]. In the same study, the minimum strength percentiles (10th percentile) found in long-lived individuals were 16 kgf to 23 kgf in men and 9 kgf to 13 kgf in women[14], well below the cutoff point of our study. This suggests that perhaps the reduction in strength in older individuals with preserved functionality is not as intense, or that a plateau has been reached at a certain age, demonstrating the uniqueness of this group and emphasizing the need for more studies on the characteristics of this population. Here, we have a sparsely studied sample of functionally independent long-lived older individuals.

One limitation of our study is that it was conducted in a state capital in the southeastern region of Brazil, so the cutoff points for MGS found here cannot be considered a reference for long-lived older individuals throughout the country. Additionally, the studied group comes from a specialized healthcare service, which does not characterize a population-based study. However, as this study was exclusively developed with long-lived individuals, a minority

group among the elderly, in the absence of other studies with this population, the findings can serve as a parameter for new research and potentially as a reference until studies with representative samples of the Brazilian population are published.

Therefore, the MGS cutoff values presented in our study are reference suggestions to be considered when working with long-lived older individuals in clinical and outpatient practice. In comparison to other Brazilian studies on the subject, this study managed to address identified limitations related to the lack of a comparative group with well-defined characteristics and provided a more focused approach to the long-lived population.

CONCLUSION

The present study defined cutoff points of ≤27 kgf for men and ≤19 kgf for women for a population of long-lived older individuals and observed that these values are indeed lower than those previously proposed in the country for MGS assessment and for the diagnosis of probable sarcopenia. This suggests that in current clinical practice, a long-lived older person, known to be healthy and without functional impairment, could be classified as having probable sarcopenia. Therefore, the proposed cutoff points aim to contribute to clinical practice by providing a more accurate diagnosis. However, it is still important to emphasize the need for further studies with representative groups of long-lived older individuals in Brazil to establish references that will fine-tune the clinical approach to the Brazilian elderly population.

AUTHORSHIP

- Lucca F. Machado (AUTHOR) – Conception, design, analysis and interpretation of data, writing of the article, approval of the version to be published, responsible for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.
- Marcelle F. Saldanha (CO-AUTHOR) – Critical review and approval of the version to be published.
- Camila D. N. Rocha (CO-AUTHOR) - Critical review and approval of the version to be published.
- Rodrigo R. Santos (CO-AUTHOR) - Critical review and approval of the version to be published.
- Ann K. Jansen (AUTHOR) – Conception, design, analysis and interpretation of data, writing of the article, approval of the version to be published, responsible for all aspects of the work, ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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The influence of physical activity on gait parameters during dual-task activities in the older people

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Abstract

Objective: To analyze the possible differences in the kinematic variables of gait between physically active and physically inactive older people while performing dual-task activities. *Method*: Older individuals, aged between 60 and 75 years, participated, divided into two groups: physically inactive (PI) (n=20) and physically active (PA) (n=20). Participants were equally grouped into ten female and male individuals, classified using the International Physical Activity Questionnaire (IPAQ). Participants initially performed simple tasks (arithmetic, verbal fluency, and gait) and then performed dual task activities, associating gait with the two cognitive activities (arithmetic and verbal fluency). The variables velocity, cadence, stride length, step width, stride time and double support were analyzed. To compare variables according to task and group, the Generalized Estimating Equations (GEE) model complemented by the Bonferroni test was used. *Results*: In the intragroup analysis both groups showed significant decreases in velocity, cadence, step width, stride time and double support, both in the arithmetic dual task and in the verbal fluency dual task. However, in the comparisons between the groups, there were no statistically significant differences in any kinematic parameter analyzed, both in the single gait analysis and in the dual tasks. *Conclusion*: The dual tasks had a negative influence on the kinematic gait parameters in both groups. However, the level of physical activity can not be considered a factor that minimizes the effects of the dual task on gait in the older people.

Keywords: Physical Activity. Aging. Gait. Cognition.

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INTRODUCTION

The aging process is related to the impairment of physical and cognitive functions[1]. Among the physical changes in older people, alterations on gait and mobility can be highlighted. Gait is a complex motor task for the older people, whose execution is considered automatic in healthy adults and with absence of this automatism in old age[2]. However, it is common for people to walk while they are performing another task.

Dual tasking involves the performance of a motor and a cognitive task simultaneously, requiring attentional and cognitive resources and it is involved in many daily activities[3]. Independent of the age, when the execution of a task intervenes in the performance of another, there is a negative interaction between the tasks, exceeding the capacity of the available resource[4]. As result of exceed capacity, a lower gait performance can occur and it has been highly related to increases in falls risk, especially in the older people[5]. Also, aging is linked to low performance in cognitive function, such as attention and executive functions, as it may be linked to increased risk of falls[6]. Due to the high cost that falls may incur to individuals and the society, it is essential to devise ways to improve physical and cognitive performance in older adults[7].

The updated WHO guidelines on physical activity confirmed the importance in regular physical activity to accomplish health benefits, especially in older adults. This helps prevent falls and injuries from falls[8]. For the maintenance of health, independence and quality of life, the practice of physical activity has beneficial effects for a better longevity and well-being of the older people, through multiple mechanisms and physiological pathways[9]. Some studies have already demonstrated that physical activities are interventions capable of reducing cognitive decline, showing favorable effects on the brain; in addition to promoting the maintenance of physical function during advancing age[10]. As you age, the importance of staying active and practicing physical exercise becomes fundamental to having a longer life[11]. Despite the knowledge that physical activity influences musculoskeletal and cognitive systems, few studies evaluated the influence of physical activity levels on gait parameters in the older population during dual-tasking[12,13]. In view of the above, the main objective of this study was to analyze the possible differences in the kinematic variables of gait between physically active and physically inactive older people while performing dual-task activities. The main hypothesis of the present study is that dual tasking would influence the gait parameters in physically active less than older people that are physically inactive.

METHOD

This is an observational, analytical, and quasi-experimental study. The study was carried out at the Laboratory of Analysis of Biomechanics of Human Movement of the Clinical Center of the University of Caxias do Sul (CECLIN-UCS), located in Block 70, of the University of Caxias do Sul (UCS). The data was collected between May and July 2022.

The sample consisted of 40 older participants, recruited through posters from the community of University of Caxias do Sul, divided into two groups: physically inactive group (PI): 20 older people of both genders (ten females and ten males), who do not practice physical exercise on a regular basis and physically active group (PA): 20 older people of both sexes (ten females and ten males), who practice physical exercises on a regular basis. The sample size was calculated using the statistical program G*Power 3.1, based on gait velocity as the primary parameter for analysis. With a sample size of 20 per group, the Generalized Estimating Equations (GEE) model (interactions between tasks and between groups) will have a statistical power of 80% and an effect size of 0.30.

For the beginning of data collection, first, a telephone contact was made with the possible participants of the research for invitation and explanations about the research. Those who agreed to participate in the study, and who met the inclusion and exclusion criteria, were invited to attend the Laboratory of Biomechanical Analysis of Human Movement on predetermined days and times. The participants were included if they were aged 60–75 years. Participants were excluded if they experienced

an acute illness during the last 3 months; had unstable cardiovascular, neurological or musculoskeletal conditions that could interfere with independent ambulation and/or limit safe performance of the experimental protocol; had taken medication that could affect memory and cognitive function; had cognitive impairment or lacked Portuguese fluency that could interfere with informed consent, questionnaires or following study instructions.

On the day scheduled for the evaluation, the participants were received in the laboratory by the researchers and immediately received explanations about the study procedures and the Informed Consent Form (ICF). Once in agreement, anthropometric data were measured [body mass, height, body mass index (BMI)] and then a questionnaire was applied with questions about personal data (name and age), history of past and current pathologies, use of medication, physiotherapy treatment. Then, the participants answered the questionnaires about the levels of physical activity and cognition. For the assessment of physical activity, the International Physical Activity Questionnaire (IPAQ) was used. This questionnaire consists of 27 items comprising different domains (related to work, transport, domestic and leisure activities) and different intensities (moderate vigorous) and requires participants to estimate the time spent in various levels of physical activity during the previous week[14]. IPAQ uses an overall physical activity level of participants based on their Metabolic Equivalent Task minutes (MET-min) per week and classified the participants into five categories: very active, active, irregularly active A, irregularly active B and sedentary. Participants classified as very active and active were included in PA group and participants classified as irregularly active A, irregularly active B and sedentary were included in PI group. It has strong psychometric characteristics for monitoring the physical activity levels of adults aged 18 to 85 years[15]. For the cognitive assessment, two questionnaires were used, the Mini Mental State Examination (MMSE) and the Montreal Cognitive Assessment (MoCA). Each questionnaire lasts approximately ten minutes, is easy to apply and does not require any specific material. The MMSE is considered a standardized, simplified, and quick assessment, with wide acceptance in the scientific and clinical community, already validated and adapted for the Brazilian population[16]. The MMSE evaluates cognitive functions such as spatial and temporal orientation, immediate and evocation memory, calculation, language-naming, repetition, comprehension, writing and drawing copy; the maximum score is 30 points and scores lower than 23 can be interpreted as cognitive impairment[17]. The MoCA assesses similar tributes to the MMSE, but also assesses visuospatial skills and executive function[18].

Subsequently, simple tasks were performed. First, the two simple cognitive tasks and then the simple motor task of walking. To perform simple cognitive tasks, study participants were invited to sit in a comfortable chair, in a quiet room, and performed the following tests: 1) subtraction arithmetic task: consisted of participants performing for one minute the subtraction of five by five, starting from the number 400[19]; 2) verbal fluency task: consisted of the older people speaking the maximum number of words in 1 minute that began with the letter "P" or "B"[20].

Afterwards, the simple gait task was performed. The procedures for gait data collection were based on the protocol by Laroche et al.[21]. The self-selected velocity was used for the evaluation. In order to adapt the participants to the evaluation protocol, they were first asked to walk for eight meters in a straight line at the self-selected velocity in the place destined for gait collection in the laboratory. The participants were instructed to memorize the number of steps and the pace needed to be able to make contact with the platform, sometimes with the entire right foot, sometimes with the entire left foot. After familiarization, retroreflective markers (VICON MX systems, Oxford Metrics Group, United Kingdom) were affixed following the Plug-in gait lower body model (Motion Capture Systems, VICON MX systems, Oxford Metrics Group, United Kingdom) at the following anatomical points, to the right and left: anterior superior iliac spine, posterior superior iliac spine -superior, medial-lateral portion of the femur, medial and lateral portion of the knee, medial-lateral portion of the tibia, medial and lateral portion of the ankle, central-posterior portion of the

calcaneus and dorsal surface of the second metatarsal. The gait protocol consisted of taking steps on the platform, and in all attempts the participant took the same route as in the adaptation session. Attempts were made until eight steps were fully captured[21]. During the walking evaluation protocol, kinematic and kinetic data were collected simultaneously. To capture the three-dimensional trajectory of the markers positioned on the participants' bodies during gait, a kinemetric system with seven integrated cameras (VICON MX systems, Oxford Metrics Group, United Kingdom) was used. Kinematic data were collected at a sampling rate of 100Hz.

After performing each of the simple tasks, both the two cognitive tasks and the motor task of walking, the dual task activities were performed. Dual tasks consisted of performing the motor gait task simultaneously with each of the two cognitive tasks. This means that walking at a self-selected velocity was performed at the same time as each of the two cognitive tasks. It is noteworthy that the participants first performed all the simple tasks, both cognitive and motor, prior to the dual task activities. Both the execution order of the simple and dual task cognitive activities was defined at random, through a raffle carried out by the researchers before the arrival of the participant to carry out the research.

The project complies with Resolution 466/2012, which approves the regulatory guidelines and standards for research involving human beings. This project was approved by the Research Ethics Committee (REC) of the University of Caxias do Sul, under CAAE number 97497518.1.0000.5341.

The statistical treatment of the data was carried out using the statistical program Statistical Package for Social Sciences version 21.0 (SPSS Inc., Chicago, USA) for Windows, and initially the data were organized in an electronic spreadsheet in the Microsoft Excel® program. The gait variables analyzed were velocity (velocity of the center of mass measured in meters per second); cadence (walking rate measured in steps per minute), stride length (distance from initial contact of one foot to the following initial contact of the same foot measured in meters), step width (the side-to-side distance between the feet measured in meters), stride time (period of time from initial contact of one foot to the following initial contact of the same foot measured in seconds), double support (period of time when both feet are in contact with the ground measured in seconds). The data was filtered with a Butterworth 4th order recursive digital filter with a cut-off of 6 Hz. In addition, the cognitive tasks of arithmetic and verbal fluency were analyzed. Quantitative variables were described as mean and standard deviation/standard error, and categorical variables as absolute and relative frequencies. Shapiro-Wilk test was used to check normal distribution. To compare means between groups, the t-student test was used. When comparing proportions, Pearson's chi-square test or Fisher's exact test was used. To compare variables according to task and group, the Generalized Estimating Equations (GEE) model complemented by the Bonferroni test was used. As a decision criterion, the significance level adopted was 5% ($p<0.05$).

RESULTS

The presented results refer to a sample of 40 research participants, divided into physically inactive group (n=20) and physically active group (n=20), with no sample losses. The general characterization of the sample was stratified by the two groups and the anthropometric and questionnaire characteristics (MMSE, MoCA and IPAQ) are presented in Table 1. It can be observed that no statistically significant difference was observed between the groups, both in terms of analysis of the characteristics of the participants and the results of the cognitive questionnaires. Regarding BMI values, both groups had average values that classify them as overweight, according to the World Health Organization[22]. However, in the PI, three (15%) as normal weight (between 18.5 Kg/m² and 24.9 Kg/m²), eight (40%) as overweight (between 25 Kg/m² and 29.9 Kg/m²), seven (35%) as grade I obesity (between 30 kg/m² and 34.9 kg/m²) and two (10%) as grade II obesity (between 35 kg/m² and 39.9 kg/m²); while PA had seven (35%) with normal weight, seven (35%) with overweight, four (20%) with grade I obesity and two (10%) with grade II obesity. The IPAQ was used to

classify the sample where all of the PI were shown to be irregularly active, that is, they perform physical activities, but insufficient to be classified as active because they do not meet the recommendations regarding frequency or duration. Of these, seven (35%) were considered irregularly active A (35%) and thirteen (65%) irregularly active B. In PA, two (10%) were categorized as very active and eighteen (90%) as active.

Regarding gait kinematic variables during single and dual tasks, the results are presented in Table 2. In the comparisons between the groups, there were no statistically significant differences in any kinematic parameter analyzed, both in the single gait analysis and in the dual tasks.

In the intragroup analysis, where the effect of dual tasks on gait parameters was verified by comparing the results of dual tasks with the simple gait task, both groups showed significant decreases in velocity, cadence, step width, stride time and double support, both in the arithmetic dual task and in the verbal fluency dual task.

Table 1. Characteristics of participants and results of cognitive questionnaires (N=40). Caxias do Sul, RS, 2022.

	PI (n=20)	PA (n=20)	
Characteristics of individuals	Mean ± SD		*P*
Mean age (years)	65.95 ± 3.87	64.80 ± 3.94	0.36
Mean body mass (Kg)	79.47 ± 12.29	78.11 ± 15.07	0.75
Mean height (m)	1.64 ± 0.10	1.66 ± 0.07	0.47
BMI (Kg/m²)	29.70 ± 3.94	28.37 ± 4.37	0.32
MEEM	26.30 ± 2.73	27.50 ± 1.67	0.09
MoCA	22.70 ± 3.78	23.85 ± 3.56	0.33
IPAQ	Absolute Frequency		
Very active	-	2 (10%)	
Active	-	18 (90%)	
Irregularly active A	7 (35%)	-	
Irregularly active B	13 (65%)	-	
Sedentary	0 (0%)	-	
Total	20 (100%)	20 (100%)	

The test used was the t-Student test for independent data (not paired); PI = Physically inactive group; PA = Physically active group; SD = Standard Deviation; Kg = Kilograms; m = meters; BMI = Body Mass Index; Kg/m² = Kilogram per square meter; MMSE = Mini Mental State Examination; MoCA = Montreal Cognitive Assessment; IPAQ = International Physical Activity Questionnaire.

Table 2. Results of the analysis of gait kinematic parameters during the performance of cognitive tasks performed in isolation (simple task) and performed in association with gait (dual task) (N=40). Caxias do Sul, RS, 2022.

	PI (n=20)	PA (n=20)			
Kinematic Parameters	Mean ± SD		Group	Effects * Task	Group x Task
Velocity (m/s)			p=0.057	p<0.001	p=0.602
Simple – gait	1.04 ± 0.04^{B,a}	1.11 ± 0.03^{B,a}			
DT – arithmetic	0.82 ± 0.04^{A,a}	0.94 ± 0.04^{A,a}			
DT – verbal fluency	0.83 ± 0.05^{A,a}	0.93 ± 0.03^{A,a}			
Cadence (steps/min)			p=0.106	p<0.001	p=0.772
Simple – gait	105.02 ± 2.43^{B,a}	109.76 ± 2.74^{B,a}			
DT – arithmetic	87.51 ± 4.62^{A,a}	95.74 ± 3.28^{A,a}			
DT – verbal Fluency	90.01 ± 4.49^{A,a}	97.97 ± 3.36^{A,a}			
Stride length (m)			p=0.215	p=0.776	p=0.978
Simple – gait	1.17 ± 0.03^{A,a}	1.21 ± 0.02^{A,a}			
DT – arithmetic	1.15 ± 0.04^{A,a}	1.19 ± 0.02^{A,a}			
DT – verbal fluency	1.15 ± 0.04^{A,a}	1.19 ± 0.02^{A,a}			
Step width (m)			p=0.164	p=0.014	p=0.877
Simple – gait	0.18 ± 0.01 ^{B,a}	0.17 ± 0.01 ^{B,a}			
DT – arithmetic	0.20 ± 0.01^{A,a}	0.19 ± 0.01^{A,a}			
DT – verbal fluency	0.19 ± 0.01^{A,a}	0.17 ± 0.01^{A,a}			
Stride time (s)			p=0.153	p<0.001	p=0.527
Simple – gait	1.17 ± 0.03^{B,a}	1.11 ± 0.03^{B,a}			
DT – arithmetic	1.41 ± 0.06^{A,a}	1.29 ± 0.05^{A,a}			
DT – verbal fluency	1.32 ± 0.05^{A,a}	1.27 ± 0.04^{A,a}			
Double support (s)			p=0.175	p<0.001	p=0.645
Simple – gait	0.30 ± 0.02^{B,a}	0.25 ± 0.02^{B,a}			
DT – arithmetic	0.35 ± 0.04^{A,a}	0.33 ± 0.02^{A,a}			
DT – verbal fluency	0.39 ± 0.05^{A,a}	0.33 ± 0.02^{A,a}			

*through the Generalized Estimating Equations (GEE) model; Capital letters (A,B): intragroup comparison, equal letters do not differ by the Bonferroni test at 5% significance; Lowercase letters (a, b): intergroup comparison, equal letters do not differ by the Bonferroni test at 5% significance. PI = Physically inactive group; PA = Physically active group; SD = Standard Deviation; DT = Dual Task; m/s = meters per second; steps/min = steps per minute; m = meters; s = seconds.

DISCUSSION

The analyzed results demonstrated that in the comparison between the PI and the PA groups, there were no statistically significant differences, despite the PI having presented lower performances in the analysis of the kinematic parameters, both in the simple gait task and during the dual tasks. However, when the effect of the dual task is related to the single task, there are significant differences in both groups and in both cognitive tasks in the velocity, cadence, stride time, step width and double support of gait. Gait is one of the keys to functional independence and presents several changes resulting from the aging process. However, the gait parameter was evaluated while participants walked in combination with a cognitive task. This presented the strongest relevance for everyday life in the older people[23]. Also, the analysis of dual-task walking can be used for monitoring gait deteriorations in aging in order to identify older adults[24]. In this direction, the present study aimed to analyze the possible differences in

the kinematic variables of gait between physically inactive and physically active older people while performing dual-task activities.

In both groups, the analysis of the MEEM and MoCA cognitive tests revealed that the MEEM average values were above the 23 points. They were considered as a threshold to differ healthy subjects from subjects that already presented cognitive damage[17]. The comparison between the average MoCA values and the normative ones revealed that both groups presented values below the 26 points that were considered as the cutoff for the Brazilian population[25]. This is because MoCA presents a greater complexity regarding its subtests. It features more complex approaches on attention, executive functions, and language and visuo-spatial abilities[25].

Regarding the influence of dual tasking on gait parameters in both groups, previous studies have shown that dual task activities reduced the gait velocity of healthy older people[26]. Other research also supports this statement with frail older people and older people with mild cognitive impairment[27]. The other kinematic gait parameters are also influenced by dual activities in both groups, with the exception of stride length. Previous studies have also demonstrated significant changes in cadence, stride length, increased stride variability, double support time and step width in older people[27,28]. The effect of the additional cognitive task with increased prefrontal and motor cortex activation, relating that we use different strategies to maintain dynamic stability and that this depends on the demands of the task and the individual capabilities of each person[28]. Changes resulting from walking followed by a secondary task are considered a predictor of falls[27]. In addition, studies show that the association of two or more tasks can affect balance, promoting higher rates of falls, which contributes to a worse quality of life in the older people[29].

Related to the influence of physical activity on gait parameters, the present study did not observe significant differences between physically active and physically inactive participants, both in the assessment of single gait and during dual tasks. However, unlike the present results, better levels of physical activity are associated with better mobility in older adults[8]. Also, other kinematic parameters such as variability of step length, step time, double support ratio[30], shorter step length, shorter step time, shorter swing time, and higher cadence were associated with physical activity level[31]. When we compared the influence of the dual task between active and inactive older people, no significant differences were observed either. Muhaidat et al.[12] evaluated 120 women older people and also identified no relationship between physical activity level and better gait parameters during dual tasking. However, Gomes et al.[13] highlight that inactive older people are more likely to present compromised gait performance during dual-task activities. Since mobility averages with dual motor task, with dual cognitive task, the worst performance being associated with physically inactive lifestyle. In this way, as is well established in several literatures, the regular practice of physical exercises provides the older people with greater security in activities of daily living, better balance, and greater walking velocity, reducing the risk of falls[9]. In addition, the importance of physical activity in older people is essential to improve quality of life and prevent age-related diseases[9,10].

It is well known that regular physical activity is an important component of healthy aging[31]. Despite the importance of physical activity in the older people already being very well described in the scientific literature; the present study was not able to verify the interference of physical activity in the kinematic parameters of gait during dual tasks.

However, some limitations need to be highlighted. First, the presente study had a quasi-experiental approach, which presents a lower level of evidence compared to a longitudinal study design. Secondly, the fact that, even though there is a lot of research related to dual tasking, the way in which these activities are evaluated is quite heterogeneous, which makes it difficult to analyze and compare data. Another aspect that may have influenced the results is that the older subjects were classified using the IPAQ, one of the most used instruments in research. This is a self-administered questionnaire in which participants reported their levels of physical activity during the previous week.

CONCLUSION

This research demonstrated that dual tasks had a negative influence on gait parameters of older individuals. However, the results did not support the hypothesis that dual tasking influences the gait parameters in physically active older people less then physically inactive ones. Although active older people show smaller declines in gait kinematic parameters compared to inactive older people, the practice of physical activity could not be considered a factor that minimizes the effects of the dual task on gait in the older in our study. We believe that this occurred due to the average age of the participants, who, despite being older people, are considered young older and also due to the degree of difficulty of the cognitive tasks used, since the complexity of cognitive interference involves greater concurrent demands.

The importance of the present study is highlighted due to the high number of studies that currently have investigated the effects of the dual task on gait performance, which reflects its importance from the research area and its potential clinical applications. In future perspectives, more studies are needed that relate the practice of physical activity with walking associated with the dual task, to provide more scientific evidence. In view of how rapidly the older population has been growing, it is hoped that the results of this research can broaden the understanding of the dual task, in order to qualify professionals, as well as assist researchers in creating strategies that allow minimizing the effects of aging.

AUTHORSHIP

- Verônica Filter de Andrade - conception, analysis and interpretation of results and writing of the article.
- Laura Buzin Zapparoli - analysis and interpretation of results.
- Pedro Henrique Farneda - analysis and interpretation of results.
- Fernanda Cechetti - design and critical review.
- Raquel Saccani - design and critical review.
- Leandro Viçosa Bonetti - conception, design, critical review and approval of the version to be published.

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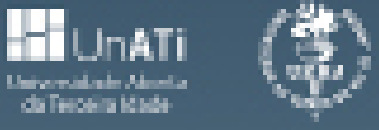
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