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ABEC

Contents

EDITORIAL

ORIGINAL ARTICLES

Contents

REVIEW ARTICLES

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The frail elderly and integral health management centered on the individual and the family

The rapid aging of the Brazilian population, combined with an increase in longevity, has had serious consequences for the structure of health care networks, with an increased burden of chronic diseases and especially of functional disabilities. Unfortunately, the care offered to frail elderly people with multiple chronic health conditions, poly-disabilities or complex needs is fragmented, inefficient, ineffective and discontinuous, which can further harm their health. The hospital-based health system of the 19th and 20th centuries that is designed to deal with acute and especially infectious diseases is inadequate for meeting the needs of chronic patients for long-term, continuous treatment. The response of the health system to the new demands means the use of a set of management technologies that are capable of ensuring optimal standards of health care in a resolutive, efficient, scientifically structured manner, which is safe for patients and health professionals, timely, equitable, humanized and sustainable, is essential. The threefold goal of a better care experience, coupled with improved populational health and reduced costs developed by the Institute of Healthcare Improvement (Triple Aim), is the best strategy for reorganizing and optimizing health system performance.

Providing the best care experience means understanding the particularities of health in the elderly. The use of parameters based on risk factors, diseases and/or age is inappropriate and is associated with a high risk of iatrogenic illness. Vitality is extremely heterogeneous among the elderly and chronological age is a precarious metric for the assessment of the homeostatic reserve of the individual. Likewise, aging without suffering any chronic illnesses is the exception rather than the rule. Knowing only the age of individuals and their diseases, therefore, does not improve the chances of a better understanding of the health situation. The best marker of vitality in the elderly is functional capacity, as measured by activities of daily living (ADL). It represents autonomy (individual decision making capacity) and independence (the ability to execute the activity), allowing individuals to take care of themselves and their lives. Thus, health in the elderly can be defined as the individual's ability to satisfy their biopsychosocial needs, regardless of age or the presence of diseases. The decline in vitality is known as frailty, clearly associated with the development of disabilities, functional dependence, hospitalization and death. Therefore, the presence of functional decline in activities of daily living should never be attributed to aging itself and should always trigger an extensive investigation of the elderly person. This should consider the performance of functional systems (cognition, mood/behavior, mobility and communication) and physiological systems (sleep, nutrition, oral health, skin and annexes, cardiovascular, respiratory, digestive, genitourinary, musculoskeletal, nervous and endocrine-metabolic systems), together with an evaluation of the medications being used, previous history and contextual factors, compiled from a socio-family assessment, the evaluation of the caregiver and an environmental assessment. This Multidimensional Evaluation of the Elderly Person is fundamental for the construction of a Personalized Care Plan (PCP), or the set of biopsychosocial and functional diagnoses of

the individual, associated with promotional, preventive, curative, palliative and/or rehabilitative interventions capable of maintaining or recovering their health. The PCP is, therefore, the guiding strategy for the health team to meet specific patient health needs in the short, medium and long term, and must also be strongly anchored in the principles of Patient-Centered Medical Home. This should be the logic that directs the team in the search for suitable resources and required treatments, serving as the guiding axis of the entire care process. The proposed interventions should also be applied based on the vitality of the elderly person, which may be robust, at risk of frailty or frail.

Frail elderly persons are the largest consumers of procedures in any health system, with these processes for the most part being associated with iatrogenic illness and therapeutic futility. Health promotion strategies and primary and secondary prevention measures should be applied with great caution as the impact of such measures requires behavioral and lifestyle changes, as well as investments in diagnostic and therapeutic interventions that take far too long to obtain positive results. This type of frail elderly person does not have a sufficiently long life expectancy to benefit from such interventions, which also present risks and can have negative repercussions for their health. Tertiary prevention, which consists of the recognition of disabilities and interdisciplinary interventions aimed at rehabilitation, demands time, qualified professional care and patient and family adherence, which are all associated with high costs. Recently the concept of quaternary prevention has been introduced, which consists of detecting individuals at risk of excessive treatment to protect them from further inappropriate medical interventions and suggest ethically acceptable alternatives. Quaternary prevention is aimed at protecting people who use the health system from an excess of disease-tracking interventions, the medicalization of risk factors, the request for too many exams, over-diagnosis, and the use of futile or potentially inappropriate and defensive medicine. Its main purpose is not to harm the patient ("*primum non nocere*"). These health micromanagement concepts are fundamental for the maintenance and/or recovery of the independence and autonomy of the elderly, and also for the sustainability of health care systems, whether public or private (health macromanagement). From this perspective, the main interventions capable of improving the health of frail elderly persons are, in order of importance: a) suspension of inadequate diagnostic and/or therapeutic interventions, with emphasis on the safe deprescription of inappropriate drugs; b) the definition of individualized therapeutic goals shared with the elderly and their family, respecting the clinical-functional stratum of the patient; (C) appropriate treatment of underdiagnosed and, consequently, under-treated conditions, commonly attributed to "age" or "senility"; D) rehabilitation, according to the patient's rehabilitation prognosis; E) secondary prevention when life expectancy is sufficiently long for the expected benefit to occur and there are no contraindications in the medication, dietary or lifestyle changes and f) primary prevention, only when the elderly individual is robust and the cost-benefit-risk ratio of the treatment is highly satisfactory, due to the scarcity of intervention studies among very old elderly persons and especially of the frail elderly.

All these premises are included in the proposed Gestão Integral da Saúde Centrada no Idoso e na Família (Integrated Health Management for the Elderly and the Family) (GISCI) model, which is capable of reconciling health micromanagement technologies and the more modern premises of clinical macromanagement, implemented in an integral and integrated form. Both technologies must be applied simultaneously to ensure the effectiveness and sustainability of the model. GISCI is being progressively installed in the SUS (the Brazilian Unified Health System), through the experiences of the Centro de Referência do Idoso (the Elderly Reference Center) of the Hospital das Clínicas of the Federal University of Minas Gerais (UFMG) and in Supplementary Health, with the Usifamília program of the Fundação São Francisco Xavier, both of which have demonstrated highly promising results.

Edgar Nunes de Moraes
UFMG professor and World Bank consultant (Aging and Health in Brazil, 2017)

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Prevalence of fear of falling, in a sample of elderly adults in the community

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Abstract

Objectives: To investigate the prevalence of fear of falling among a sample of elderly persons in the community, and to analyze its correlation with age, self-perceived health, difficulty walking, use of an assistive device for walking, history of falls, and functional capacity. Method: A cross-sectional study of 314 non-institutionalized elderly individuals, living in the city of Juiz de Fora in the state of Minas Gerais) in 2015, was carried out. A household survey was conducted and fear of falling was assessed using the Falls Efficacy Scale - International - Brazil (*FES-I-BRASIL*). The Spearman correlation was used to verify the correlation of the independent variables with the fear of falling. The significance level for the study was 5%. Results: The prevalence of fear of falling among the elderly was 95.2% (95% CI= 92.3; 97.3). Fear of falling was significantly correlated with all the variables analyzed: age (r= 0.199), self-perceived health (r=0.299), difficulty walking (r= -0.480), use of an assistive device for walking (r=0.337), history of falls (r= -0.177), and functional capacity (r = -0.476). Conclusions: A high prevalence of fear of falling was observed, with a significant correlation between the outcome and the variables studied. These findings point to the need for rehabilitation, prevention, and health promotion strategies that enable healthy aging.

Keywords: Health of the Elderly. Aging. Fear. Accidental Falls. Cross-Sectional Studies.

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INTRODUCTION

Population aging is a world-wide phenomenon with developments and impacts that are important for society and for health systems. World Health Organization data indicate that the elderly population in Brazil will rise from its current 12.5% to approximately 30% by 2050. The extent to which this process is occurring in Brazil increases the urgency of understanding the health-related needs of the elderly[1].

Within this context, fear of falling is recognized as a major public health problem that is commonly found among the elderly, and whose impact has potentially serious outcomes for the lives of these individuals. Included in this analysis are social issues, and increased requirements and costs for healthcare[2-4]. Although the causal mechanisms may not be fully explained, studies indicate that the etiology of fear of falling has a multifactorial nature, involving physical, behavioral, environmental, and functional elements[3,5-7].

It was believed that the presence of fear of falling was related exclusively to the psychological trauma resulting from experiencing a fall. However, literature shows that it is also present in elderly people who have never fallen[6-9]. Fear of falling is related to low confidence or low self-efficacy in avoiding falls. People with low self-efficacy focus on the obstacles of the task and on their limitations, and avoid situations they consider threatening. Thus, they limit skill development, which results in a basis for constructing fear[3,5-7].

The aim of this study was to estimate the prevalence of fear of falling among a population of older adults in the community and to analyze its correlation with age, self-perceived health, difficulty walking, use of an assistive device, history of falls, and functional capacity.

METHOD

This study is part of a broader research project, entitled the *Survey on the Health of the Elderly Population of Juiz de Fora*, operationalized through two waves of multidimensional population-based household surveys (2010/2011 and 2014/2015). Thus, the present study is a cross-section of the second wave of data collection, with a sample of 214 elderly persons aged 60 years or older who were resident in the northern region of the city of Juiz de Fora, Minas Gerais.

To define the sample calculation at the beginning of the segment in 2010, the national prevalence of elderly persons who had suffered a fall, as indicated by literature (30%)[10], was considered the basis, as this was the principal objective. The study considerations included a desired maximum error of 5%, a 95% confidence level, correction for finite populations, effect of the sampling design equal to 1.5 (considering the possible effects of stratification and clustering, according to the adopted selection procedure), and possible losses for dropouts (30%).

Participants were selected by random sampling, stratified and clustered in multiple stages. The primary sampling units were census tracts. For the random selection, the sectors were grouped into strata defined according to the different health care modalities in which the population of the region was enrolled, subdivided into primary care (Family Health Strategy or traditional), secondary care, or no-coverage area. The selection of these individuals was made using probabilities proportional to their size (resident population according to Census 2000 data), independently in each stratum.

For the second wave of the survey (2014), the sample size calculation was estimated based on the 2010 sample and *IBGE* data for the 2010 census for the population of the delimited area, at the census tract level of disaggregation, in order to allow resizing of the representative probabilistic sample based on stratification and clustering. To compensate for dropouts from the panel, who were no longer included in the study population, over a timespan of years, the oversample method was used. This allows the initial sampling to be respected, provided that the initial population is known and that the statistical processing, and weights attributed, are different between the groups that make up each panel dropout situation (cases of death, change of address without being able to identify the new address, long term travel, prolonged hospitalization, and entry into a long-term care institution)[11]. Age, sex, and education level were variables selected to delimit the entry of new subjects. The total survey sample included 423 elderly individuals.

The questionnaire used for the household survey was standardized and pre-tested. The Mini-Mental State Examination (MMSE) was used as a cognitive decline screening tool, which determined whether or not another respondent was needed. In such "other respondent" cases, the questions that depended on the elderly person's perception were not addressed. Individuals who presented behavior in the MMSE suggesting cognitive decline, and who were not accompanied by family members and / or caregivers, were excluded (N=23).

The sample for this study consisted of elderly persons who participated in the second phase of the *Survey on the Health of the Elderly Population of Juiz de Fora* and who presented no cognitive decline (N=315), excluding those using a wheelchair as a mobility device (N=1) (Figure 1). The intra- and inter-examiner agreement found before data collection was substantial or excellent (>75%). Throughout the course of the survey, the interviewers were monitored, evaluated, and retrained. For quality control of the information, field supervision was carried out by the principal investigators, and at the end of data collection, roughly 10% of production was reassessed via another partial interview.

The dependent variable was operationalized with the application of the *FES-I BRASIL*. This is a scale designed to assess fear of falling based on the definition of low perceived self-efficacy for avoiding falls during regular daily activities[5,12]. The scale includes 16 activities with scores, for each activity, ranging from one to four, in which the lowest score indicates the elderly person is "not at all concerned" with falling and the highest one means the individual is "very concerned" about the possibility of falling. The total scores range from 16 points for individuals without any concern about falling, to 64 points for individuals with extreme concerns[5].

Functional capacity for the instrumental activities of daily living (IADL) was assessed using the Lawton and Brody Scale. This tool investigates nine instrumental activities: using the phone, shopping, handling finances, preparing one's own meals, cleaning the house, doing household chores, washing clothes, taking medication, and going far from home using any means of transport. The scores range from 9 to 27 points and the lower the score, the greater the degree of dependence. This variable was dichotomized into dependent (<18 points) and independent (≥19 points)[13]. The other variables were obtained through a semi-structured questionnaire developed by the researchers.

The significance level was 5% and the statistical analysis considered the characteristics of the sampling plane. Absolute and relative frequencies were described, as well as the prevalence of the outcome. The variables age, self-perceived health, difficulty walking, use of an assistive device for walking, history of falls, and functional capacity were correlated with the fear of falling variable, calculating the Spearman correlation coefficient. The classification used for correlation was: <0.49, weak; 0.50 to 0.69, moderate; and ≥0.70, strong.

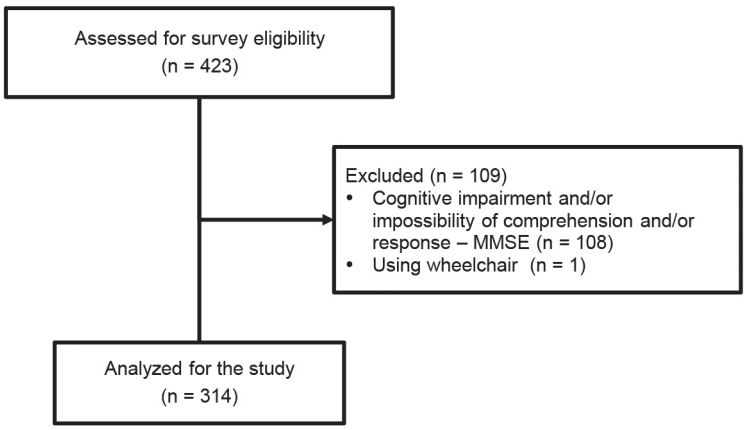

Figure 1. Flowchart of the study sample. Juiz de Fora, MG. 2015.

The Guidelines and Norms Regulating Research Involving Human Beings were followed, in accordance with the recommendations of Resolution 466/2012 of the National Health Council. The Ethics Committee of the Federal University of Juiz de Fora approved the study (Opinion No. 771/916), which was funded by the National Council for Scientific and Technological Development (Process: 480163/2012-0). All the elderly involved on the survey read and signed the free and informed consent form.

RESULTS

The study included 314 elderly participants. The sample consisted of 62.2% women, 45.2% said they were white, 56.1% were married or living in a stable union relationship, 87.9% lived with a companion, and 58.6% belonged to socioeconomic level C. The mean age was 72.7 years (sd±7.32) and education level was 4.0 years (sd±3.50). Among the respondents, 74.2% were Catholic and 96.8% considered religion important in their lives; 61% said they had no difficulty walking and 87.3% said they did not need assistance for mobility. Most (96.5%) reported using the *SUS* (Unified Health System), 88.2% reported some type of morbidity, 53.4% reported using from 1 to 4 medications, and 56.7% positively rated their own health. Regarding the history of falls, 34.1% reported having experienced an episode in the past year (Table 1).

The prevalence of fear of falling in the study population was 95.2% (CI 95%=92.3-97.3) and the average score on the scale was 24.9 (sd±8.17). Among the activities present in the *FES-I-BRASIL* scale, the highest scores, representing greatest concern about falling, were: walking on a slippery surface, going up or down stairs, bathing, going up or down a slope, and walking on an uneven surface (Figure 2).

Table 1. Sociodemographic characteristics and health profile (n=314). Juiz de Fora, Minas Gerais, 2015.

Variable	Presence of fear of falling. n (%)	Absence of fear of falling. n (%)
Sex		
Male	99 (33.1)	7 (46.7)
Female	200 (66.9)	8 (53.3)
Age (Years)		
60-70	129 (43.1)	7 (46.7)
71-80	119 (39.8)	5 (33.3)
Over 80	51 (17.1)	3 (20.0)
Education (years)		
Illiterate	27 (9.0)	2 (13.3)
1 to 4	188 (62.9)	7 (46.7)
5 to 10	59 (19.8)	5 (3.4)
11 or more	25 (8.4)	1 (6.7)
Socio-economic level		
A or B	82 (27.4)	7 (46.7)
C	177 (59.2)	7 (46.7)
D or E	40 (13.4)	1 (6.7)
Marital status		
Married or stable union	170 (56.9)	6 (40.0)
Widowed	93 (31.1)	6 (40.0)
Separated or divorced	24 (8.0)	2 (13.3)
Single	12 (4.0)	1 (6.7)

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Continuação da Tabela 1

Variable	Presence of fear of falling. n (%)	Absence of fear of falling. n (%)
Living arrangement		
Live alone	36 (12.0)	2 (13.3)
Reside with companion	263 (88)	13 (86.7)
Self-perceived health		
Excellent/very good/good	168 (56.2)	10 (66.7)
Fair/poor	131 (43.8)	5 (33.3)
Morbidity reported		
Yes	268 (89.6)	9 (60.0)
No	31 (10.4)	6 (40.0)
Difficulty walking		
No	180 (60.2)	12 (80.0)
Yes	119 (39.8)	3 (20.0)
Use of an assistive device for walking		
No	261 (87.3)	13 (86.7)
Human assistance	15 (5.0)	1 (6.7)
Cane/crutches	21 (7.0)	1 (2.3)
Walker	2 (0.7)	0 (0)
Ongoing medication use		
None	23 (7.7)	3 (20.0)
1 to 4 medications	160 (53.5)	9 (60.0)
More than 4 medications	116 (38.8)	3 (20.0)
Fall		
No	196 (65.6)	11 (73.3)
Yes	103 (34.4)	4 (26.7)
Unified Health System user		
Yes	289 (96.7)	14 (93.3)
No	10 (3.3)	1 (6.7)
Functional capacity for performing Instrumental Activities of Daily Living Scale		
Independent	280 (93.6)	15 (100.0)
Dependent	19 (6.4)	0 (0)

Source: Table prepared by authors

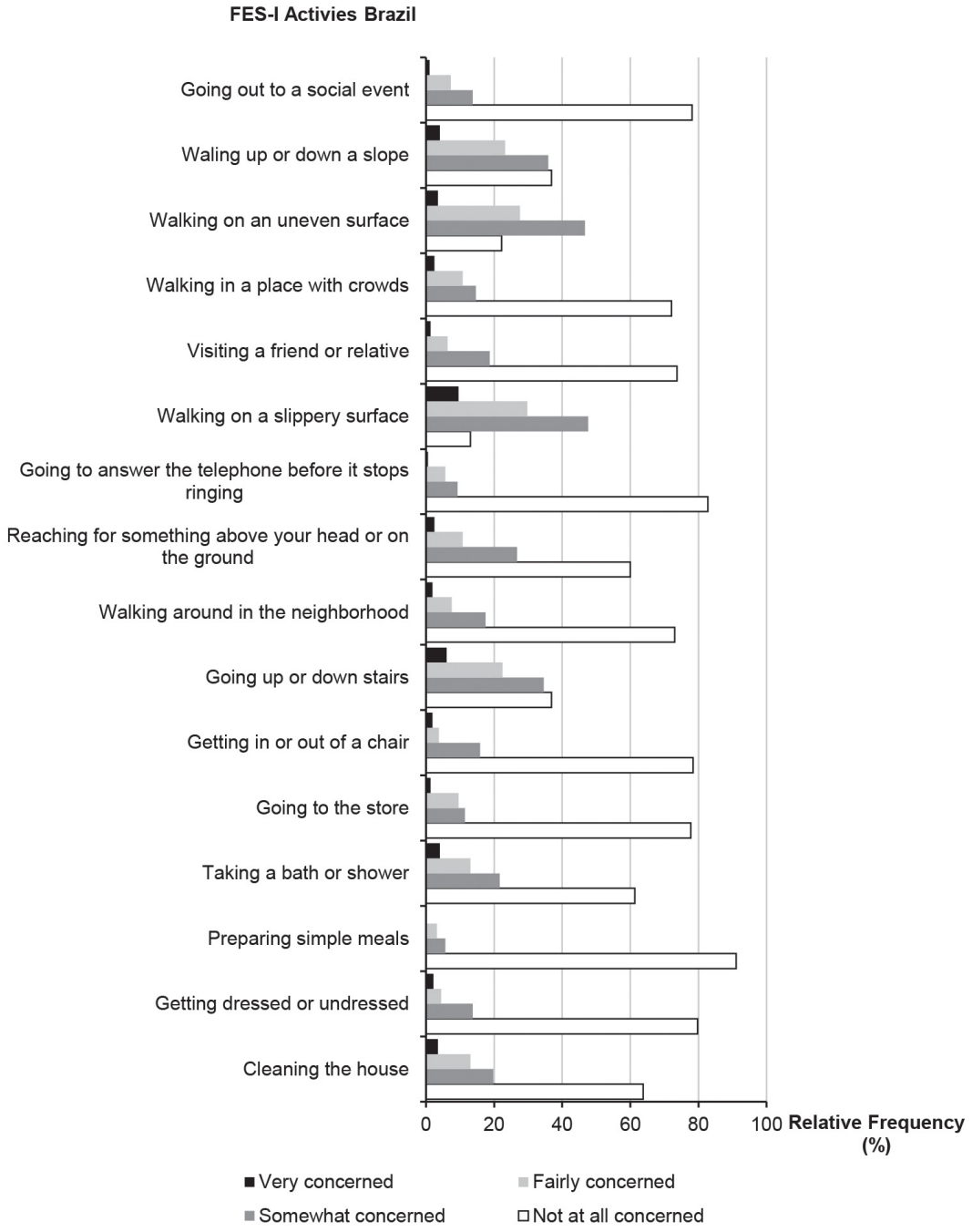

Figure 2. Concern reported by elderly persons on activities assessed in the Falls Efficacy Scale – International – Brazil. Juiz de Fora, Minas Gerais, 2015.

The Spearman correlation showed significant results (p<0.05) between fear of falling and all the variables studied. There was a weak positive correlation between *FES-I-BRASIL* and self-perceived health (r=0.299), *FES-I-BRASIL* and use of an assistive device for walking (r=0.337), and *FES-I-BRASIL* and age (r=0.199). There was also a weak negative correlation observed between *FES-I-BRASIL* and history of falls (r=-0.177), *FES-I-BRASIL* and difficulty walking (r= -0.480), and *FES-I BRASIL* and functional capacity (r= -0.476) (Table 2).

Table 2. Correlation between fear of falling and the variables analyzed. Juiz de Fora, Minas Gerais, 2015.

Variable	r	p
Age	0.199	< 0.01
Self-perceived health	0.299	< 0.01
Difficulty walking	-0.480	< 0.01
Use of an assistive device for walking	0.337	< 0.01
History of falls	-0.177	< 0.01
Functional capacity for performing Instrumental Activities of Daily Living Scale	-0.476	< 0.01

Note: p= Accurate significance level for the Spearman correlation coefficient

DISCUSSION

The prevalence of fear of falling in the study population was 95.2%, similar to that found in other studies[7,8,14]. Lower prevalence values, from 19% to 78%, were observed in other studies, however these variations can be attributed to the diversity of tools used to assess the outcome, differences in the characteristics of the population studied, and other methodological attributes[4,15-19].

Considering that 65.9% of the elderly had not reported falls in the previous 12 months, it can be inferred that fear of falling was present independent of its actual occurrence. Studies show that fear of falling has been reported both by elderly persons who have experienced falls, as well as by those who have never fallen[3,6,7]. Among those who have fallen, literature suggests that these individuals consider themselves less able to avoid a fall and, consequently, would be more prone to suffer another. Low self-confidence in avoiding falls can reduce the practice of activities due to fear of falling again, generating a functional decline due to inactivity, which would increase the risk of further falls[2,4,9,16-18]. Fear of falling proved to grow with increased age, corroborating other investigations[4,9,17,18]. With the aging process, older people tend to present a physical and functional decline due to lower functional reserve capacity. According to Lopes et al.[7] this decline of functional reserve that occurs with advancing age alters the perception of the elderly regarding these falls, which can generate a sense of low self-efficacy and consequently, concern about falling.

A weak positive correlation was also observed between fear of falling and a negative self-perception of health. Self-perceived health has been shown to be a reliable method and a robust overall health indicator and predictor of morbidity, mortality, and physical decline in the elderly population. It can synthesize a complex interaction of factors involved in the health of the elderly[20,21]. A similar result was found in the study by Silva et al.[22], which showed that among elderly participants in regular physical activity, those who rate their own health as poor tend to have higher scores on the *FES-I-BRASIL*, and consequently, a greater concern about falling than those who have a better perception of their health[4,9,17,18].

Fear of falling proved more frequent in older people who have difficulty walking. It is likely that subjects who report difficulty walking already present a certain decline in functional capacity and changes in balance and gait. These changes impede the action of safe and effective walking and undermine the self-confidence of these individuals in avoiding falls, creating a basis for constructing their fear.

The use of an assistive device for walking showed an association among the elderly who reported concern about falling. The diminished muscle strength and flexibility, and the impairment of the somatosensory, vestibular, and sensory systems, resulting from the aging process, alter postural control and balance, and hinder the practice of walking effectively and safely[3,23].

Studies point out that elderly people who report fear of falling use different strategies to maintain

stability while walking. Smaller step length and height, greater support base, and more time in the double support phase trigger a reduction in walking speed and alter stability. Thus, the variability of the spatial and temporal parameters of walking by these elderly persons contribute to a more unsteady gait and an even higher risk of falls[3,19,24-26]. Again according to Lopes et al.[7], seniors with a fear of falling tend to employ the agonist and antagonist muscles simultaneously, resulting in postural rigidity, abnormal gait, poor postural strategies, and dependence on devices to guarantee stability. These assistive devices enable functional independence and offer safety and confidence to the elderly, making it easier for them to carry out their daily activities. However, when not indicated or when used inappropriately, they can have the opposite effect and contribute to unsafe locomotion, forming an instrument capable of causing falls[23,27-29].

The correlation found between fear of falling and functional capacity indicates that functional dependence is associated with increased fear of falling. Literature reports that older adults with functional decline tend to present low self-efficacy in carrying out daily activities, since they have lower physical and functional performance, and often report fear of falling during their execution. It also reports that elderly persons who restrict their activities due to fear of falling are more prone to sedentary living and social isolation, resulting in a loss of functional capacity and consequently, a fear of falling, creating and perpetuating a vicious cycle of adverse effects[3,6,22,30,31].

Going up or down stairs, bathing, walking on an uneven surface, going up and down a slope, and walking on a slippery surface were the highest-score activities in the *FES-I-BRASIL*, similar to the findings in other studies[7,14]. Activities such as these pose challenges for elderly people due to the heavy demands placed on the osteomyoarticular system and other components responsible for maintaining dynamic equilibrium. It is noted that due to fear, the elderly tend to have diminished self-confidence about their abilities and thus avoid exposure to threatening situations they consider a risk for falling, by restricting their activities, thus perpetuating a cycle of adverse health effects for these same individuals[2,9]. A study by Dias et al.[15] reveals that older people who restrict their activities due to fear of falling present lower self-efficacy in avoiding falls, are slower at walking, have more illnesses, poorer self-perceived health, and perform worse in the IADLs.

For Camargos et al.[5], external activities involving social participation are one of the main causes of concern about falling among the elderly in the community. The level of information processing required for controlling balance and maintaining stability is significantly higher in the community environment [32].

However, the home environment can also present situations that pose a greater need for balance and postural control, as is the case for the elderly who reported being worried about falling while bathing and walking on slippery surfaces. Several studies have shown that the most frequent site where falls occur was inside the elderly person's own home, especially the bedroom and bathroom[14,23,29,30]. Oliveira et al.[31] showed a tendency for increased falls outdoors. For these authors, intrinsic factors are related to the place where falls occur. Elderly people with intact physical capacity tend to fall in outside environments, while those with functional impairment tend to suffer falls within their own homes. This situation calls attention to the risk of social isolation and acquiring sedentary lifestyles due to physical inactivity resulting from the presence of fear of falling[15,16,33].

Among the study's limitations, the possibility of memory bias is noted, due to participant self-reporting in surveying the variables of interest, which may have influenced the data. However, household population-based surveys with elderly persons living in the community are extremely important because they are configured as relevant tools for analysis and assessment in health, monitoring, and the management of collective practices. They are potentially useful tools that can offer assistance in implementing public policies and conducting future research that investigates the study theme more thoroughly.

CONCLUSION

This study identified a high prevalence of fear of falling in elderly persons in the community

and significant correlation between the outcome and self-perceived health, difficulty walking, use of an assistive device for walking, age, history of falls, and functional capacity. Among the activities that most concern the elderly regarding fear of falling, the highest scoring activities were: bathing, going up or down stairs, walking on an uneven surface, going up or down a slope, and walking on a slippery surface.

We believe that the high prevalence of fear of falling in the elderly population, within a scenario of increasing population aging, dictates the need to understand this phenomenon as a public health problem, and presses for the development and adoption of new healthcare strategies and actions for rehabilitation, prevention, and health promotion, which will contribute to the quality of life of this population and help ensure their healthy aging.

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Construction of an instrument for the prognostic evaluation of elderly persons in intensive care units

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Abstract

Objective: To create an instrument for the prognostic evaluation of elderly patients hospitalized in an intensive care unit. *Methods:* A cohort study, with prospective data collection, which included elderly persons aged 60 years or older, was carried out in the city of João Pessoa, in the state of Paraíba, Brazil. Data collection was performed using an instrument created from a pilot study and the Katz Index. Poisson's regression was used for data analysis. This technique estimates relative risk, retaining variables with $p \leq 0.10$ in the instrument, and ensures biological plausibility. The classification of risk of death was performed using quartile analysis, confirmed by the *Receiver Operator Characteristic (*ROC) curve. *Results:* 205 elderly patients with an average age of 74.6 years and a 59% risk of mortality, were included. Of the total sample and based on the scores, 16.6% of elderly persons had a low risk of developing death, 23.9% were at moderate risk, 40% had a high risk, and 19.5% exhibited a very high risk of death. The positive predictive value of the instrument was 77% and the negative value was 67.5%, with a concordance index of 0.78. The cutoff score of the instrument was 9 points or over. The sensitivity was 77.7% and the specificity was 66.7%. *Conclusions:* The instrument developed may be useful in the identification of elderly people with risk factors who require increased care. The instrument described can therefore be applied in Brazilian intensive care units.

Keywords: Elderly. Prognosis. Intensive Care Units. Patients. Evaluation.

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INTRODUCTION

With increased population aging and greater longevity accompanied by the exacerbation of noncommunicable chronic diseases, more and more elderly persons are becoming users of hospital services and consequently being hospitalized in intensive care units[1,2].

The overall rate of mortality in adult intensive care units (ICUs) is between 10 and 56%[3,4] while the mortality of the elderly in such units ranges from 28 to 62%[5,6].

This population group, which is generally characterized by a high prevalence of chronic diseases and reduced organic reserve, presents a greater demand for ICU beds and evolves more easily to a critical state, resulting in greater costs when hospitalized in these units.

To provide care to such individuals, multi-professional teams working in the ICU must have specific knowledge about the needs of the elderly and focus their actions on attending to their specific needs and the needs of their families, while also accompanying the advances of the complex technology that these units contain.

The severity of the condition of individuals leads medical professionals to think about their prognosis and to seek measures that evaluate such severity, as well as considering whether the treatment instituted will be successful, or if the search for a cure for the patient should be suspended. This means that measurement is a constant challenge which, if effectively performed, can facilitate decision-making by the health team and family members[7].

In a study carried out in 2015, Pedrosa et al.[1] found that the combination of acute and chronic diseases, together with the physiological limitations resulting from the aging process, can interfere with the treatment of elderly persons in the ICU, resulting in a more negative prognosis.

Literature remains conflicting in terms of demonstrating whether the instruments and scales of evaluation and prognosis currently used in younger populations are also the most adequate for the elderly population.

Studies support the development and validation of new indices aimed at elderly patients hospitalized in ICUs, which consider, in addition to survival, the functional and cognitive status of such individuals following hospital discharge, and argue that the creation of these indices can support decision making in the ICU, respecting the preferences of patients[8,9].

In the midst of these challenges, and due to the high percentages of elderly people in the population, a proportion which increases considerably in ICUs, there is a need for greater targeting of care through the introduction of new strategies that offer the required treatment, so reducing hospitalization and providing more resolutive approaches for the health problems of the elderly[10].

Therefore, to contribute to the care of the elderly in ICUs, the present study aimed to construct a tool for the prognostic evaluation of elderly patients admitted to an intensive care unit.

METHOD

An exploratory cohort study involving elderly ICU patients, with data collected prospectively, was carried out in four hospitals with ICU services that offered care to the severely ill from the public health network of the city of João Pessoa, Paraíba, Brazil. One of these was a teaching hospital with twelve beds, one was a military hospital with seven beds, one was a municipal hospital with ten beds and one was a state hospital with eight beds. Together these hospitals offer 37 beds for intensive care admission.

The sample was selected for convenience and based on free demand for each service. It consisted of elderly individuals aged 60 years or older admitted to the ICUs of the hospitals included in the study, with a length of stay in the unit equal or superior to 24 hours, and irrespective of their educational level or physical and mental status. Elderly patients who died within the first 24 hours; who were transferred to ICUs from hospitals that were not part of the study; and who were neither discharged nor died during the period determined for data collection were excluded from the study, along with the first hospitalizations of those subsequently readmitted to the ICU. The sample size calculation was performed according to guidelines established in literature,

which suggest that studies using regression analysis are based on a quantitative of at least 10 outcomes per predictor variable in the final instrument[11], giving a total sample of 170 patients.

Data collection was performed from the beginning of December 2012 to the end of June 2013, using the instrument constructed from the pilot study and the Katz scale[12], with the objective of evaluating the functional capacity of the elderly. Three classification categories were used: independent, partially dependent and totally dependent.

A cross-sectional pilot study was applied to 20 elderly patients admitted to two ICUs from the institutions included in the study. The construction of the instrument for the pilot study was aimed at identifying the clinical and demographic characteristics of elderly individuals in these units and the approximation of the variables to be included in the data collection instrument used in the study. While the results of the pilot study were not inserted in this study, the findings showed that this instrument allowed approximation to reality and the identification of the most important variables for the construction of the data collection instrument used in this study.

The "worst" data from the first 24 hours of the patient in the ICU were collected from medical records. To achieve this, the data which most effectively revealed the extent of the severity of the patient's condition, such as highest temperature, were gathered from the results observed and recorded by the medical team. This measure is justified by the fact that the data collected in this period reveals the status of the patient without the interference of the measures instituted in the ICU, and it is when the most severe disorders with the worst psychological deviations are observed[3,6,13].

In the case of readmission to the ICU, records of the previous hospitalization were disregarded. In sedated patients, the Glasgow Coma Scale was used to classify state of consciousness immediately before sedation.

The strategy for the construction of the data collection instrument was based on the problems raised in the pilot study, the variables contemplated in previously validated severity indexes applied to adult patients hospitalized in ICUs, and variables highlighted by several previously published studies, which address factors potentially related to the outcome of elderly persons hospitalized in ICUs. Biological plausibility, or in other words whether the findings were consistent with the state of elderly persons hospitalized in the ICU, was also considered, as was the clinical experience of the researchers of factors related to the prognosis of elderly persons in ICUs and which are considered important for this age group. The prognosis of the elderly in the ICU refers to anticipated knowledge or judgment about the evolution of the disease or patient, and the chances of a cure.

Variables related to clinical history were collected from family information and medical records, and were included in the data collection instrument. These were: age group, gender, length of previous ICU stay, hospitalization in the last year, comorbidities, functional capacity, previous cognitive decline, previous history of delirium and medication use, as well as variables related to the reason for hospitalization: type of hospitalization, Glasgow coma scale, invasive procedures performed in the ICU, vital signs, 24 hour diuresis, drugs used in the ICU, ventilatory modality, FiO_2 percentage, O_2 saturation, Ph value and blood gases, laboratory tests and length of stay in the ICU.

This information was obtained by the researchers during the working day and always at visiting times, so that the family could be approached in order to obtain the clinical history of the patient, followed by the study of medical records to obtain data related to laboratory tests, demographic information, and clinical data relating to the admission of the elderly person in the first twenty-four hours.

The process of constructing the prognostic evaluation instrument followed the steps of categorization of the variables and statistical analysis. Several variables were collected as absolute values, and were then categorized following criteria adopted in literature and articles that deal with the subject, considering the physiological and pathological peculiarities inherent in the elderly individuals.

The continuous variables were described by mean and standard deviation or median and interquartile range, and the categorical variables were described

by count data and percentages and compared by Pearson's chi-square test.

The Poisson regression technique was used to estimate the Relative Risk (RR), a measure of the association between a particular factor and the risk of a given outcome, which in this case was the outcome of hospital discharge due to improvement or death[14]. This indicates the chance of risk in the exposed and non-exposed groups, thus expressing by how many times the risk is greater or lower in the exposed group than in the unexposed group.

Univariate Poisson regression analysis was therefore performed in the construction of the prognostic evaluation instrument, and included variables with a value of $p<0.20$ or with major biological plausibility. It was followed by Poisson multivariate analysis, retaining only variables with $p\leq0.10$ in the instrument.

In order to determine the discrimination capacity of the instrument constructed, the C-index (concordance) was used. This value is equivalent to the area under the ROC (Receiver Operator Characteristic) curve, allowing the expression of the relationship between sensitivity and specificity, that is, the capacity to distinguish the final outcome.

The prognostic evaluation instrument was constructed, generating a score for the included variables, based on the point estimate of RR and the confidence interval, determined by the Poisson regression technique, with variables with major biological plausibility also considered.

The classification of risk of death was also elaborated, using quartile analysis, confirmed by the ROC curve, and the Kaplan-Meier curve was constructed in order to evaluate time until the occurrence of death in the ICU.

All the phases of the study complied with Resolution 466/12 of the National Health Council of the Department of Health[15], and the project was approved by the Ethics Research Committee of the Pontifícia Universidade Católica do Rio Grande do Sul, under Plataforma Brasil number 186.415.

RESULTS

A total of 555 patients were admitted to the ICUs of the study during the period from December 1, 2012 to June 20, 2013, of whom 252 (45.4%) were elderly. Data was collected from 233 of these subjects, with 28 individuals then eliminated due to transfer, incomplete data or a stay of less than 24 hours in the ICU. The total sample of the study was therefore composed of 205 elderly people, 30.7% of whom were from the teaching hospital, 25.8% from the military hospital, 28.7% from the municipal hospital and 14.6% from the state hospital.

The mean age of the total sample was 74.6 (± 9.04) years, with the youngest individual aged 60 and the oldest person aged 96. The length of stay in the ICU ranged from 01 to 126 days of hospitalization, with a median of 11 days (25^{th} percentile=5 days, 75^{th} percentile=22 days). Hospitalization time ranged from 10 to 114 days, with a median of two days (25^{th} percentile=1 day, 75^{th} percentile=9 days). Of the total sample, the outcome of 121 (59.02%) elderly patients was death.

Table 1 shows the Poisson multivariate analysis, including only variables that obtained a statistical significance with a value of $p<0.10$ included. Due to their statistical significance, these variables were included in the final prognostic evaluation instrument.

Based on the point estimate of RR and the confidence interval determined by Poisson regression, together with biological plausibility, a score was generated for the variables included, with a total of 33 points, and is set out in table 2.

Table 3 shows the risk of mortality of the elderly in the ICU according to score and classification of risk, based on quartile analysis and confirmed by the ROC curve. Of the total sample and based on the scores, 16.6% of the elderly persons were low risk, 23.9% presented moderate risk, 40% were high risk and 19.5% had a very high risk of evolving until death. Corroborating the findings of the scores, the probability of death increases considerably when the score is ≥ 9 points.

Table 1. Distribution of variables according to relative risk, confidence interval and $p \leq 0.10$ value, based on Poisson multivariate analysis (n=205). João Pessoa, Paraíba, 2013.

Variables	Relative Risk	CI 95%	p
Clinical antecedents			
Prior delirium	1.36	(1.14 – 1.63)	0.001
Neoplasms	1.61	(1.20 – 2.16)	0.002
Use of vasoactive drugs	1.41	(1.13 – 1.76)	0.002
Heart rate >100 bpm*	1.27	(1.03 – 1.57)	0.024
Length of stay in ICU	1.01	(1.00 – 1.01)	0.006
Glycemia <70mg/dl	1.40	(0.94 – 2.10)	0.102
Age range (years)			
60-69	1.00	-	-
70-79	1.12	(0.88 – 1.43)	0.354
≥80	1.42	(1.08 – 1.86)	0.012
Ventilatory support			
Spontaneous/Catheter	1.00	-	-
Use of Venturi mask	1.87	(1.15 – 3.15)	0.018
Invasive Mechanical Ventilation	1.82	(1.09 – 3.03)	0.022
Glasgow Coma Scale			
Mild: 13 to 15	1.00	-	-
Moderate: 9 to 12	1.48	(1.09 – 2.01)	0.013
Severe: 3 to 8	1.33	(1.02 – 1.73)	0.033
Reason for hospitalization			
Respiratory disorder	1.86	(1.00 – 3.45)	0.050
Neurological disorder	1.99	(1.07 – 3.68)	0.029
Cardiac disorder	1.96	(1.08 – 3.56)	0.028
Gastrointestinal disorder	2.26	(1.19 – 4.29)	0.013
Renal/metabolic disorder	0.82	(0.28 – 2.42)	0.723
Infection/sepsis	1.56	(0.84 – 2.92)	0.162
Surgical procedures	1.00	-	-

*bpm = beats per minute

Table 2. Variables included in the prognostic evaluation instrument for elderly persons hospitalized in ICUs, based on score (n=205). João Pessoa, Paraíba 2013.

Variables	Score
Clinical antecedents	
Prior presence of delirium	2
Neoplasms	3
Use of vasoactive drugs	2
Heart rate >100 bpm*	2
Glycemia <70mg/dl	1
Age range (years)	
70-79	1
≥ 80	2

to be continued

continued from Table 2

Variables	Score
Ventilatory Support	
Use of Venturi mask	2
Invasive Mechanical Ventilation	3
Glasgow Coma Scale	
Moderate: 9 to 12	2
Severe: 3 to 8	3
Reason for hospitalization	
Respiratory disorder	2
Neurological disorder	2
Cardiac disorder	2
Gastrointestinal disorder	2
Infection/sepsis	1
Length of stay in ICU > 6 days	1
Total points	33

*bpm = beats per minute

Table 3. Classification of risk of death for elderly persons hospitalized in ICU based on score and category of risk (n=205). João Pessoa, Paraíba, 2013.

Score	Sample n=205 (%)	Death n (%)	Category of risk
≤6	34 (16.6)	05 (14.7)	Low
7- 8	49 (23.9)	22 (44.9)	Moderate
9-11	82 (40.0)	58 (70.7)	High
>11	40 (19.5)	36 (90.0)	Very high

Table created by authors

The discriminatory power of the instrument was demonstrated by the construction of the ROC curve. The positive predictive value was 77%, while the negative predictive value was 67.5%, with a concordance index *C* = 0.78 (95% CI, 0.71-0.84). The cut-off point of the instrument through the ROC curve was ≥9 points. The sensitivity was 77.7% and specificity was 66.7% (Figure 1).

Figure 2 shows the distribution of the survival rate of the elderly participants in the study according to length of stay in the ICU. For individuals who remained in the ICU for up to 10 days, the survival rate was 69.8%, with this rate falling to 46.6%, 22.4% and 10.7% for those who remained for 20, 40 and 50 days respectively, as verified by the Kaplan Meier curve. This figure reveals that, as the length of stay of the elderly person in the ICU increases, the probability of survival decreases.

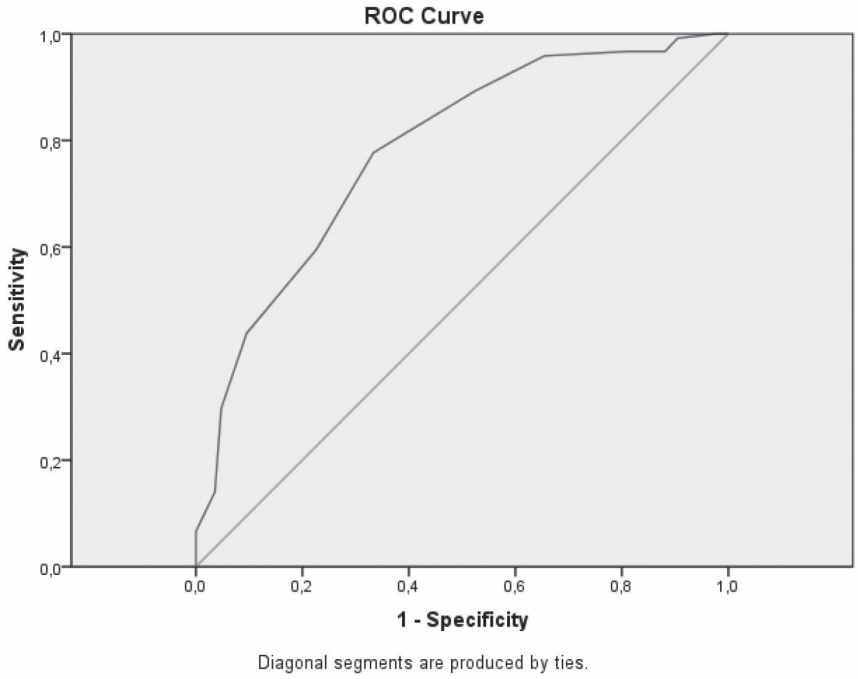

Figure 1. Area under ROC curve in detection of occurrence of mortality of elderly persons in an ICU using the final prognostic evaluation instrument. C=0.78 (CI 95%; 0.71 – 0.84), (n=205). João Pessoa, Paraíba, 2013.

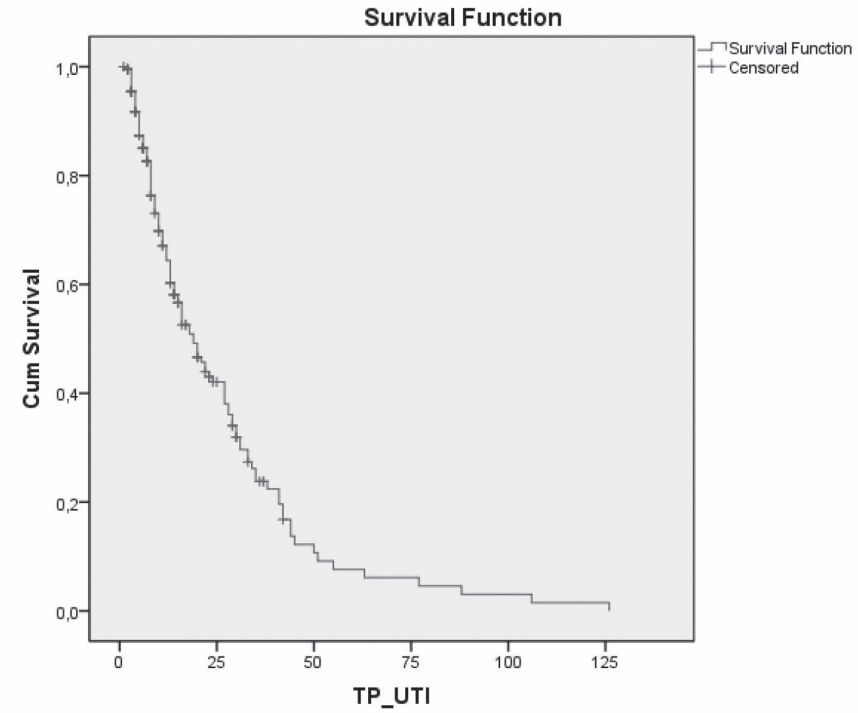

Figure 2. Kaplan-Meier Curve (n=205). João Pessoa, Paraíba, 2013.

TP_ICU = Length of stay in ICU

DISCUSSION

The results indicated ten factors which may be associated with a higher risk of mortality for elderly patients hospitalized in ICUs: previous delirium; neoplasms; use of vasoactive drugs; heart rate> 100 bpm; length of stay in the ICU> 6 days; glycemia <70mg/dl; age range ≥80 years; use of Venturi mask or invasive mechanical ventilation (IMV) as ventilatory support; a moderate or severe Glasgow coma scale rating; and respiratory, neurological, cardiac or gastrointestinal disorders as a reason for hospitalization.

The reason for hospitalization presented a significant association with death and a high relative risk of mortality among the elderly persons in the ICU, and was classified by disorders in different body systems. Disorders that affected the gastrointestinal system correlated most closely with death in the ICU, with elderly individuals admitted with pathologies that affected this system having more than twice the risk of an outcome of death than elderly persons who were not exposed to this situation. This corroborates the findings of other authors[16], who affirmed that the disorders that most affected the elderly in ICUs were neurological, cardiovascular, respiratory, gastrointestinal and renal /metabolic.

Hospitalized elderly persons with a clinical history of neoplasms had a 1.61 times greater risk of death than the elderly who did not have the clinical diagnosis of this disease. Elderly cancer patients are a significant presence in the ICU, and increased age means there is a greater chance that neoplastic disease will be present in more advanced stages[17].

Just as respiratory disorders were significantly associated with a risk of death risk, so ventilatory support was included in the instrument as a predictor of a worse prognosis, with a high risk of death. Elderly patients who used a Venturi mask were 1.87 times more likely to evolve to death in the ICU and those who used IMV were 1.82 times more at risk than those who did not use such breathing modalities. Previous studies also identified the latter as an important risk factor for the negative prognosis of elderly patients admitted to the ICU[18,19].

In terms of the Glasgow coma scale, it was observed that elderly persons with a moderate score had a 1.48-fold greater risk of death, while elderly individuals with a score between 3 and 8 had a 1.33 times greater risk.

Regarding age group, elderly persons aged 80 years or more were 1.42 times more likely to evolve to death than younger elderly individuals. Scholars have identified age as a factor related to higher mortality[5], but warn that age on its own should not be related to a worse prognosis[8,9]. Other associated factors, such as the severity of an acute illness, comorbidities and functional status appear to be more responsible for such an outcome[8,9].

The use of vasoactive drugs was identified as another important factor of mortality, with elderly people who used this type of drug during the first 24 hours of hospitalization having a 1.41 times greater chance of death than elderly individuals who did not, corroborating the findings of a previous study cited in literature[20].

The risk of mortality of elderly persons with a history of delirium was almost double that of elderly persons without such a history. This factor is a major concern as it is a problem that commonly affects the elderly and is often underdiagnosed, and because it is associated with a serious and life threatening condition[21].

Medical teams should perform careful cardiac monitoring, as elderly patients with a heart rate (HR) higher than 100 bpm are 1.27 times more likely to progress to death, corroborating other findings which affirmed the existence of a "close correlation with HR values, with values above 110 bpm implying an almost 50% risk of death, and values below 69 bpm being associated with 15% of deaths"[22].

Glycemia below 70mg/dl was associated with a poor prognosis. The American Association of Clinical Endocrinologists (AACE) and the American Diabetes Association (ADA) propose the need for glycemic control in the ICU, in view of the results of more recent studies which have showed that hypoglycemia also increases mortality. Currently, the AACE and ADA suggest that glycemic levels lower than 100 mg/

dl should be avoided, and define hypoglycemia as corresponding to values below 70 mg/dl and severe hypoglycemia to values below 40 mg/dl[23].

An ICU stay of longer than six days was also among the variables that presented a risk of an unfavorable outcome in the ICU. This variable was left in the instrument as it was considered an additional risk factor for a negative prognosis for the elderly in the ICU. As it was not possible to assess this variable in the first 24 hours of hospitalization, it was applied to elderly persons with a hospitalization time of more than six days. In a study carried out with elderly patients who developed severe sepsis and septic shock, the length of ICU stay was also related to death[13,20].

From the identification of the factors related above it was possible to develop a score-based prognostic evaluation instrument using a points scale. The overall score totaled 33 points, and according to the ROC curve, the probability of death increases considerably with scores equal to or greater than 9 points. It should be pointed out that for some variables that are grouped together the score is allocated to only one of the variables, such as age, ventilatory support, Glasgow coma scale classification and reason for hospitalization.

In addition to the aforementioned factors, the instrument included the variables age range, categorized from 70 to 79 years, and a reason for hospitalization of infection/sepsis. We chose to include these variables as we consideried them to have major biological plausibility, and other studies have identified them as risk factors for the mortality of the elderly in the ICU[13,20]. A lower score was considered for both, however, considering that they represented a lower risk.

Finally, risk was classified as the low, moderate, high or very high possibility of the elderly having an outcome of death in the ICU. The elderly classified as at high or very high risk were observed to have a high mortality rate.

The outcome of death was common (≥10%) in the present study, justifying the use of the Poisson model, which is more conservative when using relative risk than other statistical methods, such as logistic regression, which uses the odds ratio, and in this situation overestimates RR.

The instrument of prognostic evaluation constructed in this study is suitable for predicting the prognosis of the elderly in ICUs, as it presents an area under the ROC curve of 0.78, with acceptable power of discrimination, and proved itself sufficiently consistent for a reasonable degree of accuracy in predicting the risk of mortality of elderly persons hospitalized in ICUs. American indices developed for the elderly in ICUs identified an area of 0.7 when using SAPS II and a 0.7 classification tree[24].

The fact that the instrument used in this study was not compared to a severity index previously used in an ICU, which is considered a gold standard, may represent a limiting factor. However, the authors intend to carry out additional studies among similar populations, as well as to validate the instrument proposed and constructed in this study.

CONCLUSION

The instrument developed in this study appears to be adequate, objective and easy to apply, with good sensitivity and specificity for identifying the risk of mortality of elderly persons in ICUs. It may be useful in the identification of elderly individuals with risk factors that require greater care, and can therefore be applied in such units.

The identification of the risk of mortality of the elderly in ICUs is important for the support it provides to professionals and, together with institutions, offers the opportunity to evaluate the clinical and hospital practices that may be related to unfavorable outcomes in such units, thus contributing to care planning and early intervention strategies.

It should be emphasized that the instrument developed here is simple to apply, including with respect to its objective variables. It is easy to interpret and its results are easy to identify, and it costs health services nothing. It has a very small number of variables, and can be easily used by nurses, physicians and physiotherapists working in ICUs. Its applications allow the evolution and response of the

elderly to the therapy performed during their stay in the ICU to be monitored.

As there is growing demand for the hospitalization of the elderly in Brazilian ICUs, the proposal to construct an instrument to assess the prognosis risk of such individuals, as well as being innovative, aims to meet a need arising from this reality.

It is important to carry out additional studies of similar populations, as well as to validate the instrument constructed and proposed in this study.

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Quality of life based on level of physical activity among elderly residents of urban and rural areas

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Abstract

Objective: To analyze quality of life (QOL) according to level of physical activity among elderly persons living in rural (RA) and urban (UA) areas. *Method:* A descriptive cross-sectional study, analyzing 358 elderly residents of RA and 139 of UA, in the municipal region of Palmas, Paraná, Brazil was performed. Quality of life, level of physical activity and economic condition were evaluated. For the analysis of the continuous variables, the student's t-test or the Mann-Whitney test were used, based on the normality or otherwise of the data. Pearson's chi-squared or Fischer's exact test were used to analyze the categorical variables. *Results:* The general perception of QOL reported in RA was better than in UA ($p<0.05$). The analysis of the level of physical activity according to place of residence showed that the elderly are more physically active in RA ($p<0.05$), whereas insufficiently active or sedentary subjects prevail in UA. The variables age and gender were not associated with QOL ($p>0.05$), irrespective of place of residence, and active elderly persons had better QOL scores than insufficiently active or sedentary individuals, again irrespective of place of residence ($p<0.05$). *Conclusion:* The present study provides evidence that QOL is positively influenced by both maintaining satisfactory levels of physical activity and by residing in RA. It is important to establish public policies aimed at ensuring a more active and independent old age, thus generating greater health and quality of life.

Keywords: Health of the elderly. Aging. Quality of Life. Motor Activity.

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INTRODUCTION

Quality of life (QoL) is understood by the World Health Organization[1] from a multidimensional perspective associated with objective and subjective factors, based on criteria of individual satisfaction and collective well-being, reflecting the perception of individuals with what is described as their level of satisfaction with their basic needs, economic development, social integration, the quality of the environment in which they live, their opportunities in life and access to services, as well as issues referring to happiness, love, satisfaction with life and personal fulfillment[2-4].

The elderly population in Brazil has undergone rapid growth, and in the coming years the country will have the sixth largest population of people aged over 60 in the world[5]. One result of this phenomenon has been an increase in the number of elderly people in urban areas in comparison with other age groups, with a decrease in the elderly population in rural areas[6]. According to an IBGE report, this greater urban concentration has the following causes: the process of industrialization, better living conditions and access to services, especially health care, and the movement of the elderly to urban centers because of relatives who are established in the cities[7]. In view of the new challenges imposed by this reality, it is necessary to find strategies that ensure that this phase of life is lived with independence, autonomy and quality of life, in which the regular practice of physical activity (PA) can play an important role.

Physical activity has been described as fundamental to health and QoL gains in various phases of life, especially after the age of 60, when the level of PA decreases with age, with possible deleterious effects on the QoL of the elderly[8,9].

Living in rural areas (RA) and urban areas (UA) presents differences that can directly impact the life of the elderly. In RA, physical activities can differ both in relation to the level of work and the type of activity performed. There are more occupational activities, predominantly agricultural labor (family farming, extensive or subsistence), domestic activities, livestock, vegetable extractivism, and beekeeping, among others. Activity in UA is more focused on the development of technology and information, where the elderly tend to group together in centers of coexistence and reduce their work and domestic activities. These factors, associated with other aspects such as socioeconomic and educational inequalities, can influence the practice of physical activity and QoL differently in rural and urban populations[10-13].

Studies about the living conditions of the elderly in the rural or urban environment are extremely important, and can subsidize actions and policies aimed at promoting the quality of life of these populations[14]. The present study therefore aimed to analyze quality of life based on the level of physical activity of elderly persons living in urban and rural areas in the municipal region of Palmas, in the state of Paraná, Brazil.

METHOD

A quantitative, cross-sectional descriptive study was performed of elderly residents of the municipal region of Palmas, located in the southwest region of the state of Paraná, Brazil.

A minimum sample size was calculated considering an elderly population of the municipal region of 3,236 subjects (finite population), with a sample error of 5% and a confidence level of 95%. Subjects who did not reach a minimum score in the Mini Mental State Exam (MMSE), have the required educational level[15], or who were not located at home on two attempts were excluded from the study. In these cases, a new subject was randomly selected until the desired number was reached.

The individual registration numbers of the elderly persons provided by the Health Department of the municipal region of Palmas were used to select the sample. All the elderly individuals were randomly selected based on their registration number using a random number table. The subjects selected represented 15 urban districts and 13 rural localities or settlements from the urban region and were interviewed in their homes.

Each individual selected to form part of the sample was contacted in advance and the objectives and procedures of the study were explained. Once the elderly person agreed to participate, the day and time when he or she would receive a visit from an evaluator at home was scheduled. On the day of the

interview, each subject was again informed about the study procedures and signed a Free and Informed Consent Form immediately before responding to the survey instruments. The research project was approved by the Ethics Committee on Research involving human beings of UNOCHAPECÓ/SC (Approval n° 048/13).

Initially, an assessment of cognitive status was performed with the Mini Mental State Exam (MMSE)[15]. A quality of life assessment was then carried out using two instruments: the Whoqol-Bref Quality of Life Questionnaire – reduced Portuguese version[16] and the Quality of Life Assessment Questionnaire adapted for the elderly, Whoqol-Old, Portuguese version [17].

The level of the practice of physical activity and economic condition were then evaluated. For these, the International Physical Activity Questionnaire Short Version (IPAQ)[18] and the ABEP[19] economic classification questionnaire, respectively, were used. For analysis of the level of the practice of physical activity, two categories were defined: a) Insufficiently Active or Sedentary (IAS): elderly persons who reported not practicing any physical activity, or less than 150 minutes of physical activity per week; b) Active (A): those who reported more than 150 minutes of weekly physical activity. For the evaluation of economic condition, which estimates the purchasing power of individuals and families and divides them into economic classes, the elderly were placed in two categories: upper mean income (UMI) which included subjects from classes A and B and lower mean income (LMI) for those in classes C, D and E.

Prior to the beginning of data collection, 25 evaluators were trained to use the instruments mentioned above, and then participated in a pilot study in which 20 elderly people from the Instituto Federal do Paraná (IFPR) (Paraná Federal Institute) (IFPR) swimming program, Palmas Campus, were evaluated. Data collection occurred from June to August 2013. When inconsistent data were found, they were verified in the data collection sheet and corrected.

For analysis, data were presented as mean and standard deviation (for continuous variables) or frequency and percentage (categorical variables). The normality of continuous data was verified using the Kolmogorov-Smirnov test. Analysis of the association between level of physical activity and place of residence was performed using the Pearson Chi-squared test. The Mann-Whitney test was used for comparisons of the QoL domains assessed by the Whoqol-Bref and Whoqol-Old according to place of residence. In order to analyze the general perception of quality of life (assessed by the two instruments) according to level of physical activity and place of residence, the subjects were classified as: insufficiently active or sedentary in the rural area, active in the rural area, insufficiently active or sedentary in the urban area and active in the urban area. The comparisons between these categories were performed using the Kruskal-Wallis test and when statistically significant differences were found, the variables relating to the general perception of QoL were classified (ranked) and the Least Significant Difference (LSD) test for multiple comparisons was applied. The alpha or significance level was determined *a priori* as $p \leq 0.05$.

RESULTS

The sample of the present study consisted of 497 elderly persons; 358 residents of urban areas (age 70.51±7.21 years) and 139 residents of rural communities and settlements (age 69.15±7.91 years), with 57% of the total sample being female (Table 1).

An evaluation of quality of life using the Whoqol-Bref based on place of residence (Table 2) showed that subjects living in the rural area had a more positive perception of quality of life in relation to the psychological domain, social relationships and the environment ($p<0.000$). However, the scores of the elderly for the physical domain and the overall mean of the instrument did not differ significantly ($p> 0.05$) based on place of residence.

When the Whoqol-Old instrument was used to evaluate QoL, both overall quality of life and quality of life assessed through the Autonomy, Past, Present and Future Activities, Social Participation, Death and Dying, and Intimacy domains were perceived more positively by elderly residents in rural areas ($p<0.001$). The perception of quality of life assessed through the sensory abilities domain was more positive for elderly persons living in the urban environment ($p>0.05$).

The overall perception of QoL scores of the elderly assessed by the Whoqol-Bref did not differ significantly between the groups ($p>0.05$), whereas in overall analysis by Whoqol-Old, the rural elderly presented significantly greater values ($p<0.000$) than the elderly living in urban areas (Table 2).

Table 3 shows that level of physical activity was significantly associated with place of residence ($p<0.000$), with the data revealing that active elderly persons predominated in the rural environment (66.91%), while 51.7% of individuals in urban areas were insufficiently active or sedentary.

Table 1. Characterization of subjects of sample based on gender, income and place of residence. Palmas, Paraná, 2014.

	Urban areas		Rural areas	
	Upper Mean Income	Lower Mean Income	Upper Mean Income	Lower Mean Income
	N (%)	N (%)	N (%)	N (%)
Male	21 (15.1)	118 (84.9)	1 (1.4)	72 (98.6)
Female	37 (16.9)	182 (83.1)	0 (0.0)	66 (100.0)
Total	58 (16.2)	300 (83.8)	1 (0.7)	138 (99.3)

Table 2. Comparison of mean quality of life scores of elderly residents in rural and urban areas. Palmas, Paraná, 2014.

Perception of QoL	Quality of life domains	Rural areas	Urban areas	p*
Whoqol-Bref	Physical	3.33 (±0.74)	3.31 (±0.65)	0.892
	Psychological	3.82 (±0.49)	3.51 (±0.55)	0.000
	Social Relations	3.88 (±0.57)	3.60 (±0.63)	0.000
	Environment	3.37 (±0.48)	3.10 (±0.62)	0.000
	Overall mean of instrument	3.53 (±0.75)	3.54 (±0.72)	0.983
Whoqol-Old	Sensory Abilities	3.08 (±0.50)	3.27 (±0.41)	0.000
	Autonomy	3.78 (±0.56)	3.33 (±0.76)	0.000
	Past. Present and Future Activities	3.72 (±0.57)	3.46 (±0.67)	0.000
	Social Participation	3.64 (±0.60)	3.31 (±0.64)	0.000
	Death and Dying	4.35 (±0.89)	3.89 (±0.93)	0.000
	Intimacy	3.88 (±0.68)	3.47 (±0.85)	0.000
	Overall mean of instrument	3.74 (±0.35)	3.46 (±0.50)	0.000

Mann Whitney Test (*$p<0.05$)

Table 3. Percentage distribution of subjects of sample based on place of residence (rural and urban areas) by level of physical activity. Palmas, Paraná, 2014.

	Rural areas*	Urban areas
	N (%)	N (%)
Active	93 (66.9)	173 (48.3)
Insufficiently active or sedentary	46 (33.1)	185 (51.7)
Total	139 (100)	358 (100)

Chi-squared test (*$p < 0.000$).

Analysis of quality of life according to place of residence and level of physical activity (Table 4) found that physically active elderly persons in the urban environment had significantly higher overall quality of life scores than the insufficiently active or sedentary elderly (p <0.05), regardless of the instrument used. In contrast, the general perception of quality of life in rural areas was not significantly statistically different between the active and insufficiently active elderly groups for either instrument used (p>0.05).

The analysis of quality of life with the Whoqol-Bref (Table 4) did not reveal significant differences in the overall perception of quality of life among active rural and urban elderly persons, or between insufficiently active or sedentary persons from the two environments (p>0.05). However, when the Whoqol-Old was used, active and insufficiently active or sedentary elderly people in rural areas had a significantly higher overall perception of quality of life than their respective urban counterparts (p<0.05).

Table 4. Comparison between overall levels of perception of quality of life among rural and urban elderly persons in the municipal region and place of residence. Palmas, Paraná, 2014.

	Whoqol-Bref		*p*	*Whoqol-Old*		*p*
	Active	IAS		Active	IAS	
Rural areas	3.60 (±0.75)	3.39 (±0.74)	.274*	3.77(±0.43)	3.70(±0.25)	0.360*
Urban areas	3.69 (±0.64)	3.40 (±0.76)	.000*	3.67(±0.44)	3.30(±0.61)	0.000*
P	0.330*	0.762*		0.002*	0.000*	

IAS = Insufficiently active or sedentary; The test used for comparisons was Kruskal-Wallis (p<0.05); **Post-hoc* LSD for multiple comparisons between categories: sedentary or insufficiently active from rural areas, active from rural areas, sedentary or insufficiently active from urban areas and active from urban areas.

DISCUSSION

One of the main findings of the present study was the fact that the elderly from RA reported a better general perception of quality of life than their peers in the urban zone. In the comparison, it was observed that the RA elderly scored higher in the psychological, social relations and relations with the environment domains of the Whoqol-Bref, and also in aspects such as autonomy, past, present and future activities, social participation, death and dying, intimacy, and overall Whoqol-Old score, than the elderly from UA, or in other words, in the perception of practically all the analyzed questions.

This finding can be explained in large part by the fact that in the municipality of Palmas, Paraná, rural communities are mainly based on family agriculture and timber extraction. In such cases, it is understood that the social structure and arrangements of this environment offer greater social and familial conviviality, more active participation in the community, elevated autonomy and improved performance of daily physical activities, in which the productive life of the elderly persists for longer. Even after retirement, elderly persons continue to perform work, remaining productive and active, which may have contributed to the more positive perceptions of QoL of this group[20].

A study on the environmental and health conditions of urban and rural elderly persons in the northeast of Brazil found that the average income of the elderly in both rural and urban areas is one minimum wage. However, for the urban elderly, this represents the main source of income and, in many cases, financial support for their family, while for the rural elderly it is a complement to the other benefits of work, which are mainly related to agricultural activities[21].

A study carried out in Portugal on the psychosocial conditions of the elderly concluded that place of residence plays a fundamental role in the concept of quality of life of the elderly, as the rural environment instills less pressure on the elderly,

due to the closeness of the family context and greater activity, whereas greater inactivity and isolation of the elderly was observed in urban environments[22]. Similarly, results have been found that show that urban elderly persons are more prone to develop depression due to loneliness, and which identify a better quality of life in the rural environment, which may have occurred with the group studied in the present work[23].

Research into the organization of rural settlements and citizenship stresses that the family agriculture model is based on collective work, with the elderly participating more in the carrying out of daily activities, maintaining a social role in the community where they reside[24].

The highest score in the Whoqol-Bref was in the social relations domain, both in RA and RU, a finding which occurred in other surveys of the elderly[3,25]. These studies attribute this result to the good network of support and social relations of elderly persons, especially in the rural environment. In a study of elderly people of both genders, rural individuals presented better results than their urban counterparts in all the domains of the Whoqol-Bref (overall and in the physical, psychological, social and environmental domains)[23].

The results of a comparative study between rural and urban elderly persons that surveyed both QoL and social support found more positive levels of both physical functioning and social support among rural individuals[26]. It has also been shown that social networks in urban environments are smaller than in rural areas and that the most significant aspects were frequent contact with relatives, identity with environment and the feeling of belonging to a social group, factors that may also be attributed to the results of the present study, as the rural elderly live mostly in settlements or communities, in direct and daily contact with their relatives[21,23,27].

In addition to the described conditions, it is believed that greater access to public health and social policies and improved hygiene, transportation and communication conditions, among other factors, have diminished the differences between these regions and, consequently, a better perception of QoL, especially in rural areas[25].

In the Whoqol-Old, the facet that presented the highest score in both the rural and urban territories was death and dying, an outcome also identified in another study with the elderly[28]. This facet analyzes concerns, fears, and concerns about approximation to death. It is believed that this result is due to average age, which was close to 70 years, a period in which individuals understand they have a significant portion of years of life remaining, and partly because there they are not concerned with this fact. In RA, the lowest score found was in sensory abilities, a facet that analyzes sensory capacity and the impact of the loss of sensory abilities. Despite improved access to health services, the elderly require a wide network of care, something which has not yet been satisfactorily established in RA, and the absence of which can lead to greater impairment in this aspect, due to the lack of, for example, specialized care[29].

In Palmas, Paraná, the location of this study, the situation described by these authors is confirmed. Although there are Family Health teams that cover rural communities, it was noted that elderly residents of these areas have difficulties accessing specific services when affected by an illness, unlike in urban areas. This factor was also highlighted by the aforementioned authors, who point out that there is still a great discrepancy between the access to health services of elderly people residing in UA and RA.

In urban areas, the factor with the lowest score was social participation, which analyzes the possibilities of participation in daily activities, mainly in the community, of the elderly. In a study of the contribution of physical, psychological, social and environmental domains to quality of life of 211 elderly people from the southeast of Brazil, it was demonstrated that the environment in which the elderly live directly influences QoL[28]. Thus, in unsafe environments, such as urban centers, where there are increasing levels of violence, the elderly are unlikely to go out alone. Research into the perception of QoL of the elderly showed that the reduction of social participation increases the possibility of isolation and susceptibility to health problems and diminishes perception of quality of life[30], which may have caused this response in the studied group, as a significant number of elderly individuals were alone in their homes during the interviews.

Another important result of this study was that the urban elderly persons have better economic conditions than rural individuals (Upper Mean Income = 16.2% and 0.70%, respectively), despite the overall average income being low (88.1% of the total). Another study by Martins et al.[27] evaluated the subjective quality of life of 284 elderly people, 125 of whom were residents of 11 rural municipal regions in the state of Paraíba and 159 of whom lived in the capital, João Pessoa. For these authors, a lower income meant a greater propensity of having a negative perception of QoL, while an increase in income was associated with higher QoL scores. In the evaluated group, financial status was considered the main interference factor for the perception of QoL. However, the number of low-income rural subjects in the present study did not allow us to make comparisons with urban individuals based on this variable.

A study on access to and the use of health services by rural elderly people, based on IBGE data, concluded that in UA there is greater ease of access to health services and higher incomes, which facilitates a positive view of quality of life[31]. Another related factor refers to income, which is generally higher in urban environments, allowing the acquisition of consumer goods and the practice of sports and leisure activities, positively affecting QoL[32]. Other evidence found in this study was that there is a greater proportion of active elderly persons in RA (66.91%), while in UA there are more older individuals who are insufficiently active or sedentary (51.67%). Araújo et al.[20] emphasized that even with the onset of old age, the elderly maintain a certain link with previous activities, which allows greater ease of accomplishment of daily tasks and a better perception of QoL. In the urban environment, situations in which the subject continues to carry out the same activities are rare, as there is a great change in daily life upon retirement. Due to the characteristics of the population of the present study, the effective participation of rural elderly persons in the extraction of timber and agricultural activities was identified, and it is believed that this may partly explain the higher indices of physical activity found, which positively affect levels of independence and health. Level of PA has been described as fundamental to maintaining autonomy, independence and functional capacity, as well as in the delay or reversal of ongoing pathological processes, and may also provide psychological benefits such as improved self-esteem, creativity and healthy and active aging. The greater the difficulties in independently performing tasks of daily life, the worse the conception of quality of life[33,34].

Another relevant finding was that, when analyzing the overall mean scores of the Whoqol-Bref, being active in the UA seems to influence the perception of QoL to a greater extent, while being insufficiently active is unfavorable to the individuals' opinion of their QoL. Being active in both RA and UA resulted in a similar perception of QoL. However, when analyzed with the Whoqol-Old, active and IA elderly persons from RA had significantly higher scores than those from UA. A study of QoL and self-concept in aging in relation to physical activity found a significant association between the level of PA and the quality of life of the elderly[35]. While there are studies that relate QoL to levels of physical activity, we did not find any work in literature that made such a comparison between rural and urban elderly persons.

The fact that IA subjects present lower scores than active individuals may be related to the fact that those who are insufficiently active or sedentary who are in the transition period between a physically active level and a decrease in such level may feel the effects of the loss of capacity more, while sedentary individuals have already come to accept this situation and may be adapted to other types of tasks, where PA is not considered of primary importance to QoL.

It was noted that in the present study, especially in RA, that although elderly individuals lose part of their labor capacity for more intense activities in the field, they tend to continue in these tasks and remain active, which may have influenced the results. In UA, the change in the characteristics of PA affects QoL, as active and IA elderly persons perceived their QoL differently. This factor may be associated with the fact that sedentarism has been associated with low levels of autonomy, which interferes with the social participation of the elderly and significantly affects positive or negative perceptions of life, depending on the context in which the subject is inserted. It is believed that, upon retirement, especially in UA, a greater rupture occurs in the daily performance of activities, which

may impact on social insertion, directly affecting the perception of QoL. It is important to note that the active elderly, irrespective of their environment, had higher scores than those who were insufficiently active or sedentary, even though in some cases there was no statistically significant difference, indicating that the maintenance of an active life positively affects perception of quality of life, regardless of place of residence.

Due to the transversal character of the present study, it was not possible to explain the variability of factors that may affect perception of quality of life, which represents a limitation of this study and, at the same time, a possibility for continuity and the longitudinal follow-up of these individuals, as evaluation of the same human being may provide temporal variations.

More studies are needed to elucidate the causes of high rates of physical inactivity among the elderly, in order to plan actions to encourage a more active life. In spite of the previously mentioned potential limitations of the present study, analysis of the data showed that living in rural areas and remaining active is a factor that interferes positively in the perception of QoL of the elderly.

CONCLUSION

Older residents of RA have better quality of life scores in most Whoqol-Bref and Whoqol-Old domains and are more physically active than their UA-resident peers. It is understood that this result is associated with the way in which social arrangements are organized in rural and urban environments and the fact that work activities in RA are maintained for a longer period of time than in the urban space.

In conclusion, there are important differences between the QoL of the elderly living in rural and urban environments, and levels of physical activity, both in rural and urban areas, are associated with higher QoL scores. Thus, it is important to emphasize the importance of maintaining an active lifestyle, regardless of place of residence, to maintain and/or improve quality of life.

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Subjective and psychological well-being among elderly participants of a University of the Third Age

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Abstract

Objective: The present study aimed to analyze the distribution of measures of subjective and psychological well-being according to demographic criteria and length of participation in the program. *Method:* A cross sectional study using the following instruments was carried out: a sociodemographic questionnaire (age, gender, education, length of participation in University of the Third Age (U3A) and similar programs located in the city of São Paulo, Brazil; an Overall Life Satisfaction Scale; a Life Satisfaction Scale that contemplated four domains: health, physical capacity, mental capacity and social involvement; a Positive/Negative Affect Scale; and a Personal Development Scale. The data were analyzed by the chi-squared test (for comparison of categorical variables), the Mann-Whitney and the Kruskal-Wallis U tests (for comparison of continuous variables). *Results:* Age and gender were the main factors that were significantly associated with overall life satisfaction, life satisfaction in specific domains, and morale. Higher education was associated with psychological adjustment. *Conclusion:* Participating in a U3A contributes to high levels of subjective and psychological well-being. Elderly individuals of more advanced ages and men had higher rates of satisfaction with life and positive feelings. The elderly can assess their development trajectory, their commitment to society and consider their efforts in pursuing an ideal of personal excellence.

Keywords: Subjective well-being. Psychological well-being. Elderly. Third Age Universities.

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INTRODUCTION

The early 1960s saw major ideological changes in the field of gerontology. Old age and aging were no longer synonymous with disease, inactivity, and a general contraction in development. Since this time, gerontology has also investigated the positive aspects of old age, based on the view that it is possible to maintain well-being and quality of life even at advanced ages[1]. It was in this context that the term successful old age emerged, which includes among its several associated concepts those related to psychological well-being – positive mental health, which includes self-acceptance, mastery over one's environment, positive relationships with others, purpose, personal growth and autonomy[2] – and to subjective well-being – general satisfaction with life and specific domains of functioning, such as health and social relationships, activity, social integration, sense of control, and sense of meaning of existence[3].

The study of subjective well-being (SWB) seeks to understand people's assessment of their lives and has flourished with the growing recognition of the importance of subjectivity in assessing what makes life good and desirable. According to Diener and Louis[4], the indicators of SWB are satisfaction with life, positive and negative emotions. Emotions refer to the evaluation of SWB by affective criteria and are relatively less stable than satisfaction. The satisfaction with life dimension is the cognitive judgment of a specific domain in a person's life; an assessment of life according to one's own criteria. The judgment of satisfaction depends on a comparison between the individual's life circumstances and a standard chosen by the individual themselves[5].

In the late 1980s, the significant amount of research on SWB, mainly by scholars from various fields of psychology, resulted in a crisis in defining the concept and a subdivision into subjective well-being and psychological well-being. In this same period, the North American psychologist Carol Ryff presented critical studies on the construct in the field of psychology. For this author, the perspective of well-being that translates to happiness and that which translates to personal excellence belong to different domains and must be analyzed based on different philosophical perspectives[2,6].

According to Ryff[6], an alternative and multidimensional model of psychological well-being (PWB), derived from theoretical and empirical discussions, encompasses six components: a) the meaning, purpose and direction people give to their lives; b) living according to their own personal convictions (autonomy); c) using their personal talents and their potential (personal growth); d) managing life situations (mastery over one's environment); e) maintaining deep and meaningful ties with others (positive relationships), and f) self-knowledge, including awareness of personal limitations (self-acceptance).

The last few decades have witnessed major advances in the psychology of aging and intriguing discoveries regarding the well-being of individuals experiencing the final stage of life. Unpublished findings based on the perspective of lifespan (development throughout life) have generated new insights into the dynamics of well-being throughout life and on the factors that influence its maintenance or decline in old age. One of the most interesting findings was synthetically denominated in the 1990s as the "well-being paradox"[7]. This paradox brings together data showing that in old age SWB and the sense of maturity, or PWB, do not seem to decline despite the challenges and losses associated with age, and gains or increases in these indicators can be maintained[8,9].

Data from the English Longitudinal Study of Ageing (ELSA) show that the elderly have higher levels of SWB than middle-aged adults. Life satisfaction is greatest in older groups especially when controlled for marital status and health. The authors conclude that these results are probably due to the adaptive nature of the SWB assessment measures, showing that even in the face of declining health, the elderly become more satisfied and happier with their situation than when they were younger[10].

In old age, successful adaptation is linked to the balance between positive and negative affects, the selection of positive targets for affective and cognitive investment, the reduction of the intensity and variability of positive and negative emotional experiences, and a greater ability to experience more complex emotional experiences, to name and understand one's own emotions and the emotions of

others, and to select social partners who represent an opportunity for emotional comfort (rather than information and status, which are typical themes of youth and adult life)[11].

It is known that for the elderly, social contacts are motivated by events that provide well-being and meaningful social interactions which offer emotional support. Regularly maintained social contacts are those that possess greater significance as mediators of social support. In this perspective, the promotion of educational programs aimed at this age segment stands out. Such programs have an important role to play in the establishment of SWB for the elderly, since they can provide physical and mental activities, meaning and satisfaction with existence, both through the commitment and social responsibility implicit within them, and the opportunity to acquire and update knowledge and maintain a social life[12].

In view of results previously published in literature, the present study aimed to verify indicators of subjective well-being and psychological well-being among elderly students attending the Universidade Aberta à Terceira Idade da Escola de Artes, Ciências e Humanidades (the Open University of the Third Age of the School of Arts, Sciences and Humanities) (UnATI EACH). The emphasis on well-being was aimed at describing the sample of elderly people according to sociodemographic criteria (age, gender, schooling) and time of participation in the UnATI EACH and other programs of this type.

METHOD

A cross-sectional study was performed. All the students enrolled in the UnATI EACH who could read and write were included, while the elderly with cognitive deficits suggestive of dementia and/or those with severe hearing or vision deficits, making communication and comprehension difficult, were excluded. The total number of students enrolled was 307, and when the inclusion and exclusion criteria were applied, the sample corresponded to 265 elderly people.

After public disclosure of the approval of the research project, the stages of the study were defined by six professors from the Bachelor's Degree in Gerontology of the EACH who established the research protocol, with one senior individual responsible for the entire process, from the creation of the research plan to the implementation of the entire schedule established by the partnership agreement. These six professors trained 20 students who agreed to act as research assistants.

Of these 20 research assistants, three students from the previous semester with the most experience were appointed as tutors of the others.

Instruments validated for the Brazilian elderly population were used, selecting the psychosocial variables of interest related to SWB and PWB:

Sociodemographic data

a) The independent variables age, gender and schooling; B) The time of participation in UnATI EACH; C) Participation in other Universities for the Third Age (U3A) or Social Centers.

SWB Measures

a) Scale for the measurement of Overall Satisfaction with Life: single item scale that asks for the evaluation of this condition on a scale of 1 to 10, presented graphically (1=the worst life and 10=the best life); b) instrument for the measurement of Satisfaction with Life based on three domains: health and physical capacity, mental capacity and social involvement. Assessment is based on a five-point scale ranging from very unsatisfied to very satisfied; c) Positive and Negative Affect Schedule (PANAS): on a scale ranging from 1 (not at all) to 5 (very much), the subject is asked to evaluate their positive mood, composed of six expressions (happy, cheerful, excited, well, satisfied, contented) and their negative mood, indicated by eight expressions (irritated, demotivated, distressed, depressed, upset, nervous, sad, discouraged).

Measures of PWB

The Personal Development Scale (PDS), originally, contained 18 items corresponding to the six domains of PWB, as described by Ryff[2]:

positive relations with others, personal growth, self-acceptance, autonomy, purpose in life and environmental mastery, and 12 items corresponding to three domains of generability - create, maintain and offer. Each item is rated by a five-point scale (1-very little, 2-little, 3-fair, 4-much, 5-very much). A methodological study of the instrument revealed a factorial structure containing five factors composed of 25 items, which explained 54.04% of total variability. These factors were denominated: self-realization, personal growth and psychological adjustment (Factor 1); Productivity (Factor 2); Care (Factor 3); Concern for the next generations (Factor 4) and Commitment to others (Factor 5). Analysis of the internal reliability of the scale as a whole and of each of the factors resulted in satisfactory scores for the total scale (α=0.90) and for Factors 1 (α=0.89), 2 (α=0.72), 3 (α=0.67), 4 (α= 0.68) and 5 (α=0.64).

The chi-square test was used to compare the categorical variables, and when there were three categories or more to be analyzed, the chi-square test for multiple samples was used. The Kolmogorov-Smirnov test identified the absence of normal distribution of the continuous variables which therefore required non-parametric tests. Therefore, the Mann-Whitney and Kruskall-Wallis U-tests, respectively, were used to compare the continuous variables between two or three groups. In the Kruskal-Wallis test, the multiple comparison test (Multiple Comparisons z' values) was used when a *p*-value <0.05 was obtained.

The level of significance adopted for the statistical tests was 5%, resulting in a *p*-value<0.05.

The research plan was approved by the Ethics Research Committee of the Instituto de Psicologia of the Universidade de São Paulo (the Psychology Institute of the University of São Paulo), under approval number 2010.043. The subjects agreed to participate by signing a Free and Informed Consent Form. The present study complied with Resolution nº 196/96 on Regulatory Directives and Guidelines on Research involving Human Beings.

RESULTS

Table 1 shows that men scored higher than women in the health (mean= 3.90, sd±0.72) and mental (mean = 4.05; sd ± 0.77) domains of the Domain Related Satisfaction Scale. They also presented an overall positive result in terms of Affect (mean=4.16; sd±0.52).

Table 2 reveals that there were statistically significant differences when the elderly of different age groups were compared: elderly persons aged equal to or greater than 70 years scored higher in the Overall Satisfaction with Life Scale (mean=73.57; sd±3.94) than the elderly aged 60 to 64 years. -

The results show that, with the exception of educational level, the elderly were statistically the same in relation to the other socio-demographic variables and well-being, as shown in Table 3.

Elderly persons with different times of participation at the UnATI EACH were statistically equal in relation to the other socio-demographic variables and well-being, as shown in Table 4.

In order to analyze the impact of participation time on the subjective and psychological sense of wellbeing among UnATI EACH participants, the elderly were separated into two distinct groups: students with a participation time equal to or greater than one semester were enrolled in the Veterans group, while those who had never participated in the activities offered by UnATI EACH were described as First-years. Elderly persons with different participation times were statistically different, as can be seen in Table 5.

Table 1. Sociodemographic variables and well-being among male and female elderly persons. São Paulo, UnATI EACH, 2010.

Variable	Gender		
	Male	Female	
	Mean(±sd)	Mean(±sd)	*p*-value*
Age	67.22 (±5.61)	66.97 (±5.43)	0.759
Schooling	10.88 (±4.89)	9.69 (±4.56)	0.040*
Time of Participation			
UnATI EACH-USP	1.89 (±2.03)	2.11 (±2.18)	0.464
Other U3A or Social Centers	1.17 (±3.01)	3.19 (±6.18)	0.002*
Overall Satisfaction with Life Scale			
OSL/Total	8.17 (±1.47)	8.29 ± (1.53)	0.408
Domain Related Satisfaction Scale			
Health	3.90 (±0.72)	3.74 (±0.67)	0.044*
Physical Capacity	3.84 (±0.71)	3.86 (±0.66)	0.912
Mental Capacity	4.05 (±0.77)	3.84 (±0.67)	0.011*
Social Involvement	3.80 (±0.83)	3.92 (±0.78)	0.151*
DRS/ Total	3.91 (±0.61)	3.85 (±0.48)	0.294
Affect Schedule			
Positive (PA)	3.88 (±0.53)	3.76 (±0.58)	0.083
Negative (NA)	1.64 (±0.66)	1.80 (±0.69)	0.066
A/Total	4.16 (±0.52)	4.02 (±0.58)	0.041*
Personal Development Scale			
Factor 1	4.21 (±0.42)	4.27 (±0.46)	0.183
Factor 2	3.60 (±0.68)	3.66 (±0.71)	0.468
Factor 3	3.97 (±0.61)	3.96 (±0.59)	0.904
Factor 4	3.68 (±0.92)	3.79 (±0.89)	0.331
Factor 5	4.03 (±0.76)	3.90 (±0.78)	0.206
PDS/Total	3.99 (±0.37)	4.04 (±0.42)	0.278

**p-value* related to chi-square test.

Table 2. Sociodemographic variables and well-being among elderly persons of different age ranges. São Paulo, UnATI EACH, 2010.

Variable	Age Range			
	60 to 64 years	65 to 69 years	70 years or more	
	Mean (±sd)	Mean (±sd)	Mean (±sd)	*p*-value*
Gender (Fem. %)	71.30%	62.32%	70.45%	0.413*
Age	61.98 (±1.43)[b,c]	66.67 (±1.28)[c]	73.57 (±3.49)	<0.001
Schooling	10.26 (±4.89)	10.75 (±4.47)	9.30 (±4.55)	01305
Time of Participation				
UnATI EACH-USP	1.78 (±1.99)	2.17 (±2.27)	2.26 (±2.19)	0.228
Other U3A or Social Centers	1.70 (±4.36)	3.12 (±5.56)	3.16 (±6.45)	0.498
Overall Satisfaction with Life Scale				
OSL/Total	7.92 (±1.55)[c]	8.41 (±1.35)	8.55 (±1.51)	0.009

to be continued

Continued from Table 2

Variable	Age Range			
	60 to 64 years	65 to 69 years	70 years or more	
	Mean (±sd)	Mean (±sd)	Mean (±sd)	*p*-value*
Domain Related Satisfaction Scale				
Health	3.65 (±0.69)[b]	3.92 (±0.73)	3.86 (±0.64)	0.025
Physical Capacity	3.81 (±0.58)[b]	4.04 (±0.74)[c]	3.77 (±0.71)	0.013
Mental Capacity	3.83 (±0.69)	4.04 (±0.77)	3.89 (±0.67)	0.140
Social Involvement	3.86 (±0.75)	3.86 (±0.93)	3.93 (±0.75)	0.823
DRS/Total	3.80 (±0.48)[b]	3.98 (±0.60)	3.88 (±0.50)	0.030
Affect Schedule				
Positive (PA)	3.68 (±0.64)[b]	3.91 (±0.51)	3.86 (±0.51)	0.018
Negative (PN)	1.95 (±0.78)	1.67 (±0.55)[c]	1.57 (±0.59)	0.001
A/Total (PA–PN)	3.91 (±0.64)[b.c]	4.15 (±0.46)	4.19 (±0.49)	<0.001
Personal Development Scale				
Factor 1	4.22 (±0.43)	4.32 (±0.43)	4.24 (±0.47)	0.424
Factor 2	3.64 (±0.68)	3.68 (±0.68)	3.61 (±0.74)	0.862
Factor 3	3.91 (±0.55)	4.08 (±0.60)	3.93 (±0.64)	0.106
Factor 4	3.75 (±0.96)	3.79 (±0.87)	3.73 (±0.86)	0.902
Factor 5	3.91 (±0.76)	4.01 (±0.77)	3.91 (±0.80)	0.668
EDEP/Total	4.00 (±0.39)	4.09 (±0.39)	4.00 (±0.42)	0.364

*p-value related to chi-square test; p-value related to Kruskal-Wallis test, followed by Multiple Comparisons z' values test: a. differs from 60 to 64 years; b. differs from 65 to 69 years; c. differs from 70 years or more; Factor 1: Self-realization, Personal Growth and Psychological Adjustment; Factor 2: Productivity; Factor 3: Care; Factor 4: Concern for next generations; Factor 5: Commitment to others.

Table 3. Sociodemographic variables and well-being among elderly persons with different degrees of schooling. São Paulo, UnATI EACH, 2010.

Variable	Schooling				
	0 to 4 years	5 to 8 years	9 to 11 years	12 or more	
	Mean (±sd)	Mean (±sd)	Mean (±sd)	Mean (±sd)	*p*-value*
Gender (Fem. %)	78.57%	68.49%	76.79%	59.57%	0.064*
Age	67.55 (±6.29)	67.47 (±5.16)	66.04 (±4.86)	67.11 (±5.68)	0.502
Schooling	3.76 (±0.80)[a.b.c]	6.89 (±1.14)[b.c]	10.36 (±0.82)[c]	15.12 (±2.98)	<0.001
Length of Participation					
UnATI EACH-USP	2.21 (±2.52)	2.01 (±2.06)	1.86 (±1.85)	2.10 (±2.19)	0.992
Other U3A or Social Centers	2.26 (±4.75)	3.15 (±6.53)	3.13 (±6.66)	1.88 (±3.83)	0.748
Overall Satisfaction with Life Scale					
OSL/Total	8.43 (±1.67)	8.42 (±1.52)	8.25 (±1.42)	8.04 (±1.48)	0.287
Domain Related Satisfaction Scale					
Health	3.77 (±0.75)	3.92 (±0.58)	3.77 (±0.80)	3.71 (±0.67)	0.436
Physical Capacity	3.90 (±0.53)	3.85 (±0.71)	3.96 (±0.76)	3.78 (±0.66)	0.497
Mental Capacity	3.77 (±0.70)	3.87 (±0.69)	3.88 (±0.74)	4.00 (±0.70)	0.204
Social Involvement	3.99 (±0.63)	3.89 (±0.86)	3.84 (±0.99)	3.85 (±0.68)	0.697
DRS/ Total	3.86 (±0.46)	3.90 (±0.51)	3.88 (±0.67)	3.84 (±0.47)	0.931
Affect Schedule					
Positive (PA)	3.74 (±0.55)	3.79 (±0.61)	3.82 (±0.55)	3.82 (±0.56)	0.884
Negative (NA)	1.73 (±0.64)	1.66 (±0.72)	1.73 (±0.65)	1.84 (±0.70)	0.189
A/Total	4.06 (±0.49)	4.11 (±0.60)	4.08 (±0.56)	4.02 (±0.58)	0.546

to be continued

Continued from Table 3

Variable	Schooling				
	0 to 4 years	5 to 8 years	9 to 11 years	12 or more	
	Mean (±sd)	Mean (±sd)	Mean (±sd)	Mean (±sd)	*p*-value*
Personal Development Scale					
Factor 1	4.22 (±0.46)	4.22 (±0.44)	4.23 (±0.42)	4.30 (±0.47)	0.411
Factor 2	3.59 (±0.71)	3.53 (±0.74)	3.72 (±0.65)	3.70 (±0.69)	0.416
Factor 3	3.89 (±0.60)	3.90 (±0.66)	3.94 (±0.49)	4.05 (±0.60	0.234
Factor 4	3.68 (±0.79)	3.65 (±1.02)	3.69 (±0.96)	3.90 (±0.79)	0.322
Factor 5	3.91 (±0.84)	3.91 (±0.81)	3.86 (±0.76)	4.02 (±0.73)	0.719
PDS/Total	3.97 (±0.39)	3.97 (±0.41)	4.01 (±0.38)	4.10 (±0.41)	0.069

**p*-value related to chi-square test. *p*-value related to Kruskal-Wallis test, followed by Multiple Comparisons z' values test: a. differs from 5 to 8 years; b. differs from 9 to 11 years; c. differs from 12 years or more; Factor 1: Self-realization, Personal Growth and Psychological Adjustment; Factor 2: Productivity; Factor 3: Care; Factor 4: Concern for next generations; Factor 5: Commitment to others.

Table 4. Sociodemographic variables and well-being among elderly persons stratified by time of participation. São Paulo, UnATI EACH, 2010.

Variable	Time of Participation at UnATI EACH-USP				
	Freshman	1 Semester.	1 Year	> 1 Year	
	Mean (±sd)	Mean (±sd)	Mean (±sd)	Mean (±sd)	*p*-value*
Gender (Fem. %)	65.43%	72.22%	62.79%	72.41%	0.579*
Age	66.69 (±5.76)	66.76 (±5.37)	67.12 (±5.32)	67.53 (±5.40)	0.618
Schooling	10.19 (±4.99)	10.06 (±4.47)	9.72 (±4.81)	10.14 (±4.54)	0.953
Length of Participation					
UnATI EACH-USP	0.00 (±0.00)	1.00 (±0.00)	2.00 (±0.00)	4.61 (±1.65)	<0.001**
Other U3A or Social Centers	1.73 (±4.73)	2.52 (±4.73)	3.37 (±6.55)	2.94 (±5.92)	0.209
Overall Satisfaction with Life Scale					
OSL/Total	8.11 (±1.57)	8.39 (±1.37)	8.38 (±1.41)	8.24 (±1.59)	0.717
Domain Related Satisfaction Scale					
Health	3.74 (±0.79)	3.80 (±0.74)	3.79 (±0.63)	3.84 (±0.60)	0.819
Physical Capacity	3.82 (±0.71)	3.92 (±0.69)	3.94 (±0.65)	3.81 (±0.66)	0.635
Mental Capacity	3.91 (±0.79)	3.92 (±0.69)	3.90 (±0.76)	3.89 (±0.63)	0.964
Social Involvement	3.77 (±0.90)	4.00 (±0.81)	3.96 (±0.67)	3.87 (±0.74)	0.330
DRS/ Total	3.83 (±0.62)	3.92 (±0.53)	3.91 (±0.49)	3.86 (±0.45)	0.675
Affect Schedule					
Positive (PA)	3.73 (±0.62)	3.87 (±0.55)	3.80 (±0.55)	3.82 (±0.54)	0.459
Negative (NA)	1.83 (±0.67)	1.62 (±0.61)	1.70 (±0.69)	1.77 (±0.74)	0.237
A/Total	3.99 (±0.57)	4.16 (±0.51)	4.10 (±0.57)	4.06 (±0.59)	0.164
Personal Development Scale					
Factor 1	4.21 (±0.46)	4.26 (±0.44)	4.33 (±0.44)	4.24 (±0.44)	0.521
Factor 2	3.51 (±0.69)	3.68 (±0.74)	3.76 (±0.66)	3.67 (±0.70)	0.153
Factor 3	3.97 (±0.58)	4.09 (±0.57)	3.93 (±0.68)	3.89 (±0.58)	0.223
Factor 4	3.92 (±0.93)	3.65 (±0.86)	3.72 (±0.87)	3.67 (±0.90)	0.175
Factor 5	3.97 (±0.84)	3.99 (±0.80)	3.96 (±0.84)	3.86 (±0.75)	0.634
PDS/Total	4.01 (±0.41)	4.02 (±0.40)	4.08 (±0.40)	4.00 (±0.40)	0.691

*****p*-value related to chi-square test. ******p*-value related to Kruskal-Wallis test; Factor 1: Self-realization, Personal Growth and Psychological Adjustment; Factor 2: Productivity; Factor 3: Care; Factor 4: Concern for future generations; Factor 5: Commitment to others.

Table 5. Sociodemographic variables and well-being among elderly persons stratified by length of time spent in the program, first-years or veterans. São Paulo, UnATI EACH, 2010.

Variable	Group		
	First-years	Veterans	
	Mean (±sd)	Mean (±sd)	*p*-value*
Gender (Fem. %)	65.43%	70.11%	0.449*
Age	66.69 (±5.76)	67.21 (±5.35)	0.320
Schooling	10.19 (±4.99)	10.02 (±4.56)	0.933
Length of Participation			
UnATI EACH-USP	0.00 (±0.00)	2.94 (±1.98)	<0.001**
Other U3A or Social Centers	1.73 (±4.73)	2.92 (±5.73)	0.035**
Overall Satisfaction with Life Scale			
OSL/Total	8.11 (±1.57)	8.32 (±1.48)	0.284
Domain Related Satisfaction Scale			
Health	3.74 (±0.79)	3.81 (±0.65)	0.473
Physical Capacity	3.82 (±0.71)	3.87 (±0.67)	0.748
Mental Capacity	3.91 (±0.79)	3.90 (±0.67)	0.913
Social Involvement	3.77 (±0.90)	3.93 (±0.74)	0.196
DRS/Total	3.83 (±0.62)	3.89 (±0.48)	0.356
Affect Schedule			
Positive (PA)	3.73 (±0.62)	3.83 (±0.54)	0.142
Negative (NA)	1.83 (±0.67)	1.71 (±0.69)	0.092
A/Total	3.99 (0±.57)	4.10 (±0.56)	0.050**
Personal Development Scale			
Factor 1	4.21 (±0.46)	4.27 (±0.44)	0.398
Factor 2	3.51 (±0.69)	3.70 (±0.70)	0.028**
Factor 3	3.97 (±0.58)	3.96 (±0.60)	0.729
Factor 4	3.92 (±0.93)	3.68 (±0.88)	0.030**
Factor 5	3.97 (±0.75)	3.92 (±0.79)	0.737
PDS/Total	4.01 (±0.41)	4.03 (±0.40)	0.810

*****p-value related to chi-squared test. **p-value related to Mann-Whitney U-Test; Factor 1: Self-realization, Personal Growth and Psychological Adjustment; Factor 2: Productivity; Factor 3: Care; Factor 4: Concern for future generations; Factor 5: Commitment to others.

DISCUSSION

The analysis of the results of the sample of 265 students of UnATI EACH suggests that men are more satisfied and happy than women. Yang[13], Plagnol and Easterlin[14], in studies carried out in the USA and in another 65 countries, found that men are happier than women after middle age. In the study by Hansen and Slagsvold[15], the authors found that in a sample of 3,750 people aged between 40 and 85, both men and women presented similar patterns of overall satisfaction with their lives, even though women are more likely to be widows and caregivers of spouses than men.

Neri et al.[9] also confirmed the findings of the present study. According to the authors, the SWB and self-concept of elderly women are more negative than those of men. The reasons for these data are well-known: women are more ill, dependent, alone, poor and suffer more medical complaints than men, and have lower expectations; they tend to be considered less attractive and less valued than men.

In relation to the positive results obtained by men in terms of satisfaction with health, personal mental capacity and when compared to other people of the same age, Sposito et al.[16] found in a study with 125 elderly persons that men are more satisfied with their health in comparison with other individuals of the same age. The same finding occurred in relation to the evaluation of mental capacity. A study by Lima-Silva et al.[17] based on a sample of 383 elderly residents of the neighborhood of Ermelino Matarazzo in the municipal region of São Paulo, found that men exhibited a greater cognitive performance than women, perhaps due to higher schooling. The opposite was identified in a study with a sample of elderly Europeans. In this study, the cognitive performance of women was better than that of men, a finding justified by the increase in educational levels in the last four decades in the European continent[18]. The data presented may suggest that satisfaction with the mental ability domain may be influenced by socioeconomic factors, which can result in higher cognitive performance.

The results related to age and the SWB indicators of this study are in keeping with data in literature. In the first study identified in non-Brazilian literature on the relationship between age and life satisfaction, Campbell et al.[19] found similar data to the findings of the research at UnATI EACH. The authors identified that older people, when compared to younger groups, were more satisfied and happy with life.

For Diener and Suh[20], the elderly have a lower aspirational level than younger people because they are more prepared, or in other words, they have been taught not to expect so much from life. Older people adjust their goals to their resources and competencies and thus have lower expectations of achievement and pleasure than younger people, and so their assessments of life are more positive. This conclusion exemplifies the role of the self in regulating individual functioning and in determining the sense of SWB in old age.

Authors such as Yang[13], Charles and Carstensen[21] and Sposito et al.[22] affirm that SWB does not decline with age, a fact verified in the present study. In the studies of these researchers all the findings indicated a greater satisfaction with life among elderly persons and reported that advanced age is related to an increase in the capacity to regulate the emotions and the expression of more positive affections and lower levels of negative affections.

Elderly persons aged over 65 years presented high SWB measurements. These data suggest that this group may be more adapted to the loss of their family and social roles than younger elderly persons (60-64).

These results are also consistent with the Lifespan Perspective in Psychology, described by Baltes and Carstensen[23]. The authors speak of increasing wisdom and emotional intelligence with the advancement of age and state that the reduction in negative affective states is a result of increasing wisdom. The findings are congruent with the Socioemotional Selectivity Theory of English and Carstensen[11], where elderly persons have a greater ability to self-regulate emotions and see situations more positively.

In relation to the data obtained in the domains of comparisons of satisfaction with health, physical and mental capacity with people of the same age, Sposito et al.[16] found positive results among older elderly people resident in the city of Campinas, based on the same scale used in the UnATI EACH study.

Cheng et al.[24] conducted two studies to evaluate age differences through social comparison and their effect on health self-assessment. The two studies aimed to shed light on the theme of social comparison as a mechanism that can help older adults maintain their self-rated health in the face of physical decline. Study 1 examined whether self-rated health was related to a more positive physical self-perception in comparison with others and whether such relationships differed according to age. Study 2 focused on older adults, where over a twelve-month period it was verified through social comparison whether increases in physical symptoms were associated with greater self-improvement in the physical domain. In study 1, it was observed that the effect of social comparison is greater for the elderly than for younger people. The positive effect of social comparison on the self-assessment of health was verified. Study 2 found that elderly persons who perceive their physical mastery to be better than others are more likely to maintain their self-rated health when faced with an increase in physical symptoms. In summary, the authors concluded that social comparison plays a more important role in

determining self-assessment of health (study 1) and in fact is effective in partially compensating for the negative effect of the increasing physical symptoms that accompany aging (study 2).

Schooling is described in literature as a strong determinant of SWB, especially among young and middle-aged people[25]. This data explains the lack of significant results for this variable in the present study, as the sample was comprised of elderly people. The fact that men had higher levels of schooling (M = 10.88) did not reflect the overall satisfaction with life score.

Similar data were verified by Yang[13]. The author states that schooling is strongly related to happiness at all ages except among the elderly. In a systematic review conducted by Read et al.[26], the data revealed that income is more strongly associated with well-being than education. In this review, education was more associated with self-perception of health than with the evaluation of satisfaction with life.

It can be concluded that both schooling and opportunities for education in general offer important attributes for an individual to participate in activities to acquire knowledge and form social connections, which are linked to SWB, but which are not predictors of SWB, especially for the sample of this study.

To evaluate the effect of the time of participation in the activities of the UnATI EACH on the SWB and PWB of the students, participants were characterized as First-years: beginners in the program (first semester of 2010) and Veterans: those with a participation time equal to or greater than one semester. The group of veteran students were more emotionally positive than the first-years, since they had high rates of positive affect. They were also happier and less demotivated than the first-years, and described a desire to be productive, while the first-years were more concerned about the next generations.

The positive emotional well-being reported by veterans suggests that UnATI EACH provides significant social and educational situations. They are happy with the network of social relations established and motivated to learn. This conclusion is confirmed by authors such as Charles and Carstensen[21] who assert that elderly persons tend to maintain the maximum number of positive experiences with their networks of social relationships, avoiding situations or people who result in negative feelings.

It can also be emphasized that regular social contacts, such as those provided by UnATI EACH, act as emotional support to participants. The findings of a study by Matz-Costa et al.[27] point to the benefits of continuing education as an informational and instrumental source for the needs of the elderly. It acts as an important stimulus for interpersonal relations and the acquisition of new knowledge.

The sense of productivity described by veteran students expresses commitment to the people closest to them and their own contribution to society. This contribution is translated in literature as the desire to guide and teach and, consequently, to be part of the memory of the group. Similar data were verified by Queroz[28] in surveys which analyzed the PWB of middle-aged and elderly people through the Personal Development Scale. According to the author, positive self-reports about psychological adjustment predominated among the elderly, who expressed their concerns and goals as geared towards specific individuals and groups.

Associations were made between the time and the characteristics of participation in the UnATI EACH and in other U3A or Social Centers. From this association, three groups were generated: Group I (first-years in all programs), Group II (first-years from UnATI EACH, but participants for a semester or more in other institutions of this type, and veterans of UnATI EACH who had never participated in other programs) and Group III (veterans in all programs with a time of participation of one semester or more).

Although a causal relationship was not established, a participation time of over six months in UnATI EACH and other U3A and Social Centers seemed to be a determining factor for positive SWB and PWB indices in the sample studied. In agreement with the results obtained in the current study, researchers such as Ordonez et al.[29] described the positive impact that participation in permanent education programs provides to the elderly, in relation to physical and mental health, social relations, a positive affective state, and satisfaction with life.

Regarding the sense of psychological adjustment, factors of the Personal Development Scale (productivity, care and concern for the next generations) are related to generative concerns, and for Erikson[30] generability is an important component of the development of adulthood. These factors would be more directed toward interpersonal psychological adjustment. Generative actions are expressed in the exercise of adult roles, in the family, at work, in the community, in social institutions and in society in general. According to Erikson,[30] generability is an indicator of adjustment: generative actions manifest themselves from adulthood through care and commitment to caring for people (procreation), dedicating time and energy to one's productive life (productivity) and ideas (creativity) through which the individual learns to care about themselves. The fulfillment of these tasks is socially valued. According to McAdams[31], generative concern is positively associated with PWB measures and personality traits – extroversion, affability, openness to experiences and emotional stability, and low tendency to neurosis.

It is important to note some limitations of the present study. The most important of these is that the sample is not representative of the Brazilian elderly population, since the average level of schooling is higher. In theory, it can be said that it is representative of the population attending educational programs for the elderly. It may also be considered a limitation that students already have the characteristics of a successful and active aging, since they have successfully enrolled in the programs.

Additionally, the impact of the intensity of participation in the activities (number of workshops and frequency) was not investigated.

CONCLUSION

It can be concluded that the Open University for the Third Age of the School of Arts, Sciences and Humanity has supported the desire to establish important and memorable connections with others. Elderly persons want the program to provide them with knowledge that can generate meaningful actions and leave a personal legacy.

It was concluded, then, that permanent education for the elderly, provided by universities and through other sources, contributes to maintaining high rates of satisfaction with life and positive feelings. Older people can assess their own development trajectory and commitment to society, and consider their own commitment to pursuing an ideal of personal excellence. It can be said that living through the experience of aging as a privileged moment of life is also something that is learned in an educational establishment.

It is important to note that the empirical work carried out so far has been cross-sectional. Future research should examine the action of time and the associations of subjective and psychological well-being in UnATI students longitudinally.

A strength of this study is that it is pioneering in Brazilian literature. In terms of both the representative number of elderly people from an Open University of the Third Age surveyed and the subject investigated, there are no other studies that have used instruments for the joint evaluation of the two constructs - subjective and psychological well-being – and verified their possible correlations.

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Clinical and epidemiological characterization of patients receiving home care in the city of Maceió, in the state of Alagoas, Brazil

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Abstract

Objective: To clinically and epidemiologically characterize patients receiving home care in the city of Maceio, in the state of Alagoas, Brazil. *Methods:* An observational, cross-sectional study with a sample of 859 patients was carried out, based on data obtained from the medical records of institutions that provide a home care service. A total of 445 patients were from a public service and 414 were from a private service. Descriptive analysis was used for the demographic, clinical and functional variables. *Results:* Most patients were elderly, female, bedridden, fed orally and had neurological disorders, with stroke the most common diagnosis. Regarding patient evolution, 16.8% of individuals were discharged from home care, 45% of patients died and 24% were hospitalized during the period of home care. A total of 9% of patients had a tracheostomy, 84.7% breathed room air, 9.3% used oxygen, 4% used noninvasive mechanical ventilation, 1.9% used invasive mechanical ventilation, and 24.9% of patients had pressure ulcers. All patients received medical visits, with 693 receiving nursing care, 767 undergoing physiotherapy, 233 receiving speech therapy sessions, 665 patients accompanied by a nutritionist, 64 undergoing occupational therapy sessions and 98 receiving counseling. *Conclusion:* It was noted that some results differed from literature and between the public and private service. This divergence could be related to the specific epidemiology of each region and the type of insurance paying for care (Unified Health Service or Private).

Keywords: Home Nursing. Epidemiological Profile. Elderly.

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INTRODUCTION

The present study emerged from the expansion in home care in Brazil. The main aim of this modality of care is to de-hospitalize chronic, stable patients in order to vacate hospital beds, and subsequently to reduce hospital overcrowding and minimize some of the biggest problems inherent in existing health systems, especially the public health system[1,2].

The term "home care" can be defined as a set of potential hospital procedures to be carried out in the home of the patient, and includes health actions developed by a multi-professional team[3]. Use of this model is growing throughout Brazil and it has emerged as a new workplace for health professionals[3].

This care modality has been recurrently recommended to meet the needs of people with chronic illnesses and diseases that lead to dependency, based on values such as family coexistence and affection, as well as the presumption of a better quality of life for the patient and, obviously, a reduction in costs related to hospital beds[4,5].

The objectives of this type of home care service are: to contribute to the optimization of hospital beds; reduce hospital admission costs; reduce the risk of nosocomial infection; reintegrate the patient into their family and support nucleus; provide humanized and comprehensive care; improve the patient's quality of life; avoid readmissions; reinsert the patient into society; preserve patient autonomy; stimulate the increased participation of the patient and their family in the proposed treatment[6,7].

It is therefore necessary to understand the epidemiological profile of the population receiving home care to develop techniques that best fit and meet the specific needs of patients. The present study aimed to clinically and epidemiologically characterize patients undergoing home care in the city of Maceió. The specific objectives were: demographically characterize patients undergoing home care; identify the main diseases that motivate home care; analyze the outcomes of home care; identify the level of dependency of patients in home care; characterize the composition of the multidisciplinary team; identify the presence of hospitalizations and decubitus ulcers; analyze the feeding and breathing routes and compare the profiles of patients receiving care in the public and private systems.

METHOD

An observational and cross-sectional study was performed. Data were collected in the records departments of institutions that provide home care services in the municipal region of Maceió, in the state of Alagoas, Brazil: Clinilar, NIAD (Núcleo Interdisciplinar de Assistência Domiciliar (Interdisciplinary Home Care Center)) and SAD (Serviço de Atenção Domiciliar (the Home Care Service)). The city of Maceió, the capital of Alagoas, has a population of 936,314 inhabitants, approximately 66,470 of whom are elderly, and life expectation in the state is 67.2 years.

The SAD (public) is part of the activities of the Municipal Secretary of Maceió, Alagoas, and provides suitable, free multi-professional care to patients of low to medium complexity. Those that require more complex treatment, such as mechanical ventilation or the 24-hour presence of a nurse, are not included in the program.

Clinilar and NIAD are private companies that offer a home care service in Maceió, Alagoas. The services offered are provided by a multi-professional team, composed of qualified health professionals trained to carry out both simple and complex procedures, capable of installing a structure similar to an ICU bed and even offering 24-hour nursing care. These companies provide care either on a private or health plan basis.

The sample size was calculated as 879 patients, using the equation below for finite populations and based on the following criteria: a) a total number of patients in home care of 1,950; B) a 95% confidence interval, expressed as a standard deviation of 1.96; C) a sample error of 5%; D) a prevalence of 80%. The prevalence estimate of 80% was adopted based on a pilot study in which the medical records of 30 patients were randomly evaluated, taking as a reference the proportion of elderly patients.

$$n \frac{\sigma^2 p.q.N}{e^2(N-1)+\sigma^2 p.q}$$

The medical records of all patients inserted in the Home Care Programs of three institutions in the municipal region of Maceió, Alagoas, during the period from January 2011 to December 2015, were included in the study. Medical records containing a large quantity of incomplete and/or illegible were excluded.

A data collection instrument was developed that contained the following variables: name, age, gender, main diagnosis, degree of dependence in walking, breathing route, feeding route, use of ventilatory support, presence of pressure ulcers, hospital discharges and hospitalizations. As the study was retrospective, many patients had already been discharged from home care and many had died.

The study was approved by the Research Ethics Committee of the Centro de Estudos Superiores de Maceió (the Maceió Higher Level Studies Center) (CESMAC), under approval number 1.252.375. The waiver of free and informed consent was requested, as the study was retrospective and the data were collected from the records of the institutions.

The quantitative variables were presented as mean, median and standard deviation. The qualitative variables were presented in frequency tables.

RESULTS

Of the 879 medical records collected from the institutions providing home care services, 20 were excluded as their data was incomplete. Thus, the final sample of the study consisted of 859 patients, of whom 445 were from a public home care service and 414 were from private services. The majority of the patients were female (56.9%) and most were elderly, with a mean age of 72.62 (±18.28) and a median of 78 years. The most frequent age group was that over 79 years (44%), a result that was similar in both the private and public institutions.

In terms of the diagnosis variable, neurological diseases were most frequent in home care, with 61.1%, followed by oncological diseases, with 6.5%. Neurological diseases (64.7%) were also the most common, followed by endocrine diseases (10.5%) and orthopedic diseases (8.7%), in the public institution. In the private institutions, the most frequent causes that led to home care were neurological diseases (57.2%), followed by oncological diseases (8.9%) and orthopedic diseases (3.8%).

Some medical records did not present a single pathology, but instead the interaction of several pathologies that acted concomitantly in the body, and therefore presented more than one diagnosis.

With regard to the evolution of the patient, 145 (16.8%) patients were discharged from home care, 386 (45%) patients died and 206 (24%) patients were hospitalized during the period of home care (Table 2). Of the 145 patients who were discharged, 124 were from public institutions and only 21 patients were from private institutions.

Table 1. Sociodemographic characteristics of patients undergoing home care. Maceió, Alagoas, 2011-2015.

Variable	n (%)	Public (%)	Private (%)
Gender			
Female	489 (56.9)	247 (55.5)	242 (58.5)
Male	370 (43.1)	198 (44.5)	172 (41.5)
Age range (years)			
0-19	14 (1.6)	6 (1.3)	8 (1.9)
20-39	50 (5.8)	20 (4.5)	30 (7.2)
40-59	83 (9.6)	35 (7.8)	48 (11.6)
60-79	308 (36)	188 (42.2)	120 (29)
Over 79	378 (44)	185 (41.6)	193 (46.6)
Age not given	26 (3)	11 (2.5)	15 (3.6)

Table 2. Characteristics of diagnosis. Maceió, Alagoas, 2011-2015

Variable	n (%)	Public (%)	Private (%)
Diagnosis			
Neurological diseases	526 (61.1)	288 (64.7)	237 (57.2)
Oncological diseases	56 (6.5)	19 (4.3)	37 (8.9)
Orthopedic diseases	55 (6.4)	39 (8.7)	16 (3.8)
Endocrine diseases	48 (5.6)	47 (10.5)	1 (0.2)
Pulmonary diseases	20 (2.3)	7 (1.6)	13 (3.1)
Heart diseases	18 (2.1)	6 (1.3)	12 (2.9)
Rheumatic diseases	12 (1.4)	8 (1.8)	4 (0.9)
Hepatic diseases	7 (0.8)	1 (0)	6 (1.4)
Renal diseases	6 (0.7)	2 (4)	4 (0.9)
Psychiatric diseases	6 (0.7)	6 (1.3)	0 (0)
Others	19 (2.2)	18 (4)	1 (0.2)
No information	104 (12.1)	12 (2.7)	92 (22.2)

In terms of specific diagnosis, strokes were the most frequent cause of the patient seeking the home care service, with 35.2%, followed by dementia (9.4%) and neoplasia (5.8%) (Table 3).

Regarding the clinical and functional characteristics of patients cared for in the home, bedridden patients (non-ambulatory) represented the majority of the sample (72.5%). Patients who depended on third parties to walk represented 19.5%, while patients were not dependent for walking made up 3% of the sample. An interesting fact was that of the 26 patients who walked independently, 22 were from the public sector and only four were from private services.

In terms of the feeding route, 538 patients (64%) were orally fed, 134 (15.6%) were fed via gastrostomy, 132 patients (15.3%) were fed by nasoenteral catheter (NEC) or nasogastric catheter (NGC) and only five patients (0.6%) underwent parenteral nutrition. Another significant fact was that the prevalence of NEC or NGC was greater than the use of gastrostomy in the public sector, something which did not occur in the private service.

A total of 9% of patients (78) were tracheostomized. It was observed that the majority of tracheostomized patients and who underwent gastrostomy were from the private service, while only eight and nine patients, respectively, were from the public service.

Most patients (84.7%) breathed room air, 9.3% used oxygen, and 4% used Non-Invasive Mechanical Ventilation or Invasive Mechanical Ventilation.

In relation to the presence of pressure ulcers, 214 of patients (24.9%) had some type of ulcer (Table 4), the majority of whom were from the public sector.

Table 3. Characteristics based on specific diagnosis. Maceió, Alagoas, 2011-2015.

Diagnosis	n (%)	Public (%)	Private (%)
Stroke	303 (35.2)	186 (41.8)	117 (28.2)
Dementia	81 (9.4)	37 (8.3)	44 (10.6)
Neoplasm	50 (5.8)	15 (3.3)	35 (8.4)
Decompensated Diabetes	48 (5.6)	47 (10.5)	1 (0.2)
Fractures	38 (4.4)	31 (7)	7 (1.7)
Parkinson's	29 (3.3)	15 (3.3)	14 (3.4)
Neuromuscular diseases	23 (2.6)	2 (0.4)	21 (5)
Spinal cord injury	21 (2.4)	13 (2.9)	8 (1.9)
Traumatic brain injury	19 (2.2)	9 (2)	10 (2.4)
Polytrauma	14 (1.6)	6 (1.3)	8 (1.9)
Cardiac insufficiency	14 (1.6)	6 (1.3)	8 (1.9)
Hypoxic encephalopathy	12 (1.4)	0 (0)	12 (2.9)
Chronic obstructive pulmonary disease	11 (1.3)	1 (0.2)	10 (2.4)
Arthrosis	9 (1)	6 (1.3)	3 (0.7)
Others	83 (9.6)	59 (13.2)	24 (5.8)
No information	104 (12.1)	12 (2.7)	92 (22.2)

Table 4. Medical and functional characteristics of patients undergoing home care. Maceió, Alagoas, 2011-2015.

Variable	N (%)	Public (%)	Private (%)
Levels of dependency			
Does not walk (restricted to bed)	623 (72.5)	322 (72.3)	301 (72.7)
Walks with dependency	168 (19.5)	97 (21.7)	71 (17.1)
Walks without dependency	26 (3)	22 (4.9)	4 (0.9)
No information	42 (4.9)	4 (0.9)	38 (9.1)
Feeding route			
Oral	538 (64)	393 (88.3)	145 (35)
Gastrostomy	134 (15.6)	9 (2)	125 (30.2)
Nasal catheter (enteral or gastric)	132 (15.3)	40 (9)	92 (22.2)
Parenteral	5 (0.6)	0 (0)	5 (1.2)
No information	50 (5.8)	3 (0.7)	47 (11.3)
Use of tracheostomy			
No	781 (91)	437 (98.2)	344 (83)
Yes	78 (9)	8 (1.8)	70 (16.9)
Ventilatory support			
Room air	728 (84.7)	439 (98.6)	289 (69.8)
Oxygen therapy	80 (9.3)	6 (1.3)	74 (17.8)
Non-invasive mechanical ventilation	35 (4)	0 (0)	35 (8.4)
Invasive mechanical ventilation	16 (1.9)	0 (0)	19 (0.4)
Presence of pressure ulcer			
Yes	214 (24.9)	133 (29.9)	81 (19.5)
No	645 (75)	312 (70.1)	333 (80.4)

All patients received medical visits, as the doctor was the professional responsible for the prescription of medication. The data referring to the number of patients attended by a multidisciplinary team are shown in Table 5. It is striking that all patients in the private service underwent physiotherapy sessions, and only one patient did not receive a visit from a nutritionist.

Table 5. Number of patients treated by multi-professional care team. Maceió, Alagoas, 2011-2015.

Variable	N (%)	Public (%)	Private (%)
Doctor	859 (100)	445 (100)	414 (100)
Physiotherapist	767 (89.3)	353 (79.3)	414 (100)
Nursing	693 (80.6)	321 (72.1)	372 (89.8)
Nutritionist	665 (77.4)	252 (56.6)	413 (99.7)
Speech Therapist	233 (27.1)	79 (17.7)	154 (37.1)
Psychologist	98 (11.4)	41 (22.4)	57 (13.7)
Occupational Therapist	64 (7.4)	44 (9.9)	20 (4.8)

DISCUSSION

The sociodemographic characteristics of the patients studied were compatible with literature regarding the population of home care programs [1,2,8,9]. Elderly persons aged over 79 years made up the most prevalent age range, with this group and other age ranges over 60 years representing 80% of the sample, showing that home care is mainly aimed at a geriatric population. Benassi et al.[2], in a study of the epidemiological profile of patients undergoing physiotherapy as part of a home care program in the city of São Paulo, found that the most prevalent age group was that between 71 and 90 years. A study by Góis[9] identified a similar result in terms of age, with the 70 to 89 year range predominating. An age over 80 years was most prevalent in the studies by Martelli et al.[1] and Del Duca et al.[10], while a similar result was found in the home care program of the Hospital Público de Santa Maria (Santa Maria Public Hospital) (Rio Grande do Sul)[8]. The target population in an Austrian study of the home care population by Kamenski et al.[11], was composed in the majority (more than two thirds) by women, and the mean age was 80 years.

This predominance can be explained by the fact that this age group (over 60 years) includes severe levels of disability, generated by the evolution of chronic diseases. Home care has grown among the elderly in comparison with other types of care, and now represents 72% of health plan beneficiaries[12].

This prevalence is explained by the process of demographic transition that Brazil is undergoing and by the increase in the number of chronic diseases among this population. The disorders that occur during the aging process can be ameliorated by actions that promote health and assist in the maintenance of the functional capacity of the elderly person. As such, home care programs represent one of the alternatives incentivized by the Brazilian government when facing such demand[12].

In terms of gender, women predominated, a finding similar to the majority of studies carried out on home care[1,2,9,10,12-14]. This fact can be explained by the results of the IBGE survey[15]. When observing the ratio between the genders by age group in Brazil, the ratio of gender was over 100 up to the 20 to 24 year age group, indicating an excess of men in the population. For age groups over 25 years, however, there was an excess of women, and in the group aged over 60, the indicator was 80 men for every 100 women.

The mortality index is greater among men than among women, meaning the female population is larger. The over-mortality of male adults and young elderly men and the subsequent "feminizing" of the

elderly population result, therefore, from greater rates of mortality from diseases of the circulation and other illnesses associated with smoking, such as neoplasias and CPOD (Chronic Obstructive Pulmonary Disease), alcoholism (some digestive neoplasias and alcoholic liver disease) and external causes (violent deaths and traffic accidents), among men[16]. Life expectancies upon reaching 80 years of age in 2015 were 10.1 and 8.4 years for women and men, respectively[17].

According to the IBGE census[15], the population in the municipal region of Maceió, Alagoas is predominantly female. The predominance of women may also reflect the unequal increase of life expectancy between the sexes, which is more significant among women than men, and can be attributed to biological factors and/or unequal exposure to risk factors for health.

Neurological disturbances were the most frequent, affecting 61.15 of patients, followed by oncological diseases, which affected 6.5% of patients. Strokes were the neurological disturbances that appeared most frequently as the main motive for being referred for home care (35.2%), both in the public (41.8%), and the private (28.2%) sectors.

It is important to note that the diagnoses varied when the public (SAD) and the private (NIAD and CLINILAR) services were compared, which can be explained by the greater complexity of the health profile of patients in the private service, as the SAD service of the municipal region of Maceió does not provide care to high complexity patients who require special equipment and procedures.

A similar result was found in the study by Fabrício et al.[18], where the most prevalent diagnosis was neurological disease (27%), followed by neoplasias (17%). In the study by Aguiar[19], the majority of patients suffered from neurological diseases (68.7%), followed by endocrine-metabolic illnesses (64.8%).

In the study by Brondani et al.[20] of patients from a Home Care Service in Rio Grande do Sul, the most prevalent diagnosis was strokes (26.3%), followed by neoplasias (18%). The most common conditions of users of a Programa de Internamento Domiciliar (Home Hospitalization Program) (PID), in Monte Claros, in the state of Minas Gerais, were pneumonia (16.1%) and diabetes *Mellitus* (6.6%)[1]. In the study by Gargano et al.[8], the main illnesses were respiratory disease (35.5%) and complications from neoplasias (12%).

This high prevalence of neurological diseases can be explained by the fact that the volume and weight of the brain decrease with age, at a rate of close to 5% per decade over the age of 40, with an increase in the rate of this decline from the seventh decade of life onwards. This fact makes the elderly person more predisposed to a series of clinical conditions with neurological repercussions[21].

In Brazil, strokes are the leading cause of hospitalization, mortality and disability, even surpassing cancer and heart disease [15,22,23]. The results of some of the studies above varied, a finding which may be explained by the conditions identified being related to the specific epidemiology of each location, and may also be related to the type of health insurance provider, such as the Sistema Único de Saúde (the Unified Health System) (SUS) or private health insurance. For example, the SUS does not support patients who require mechanical ventilation in the home environment, meaning that the provision of such treatment must be outsourced to services that provide private home care. The same occur with patients who need continuous monitoring with 24-hour nursing professionals. This situation may explain the lower complexity of public service patients, and may explain the variation in diagnosis.

Regarding the outcomes of the studied population, death was the main reason for ending the Home Care Program. This can be explained by the clinical profiles involved, where chronic conditions associated with several comorbidities and sequelae prevail, which cause great dependence and dysfunctionality for the individual.

In terms of hospitalization, similar results were obtained between the two services, with 24% of patients being hospitalized during the home care program.

Rehospitalization is an important indicator of quality of care, and a good thermometer for the degree of resolution of extra-hospital care[24].

Therefore, 24% is considered a low percentage, illustrating the effectiveness of the home services studied. However, no official parameters have yet been disclosed, which are capable of indicating the number of rehospitalizations expected for patients assisted by home care.

Regarding patient discharge, of the 145 patients discharged, 124 were from the public institution and only 21 patients were from private institutions. This can be explained by the fact that SUS home care is aimed at the care of patients with more specific care needs, resulting in high levels of patients requiring this service and a large turnover. Another important factor is the lower degree of complexity in SUS patients, who are subsequently more likely to be discharged.

Discharge represents a positive outcome of home care, and can demonstrate the effectiveness of the program, as discharge is often necessary to improve the clinical condition ascertained at admission[20]. Therefore, as the research was carried out based on medical records, it is difficult to identify the true reason for discharge, as it is believed that besides clinical improvement, there are other factors that affect discharge from home care, including: the need for rotation in the SUS service, due to high demand; interference from the health plan; discharge at the request of the family, who often do not adapt to the home care service, describing, among other factors, interference of their privacy.

The predominant level of dependence was "bed restricted" or, better, completely bedridden, which affected 72.5% of the patients. Most patients in both the public service and the private service were bedridden. The major difference was among patients who walked independently, of whom 22 were in the public service and only four were in the private service, a fact that can be explained by the lower degree of complexity of the public service patients.

The study by Góis[9], which found that 37.8% of the patients undergoing home physiotherapy had a severe disability and were restricted to bed (completely bedridden) while 52% were dependent on third parties for walking, and the other 9.2% were wheelchair users or walked independently. In the same study, the authors found an association between age and level of patient limitation. This discrepancy in results can be explained by the fact that in the study by Góis[9] the home care provided was physiotherapy, and thus aimed at a different public; the percentage of patients with neurological disease was much lower than that found in the present study, a fact that can be justified by the greater level of mobility among these patients, as neurological conditions are the diseases that cause the greatest motor impairment.

In the study by Biscione et al.[14], conducted with 2,934 patients enrolled in a home care program in Belo Horizonte (Minas Gerais), it was found that degree of dependence varies according to the degree of complexity of the patients, with the greater the degree of complexity, the greater the degree of dependence, and where 53% of patients with high complexity were totally dependent. In the study by Bastos et al.[13], it was observed that most patients (50%) walked with help, 25% were bedridden, 15% walked independently and only 10% were wheelchair users. The difference between the results of the Bastos study and the present study can be explained once again by the type of care (public or private), as in the study by Bastos et al.[13] the service was exclusively public.

Therefore, the degree of limitation may vary according to the population studied, the type of care (public or private) and the degree of patient complexity.

With regard to feeding route, the present study demonstrated that most of the patients were fed orally (64%). However, when the services were analyzed in isolation, a divergence between the results was observed, with 88.3% in the public service fed orally and the majority in the private service (52.4%) fed by means of catheters. Another important finding of the present study is that when comparing the use of catheters in the two services, the prevalence of NEC or NGC was greater than the use of gastrostomy in the public service, whereas the use of gastrostomy was greater than the use of nasal catheters in the private service.

The lower use of gastrostomy in the SUS may be due to the high cost of this procedure, when compared to access via NEC or NGC, and also the difficulty of carrying out this surgical procedure

within the SUS. These factors were possibly responsible for the higher prevalence of the nasal route in the public service.

In the study by Biscione et al.[14], most of the patients were also fed orally. In the study by Gaspar et al.[25], in which the profile of patients treated by the Programa Saúde da Família (Family Health Program) (PSF) in the city of São Paulo was evaluated, only 1.2% of the patients used some type of catheter (gastrostomy or nasoenteral). In the study by Aguiar[19], however, the majority of patients (52.5%) were fed by gastrostomy, 42.5% by the oral route and 5% by NEC. The study by Azank et al.[26], found that 73.3% of the patients received food via nasoenteric catheter (NEC) and 26.6% were fed by gastrostomy (GT). In the study by Brondani et al.[20], 73.7% (n=42) of patients required devices (gastrostomy or nasoenteral catheter) to supplement feeding or as an exclusive route of feeding.

In relation to tracheostomy, of the 78 patients who were tracheostomized, 70 were from private services. The same behavior occurred for the use of oxygen and mechanical ventilation, in which the prevalence is much higher in private services (home-care).

The SAD service in Maceió, Alagoas does not offer oxygen and mechanical ventilation to patients. Patients with chronic dependence on mechanical ventilation and oxygen therapy are usually hospitalized for an extended period of time, some until their death, while others are able to enter the private home care service through the state.

In a study by Lima et al.[27] on intensive home care through the SUS, results revealed that the route to obtain life support are filled with obstacles and that the search for home care through the dynamics of the SUS involves bureaucracy, professionals and equipment that, in many situations, hinder the access of the population.

Also in relation to the devices used by the patients, in the study by Brondani et al.[20], 24.6% used tracheostomy. In the study by Watanabe et al.[28] on the profile of users of prolonged home oxygen therapy, it was observed that 62.6% of the users had Chronic Obstructive Pulmonary Disease (COPD).

In relation to the presence of pressure ulcers (PU), a prevalence of 24.9% of patients was observed. In the study by Chayamiti et al.[29], 19.1% of patients had PUs, and the relationship between increased age and ulcer occurrence was significant. In the study by Nogueira et al.[30] of patients from a home care program in Spain, 5% had pressure ulcers.

As for multi-professional assistance, it was observed that doctors, physiotherapists, nurses and nutritionists were the most active professionals in the present study. All patients received medical care. Physiotherapists were the second most frequent profession involved in home visits, and 89.2% of the patients received physiotherapy sessions.

It is important to emphasize that the multi-professional team varies according to the type of care (public or private) and the differentiated profile of the patients.

CONCLUSION

The present study sought to identify the epidemiological profile of patients in home care in the city of Maceió. It was found that the majority of the patients receiving home care are elderly, bedridden, female, and suffer from neurological diseases, with strokes being the most common diagnosis.

It can be observed that some of the results differed between the public and private service. For example, in relation to feeding route, most patients in the public service were fed orally, whereas in the private service most of the patients used feeding tubes.

The study allowed the characterization of the population receiving home care and identified the principle recommendations for the home care service, so that it can be compared with data from other localities and allow specific and effective interventions to improve the service to be carried out.

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Factors associated with diabetes among the elderly receiving care at a specialized gerontology-geriatric outpatient clinic

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Abstract

Objective: To identify the prevalence of diabetes and its relation to associated factors in elderly persons receiving care at a specialist gerontology-geriatric outpatient service. A descriptive cross-sectional study of 301 elderly persons of both genders was performed. *Method:* The bivariate analysis was performed using the Pearson's Chi-square test for Independence and Fisher's exact test, considering 5% of significance and 95% confidence. A multivariate logistic regression model was adjusted to identify factors that may influence the occurrence of diabetes. *Result:* There was no statistically significant association between the prevalence of diabetes and socioeconomic and demographic variables, behavioral factors and health conditions. Only the Body Mass Index variable was close to being statistically significant (p=0.059). *Conclusion:* The result confirms the need to develop new studies on the subject to consider the particularities and specificities of the elderly population to enable the creation of educational intervention strategies aimed at this group.

Keywords: Diabetes Mellitus. Prevalence. Elderly.

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INTRODUCTION

The growth in the proportion of elderly persons has been accompanied by an increase in the prevalence of chronic non-communicable diseases, among which diabetes mellitus stands out for its high morbidity and mortality rates, especially in more advanced age groups[1]. According to the *American College of Cardiology Foundation* and the *American Heart Association*, diabetes affects 18% of elderly persons and 50% of type 2 diabetes sufferers are aged over 60[2].

Diabetes among the elderly is related to an increased risk of premature death, a greater association with other comorbidities, and especially with major geriatric syndromes, including a decline in functional capacity, autonomy and quality of life, making it a high-impact disease, which affects the health system, the family and the elderly person themselves[2,3].

It is a highly limiting disease, with long-term consequences that include the damage to, dysfunction and failure of various organs, especially the kidneys, eyes, nerves, heart and blood vessels. People with diabetes are at increased risk of hypertension and coronary, peripheral arterial and cerebrovascular disease, and may also develop neuropathy, arthropathy and autonomic dysfunction, including sexual dysfunction, which more frequently affect the elderly[4].

In addition, the diabetic elderly, when compared to non-diabetics, are more likely to be polymedicated, suffer functional loss (difficulty in locomotion, for example), cognitive problems, depression, falls and fractures, urinary incontinence and chronic pain, and should, therefore, be treated in an individualized manner[2].

Although diabetes has increased exponentially, there is little comprehensive research that allows epidemiological surveillance of the disease[5]. Therefore, a study that addresses diabetes mellitus and its associated factors in the elderly would play an important role in the health care of such individuals, supporting the planning of intervention modalities adjusted to the specificities of this population.

The objective of this study was to identify the prevalence of diabetes and its relationship with associated factors among elderly persons receiving care in a specialized geriatric-gerontology outpatient service.

METHOD

A cross-sectional descriptive study with a quantitative approach was carried out, involving 301 elderly persons (aged 60 years and over) receiving care at the Núcleo de Atenção ao Idoso (Care Center for the Elderly) (NAI) linked to the Universidade Federal de Pernambuco (Pernambuco Federal University) (UFPE). This is a geriatric-gerontology outpatient service, where individual consultations in various specialties are held and group care is provided through thematic workshops aimed at promoting/recovering the health of the elderly, with guidance for family members and caregivers. The NAI is considered a subprogram of the Elderly Program, both of which are administered by the Dean's Office for Extension Studies of UFPE.

The population of the study was 1834 elderly persons and the sample size was calculated based on a prevalence of diabetes in this population of 50%, a confidence level 95% and a sample error of 0.05.

A database was created in a statistical program and the elderly were selected by means of proportional sampling stratified by gender, with individuals selected by systematic draw, with the aim of obtaining more accurate estimates and reducing the possibility of selection bias. The elderly were randomly selected to participate in the survey by phone and losses were replaced by the drawing of replacements.

Data collection took place from February to July 2011 through the analysis of medical records and the application of a scripted interview composed of closed questions organized by thematic units. The inclusion criteria were elderly persons aged 60 years or older, of both genders, receiving care at the service from January 2006 to December 2010, with a diagnosis of DM identified in their medical records. Elderly persons with communication and/or cognition impairment described in their medical records, which could interfere with the collection of the primary data during the interview, were excluded from the study.

Three students from the nursing undergraduate course at UFPE, linked to the extension project entitled: Systematized Nursing Care for the Elderly Receiving Care From A Geronto-Geriatric Service helped with the interviews. All the students received prior-training for the carrying out of the interview script and the application of the scales used.

The dependent variable of this study was experience or not of diabetes according to the medical diagnosis on the patient's medical record. The independent variables were a) socioeconomic and demographic (age, gender, ethnicity/skin color, marital status, schooling, social security status, individual income, contribution to household income and living arrangement); B) health conditions; C) behavioral factors related to health (habits of consumption of alcohol, smoking habits, practice of regular physical activity and nutritional status).

Based on the proposal of the SABE project (*Saúde, bem-estar e envelhecimento*, or Health, Well-being and Aging) project coordinated by the Pan American Health Organization, the measure of self-rated health was categorized as excellent, very good and good, to indicate a good self-perception of health; and regular and poor, to refer to a poor self-perception[6].

Functional capacity was evaluated by applying the Basic Activities of Daily Living Scale (BADL) (Katz Scale), which evaluated the functional independence of the elderly in the performance of six functions (bathing, dressing, going to the bathroom, transference, continence, and feeding) and the Instrumental Activities of Daily Living Scale (IADL) (Lawton Scale), which classified the elderly as independent or dependent in performing nine functions (ability to use telephone, using transportation, shopping, preparing their own meal, housekeeping, doing household chores, washing and ironing their clothes, taking their medicines properly and taking care of their finances)[7,8].

As cut-off points, the proposal of the Hartford Institute for Geriatric Nursing was adopted for the Katz Scale, with the elderly categorized as independent, moderately dependent, and highly dependent, based on scores of 6 points, between 3 and 5 points, and 2 points or less, respectively. For the Lawton Scale, categorization was based on the following score: total dependence (up to 9 points), partial dependence (10 to 18 points) and independence (from 19 to 27 points)[8].

In relation to the behavioral factors, the practice of physical activity was evaluated through the application of an adapted script of the International Physical Activity Questionnaire (IPAQ) in its short version, validated in Brazil[9], with the elderly being classified as very active, active, irregularly active or sedentary individuals, based on compliance with recommendations regarding the frequency and duration of the activities.

Nutritional state was diagnosed using the body mass index (BMI) ($BMI = P/A^2$) where individuals were classified according to the following cutoff points recommended for the elderly: underweight ($<22kg/m^2$), normal weight ($22 \leq BMI \leq 27kg/m^2$) and overweight ($>27kg/m2$)[10]. BMI was calculated from weight and height data measured at the time of the interview.

The association between the independent variables and the presence of diabetes was examined by bivariate analysis using Pearson's Chi-squared test of independence or the Fisher Exact test, with the latter used when the results did not meet the requirements for the first test. A significance level of 5% and 95% confidence intervals were used in both cases. For the comparison between two categories with numerical variables, the T-student test with equal variances was used. Verification of the equality of variance hypothesis was performed using the Levene F test.

For the study of factors that could influence the occurrence of diabetes, an adjusted multivariate logistic regression model was used. Variables that were significant in the bivariate test up to 20.0% ($p < 0.20$) were used in the adjustment of the initial model. In addition, we included variables that are traditionally associated with diabetes: years of schooling, physical activity, individual income, age, body mass index and functional capacity. Through the model, the values of the prevalence ratio of

diabetes were estimated according to the independent variables and confidence intervals for said parameter.

The research protocol was approved by the Research Ethics Committee of the Centro de Ciências Saúde of the Universidade Federal de Pernambuco (CAEE 0486.0.172.000-10) (the Center of Health Science of the Federal University of Pernambuco). The elderly persons interviewed signed or fingerprinted a Free and Informed Consent Form, in which the objectives of the research were explained, guaranteeing the confidentiality of the information obtained.

RESULTS

Of the 301 elderly persons interviewed, 221 (73.4%) were female. The mean age was 70.16 years; the majority, 162 (53.8%), were in the 60-69 age group with a median of 69.00 years, a standard deviation of 6.41 years and a coefficient of variation of 9.13%. The prevalence of diabetes obtained from the medical records of all the elderly people who composed the sample was 28.2%. This prevalence was higher among men (35%) than among women (25.8%), but there was no significant difference between the sexes (p = 0.117) (Table 1).

Table 1. Prevalence of diabetes among elderly persons receiving care at a geriatric-gerontology service according to socioeconomic and demographic factors. Recife, Pernambuco, 2012.

Variable	Diabetes *Mellitus*			Value *p*	OR
	Yes. n (%)	No. n (%)	Total. n (%)		(CI to 95%)
Total Group	85 (28.2)	216 (71.8)	301 (100)		
Mean					
Age (±sd)	70.71 (±6.42)	69.94 (±6.03)	70.16 (±6.14)	0.334**	
Gender					
Male	28 (35)	52 (65)	80 (100)	0.117*	1.55 (0.89 to 2.68)
Female	57 (25.8)	164 (74.2)	221 (100)		1
Ethnicity/Skin Color					
White	25 (26)	71 (74)	96 (100)	0.815*	1
Black	13 (31)	29 (69)	42 (100)		1.27 (0.57 to 2.83)
Brown/Mixed Race	47 (28.8)	116 (71.2)	163 (100)		1.15 (0.65 to 2.03)
Marital status					
Single	5 (18.5)	22 (81.5)	27 (100)	0.517*	1
Married	43 (27)	116 (73)	159(100)		1.63 (0.58 to 4.58)
Widowed	28 (32.6)	58 (67.4)	86 (100)		2.12 (0.73 to 6.20)
Separated/Divorced	9 (31)	20 (69)	29 (100)		1.98 (0.57 to 6.91)
Schooling (years)					
*Up to 8	40 (25.3)	118 (74.7)	158 (100)	0.205*	1
> 8	33 (28.9)	81 (71.1)	114 (100)		1.20 (0.70 to 2.06)
Never studied	12 (41.4)	17 (58.6)	29 (100)		2.08 (0.92 to 4.73)
Social security situation					
Retired	54 (28.4)	136 (71.6)	190 (100)	0.614*	1.19 (0.54 to 2.60)
Pensioner	12 (25)	36 (75)	48 (100)		1.00 (0.38 to 2.64)
Retired and Pensioner	9 (39.1)	14 (60.9)	23 (100)		1.93 (0.64 to 5.80)
Not retired	10 (25)	30 (75)	40 (100)		1

to be continued

Continued from Table 1

Variable	Diabetes *Mellitus*			Value *p*	OR
	Yes. n (%)	No. n (%)	Total. n (%)		(CI to 95%)
Individual income (minimum salary)					
<1	12 (40)	18 (60)	30 (100)	0.250*	3.17 (0.86 to 11.65)
≥1 ≤ 2	47 (28.1)	120(71.9)	167 (100)		1.86 (0.60 to 5.76)
>2 < 4	12 (22.2)	42 (77.8)	54 (100)		1.36 (0.39 to 4.76)
≥4	10 (37)	17 (63)	27 (100)		2.79 (0.74 to 10.58)
No income	4 (17.4)	19 (82.6)	23 (100)		1
Contribution to household upkeep					
Total	47 (33.1)	95 (66.9)	142 (100)	0.130*	2.47 (0.89 to 6.87)
Partial	33 (25.6)	96 (74.4)	129 (100)		1.72 (0.61 to 4.86)
Does not contribute	5 (16.7)	25 (83.3)	30 (100)		1
Living arrangements					
Spouse only	16 (26.2)	45 (73.8)	61 (100)	0.744*	1
Relatives	25 (26.9)	68 (73.1)	93 (100)		1.03 (0.50 to 2.15)
Spouse and relatives	27 (27.6)	71 (72.4)	98 (100)		1.07 (0.52 to 2.20)
Lives alone	17 (34.7)	32 (65.3)	49 (100)		1.49 (0.66 to 3.39)

*Pearson Chi-Squared Test; **Fisher's Exact Test.

In terms of socioeconomic and demographic characterization, the majority of the elderly were mixed race/brown-skinned, 163 (54.2%); married, 159 (52.8%); retirees, 190 (63.15%); had up to 8 years of study, 158 (52.5%); earned between one and two minimum wages 167 (55.5%); and contributed totally or partially to the upkeep of the house, 271 (90.1%). Concerning living arrangements, the greatest percentage of elderly persons reported living with a spouse and family members, 98 (32.6%), followed by those who lived only with relatives, 93 (30.9%); however, 49 (16.3%) of the sample reported living alone.

There was no statistically significant association between the socioeconomic and demographic variables (Table 1) and the only variables with $p<0.20$ were: gender and contribution to household upkeep. For these variables, it was observed that the odds ratio of having diabetes was 1.55 times greater in men than in women and 2.47 times and 1.72 times greater in elderly people who contributed totally and partially, respectively, to the upkeep of the house, in comparison with those who did not contribute.

Regarding health-related behavioral factors (Table 2), only the variable BMI, analyzed numerically, was close to statistical significance in the bivariate analysis ($p=0.059$) (Table 2). For this variable, mean BMI was higher among those who were diabetic (28.19kg/m^2) when compared to the mean of non-diabetic patients (26.95kg/m^2).

Regarding variables related to health conditions (Table 3), the only one with $p<0.20$ was self-rated health, where the prevalence of elderly people with diabetes was 7.2% higher among those who self-rated their health as fair/poor than among those who considered it as excellent, very good or good. Although not statistically significant, the prevalence of diabetes was higher among the elderly who considered their health worse/much worse than other people of the same age (41.2%) when compared to those who considered their health "better/much better" (27.5%).

Turning to the assessment of functional capacity, even after adjusting for the logistic regression model, statistical significance was not identified in either the Katz ($p=0.722$) and Lawton ($p=0.640$) indices. Despite this, the prevalence of the disease was higher among the elderly classified as dependent by the Katz scale (29%) in relation to independent elderly people (27.9%). The same behavior was observed in the Lawton index, where the difference was 68.7% versus 71.9%, respectively.

The variable BMI variable, when analyzed in the logistic regression model, remained close to being significantly associated with diabetes (p=0.076) (Table 4), as for each point BMI that increased, the odds ratio for the elderly having diabetes increased 1.05 times. The logistic regression model had a degree of explanation of 71.8%, and the Wald test indicated an adequate fit (p = 0.929).

Table 2. Prevalence of diabetes according to behavioral factors linked to the health of elderly persons receiving care at a geriatric-gerontology service. Recife, Pernambuco, 2012.

Variable	Diabetes *Mellitus* Yes. n (%)	No n (%)	Total n (%)	Value *p*	OR (CI to 95%)
Total Group	85 (28.2)	216 (71.8)	301(100)		
Smoking					
Smoker	3 (37.5)	5 (62.5)	8 (100)	0.773*	1.61 (0.37 to 7.01)
Ex-smoker	34 (29.3)	82 (70.7)	116 (100)		1.11 (0.66 to 1.87)
Never smoked	48 (27.1)	129 (72.9)	177 (100)		1.00
Duration of habit (years)					
Never smoked	48 (27.1)	129 (72.9)	177 (100)	0.748*	1.00
Up to 10	7 (35)	13 (65)	20 (100)		1.45 (0.54 to 3.84)
11 or more	30 (28.8)	74 (71.2)	104 (100)		1.09 (0.64 to 1.87)
Consumption of alcohol					
Consumes alcohol	18 (26.5)	50 (73.5)	68 (100)	0.923*	1.00
Ex-consumer of alcohol	29 (29.3)	70 (70.7)	99 (100)		1.15 (0.58 to 2.30)
Has never drunk	38 (28.4)	96 (71.6)	134 (100)		1.10 (0.57 to 2.12)
Frequency of habit (month)					
No habit	67 (28.8)	166 (71.2)	233 (100)	0.562*	1.36 (0.65 to 2.82)
>4 times	7 (35)	13 (65)	20 (100)		1.81 (0.58 to 5.66)
≤ 4 times	11 (22.9)	37 (77.1)	48 (100)		1.00
Physical activity					
Very active/ active	35 (26.3)	98 (73.7)	133 (100)	0.415*	1.00
Irregularly active	33 (27.3)	88 (72.7)	121 (100)		1.05 (0.60 to 1.83)
Sedentary	17 (36.2)	30 (63.8)	47 (100)		1.59 (0.78 to 3.22)
Nutritional state					
Overweight (BMI >27)	50 (32.5)	104 (67.5)	154 (100)	0.204*	1.92 (0.83 to 4.48)
Normal weight (BMI 22 to 27)	27 (25.2)	80 (74.8)	107 (100)		1.35 (0.55 to 3.28)
Underweight (BMI <22)	8 (20)	32 (80)	40 (100)		1.00
Body Mass Index	28.19±5.18	26.95±5.10	27.30±5.15	0.059**	

* Pearson's Chi-squared Test; ** Fisher's Exact Test.

Table 3. Prevalence of diabetes according to health condition of elderly persons receiving care at a geriatric-gerontology service. Recife, Pernambuco, 2012.

Variable	Diabetes *Mellitus* Yes n (%)	No n (%)	Total n (%)	Value *p*	OR (CI to 95%)
Total Group	85 (28.2)	216 (71.8)	301 (100)		
Hospitalization in previous six months					
Yes	6 (33.3)	12 (66.7)	18 (100)	0.621*	1.29 (0.47 to 3.56)
No	79 (27.9)	204 (72.1)	283 (100)		1
Self-evaluated health					
Excellent/Very good/Good	24 (23.5)	78 (76.5)	102 (100)	0.194*	1
Fair/Poor	61 (30.7)	138 (69.3)	199 (100)		1.44 (0.83 to 2.48)
Comparison with health of others					
Much worse/worse	7 (41.2)	10 (58.8)	17 (100)	0.267**	1.85 (0.68 to 5.03)
Better/much better	78 (27.5)	206 (72.5)	284 (100)		1
Functional capacity (Katz Scale)					
Dependent	29 (29)	71 (71)	100 (100)	0.836*	1.06 (0.62 to 1.79)
Independent	56 (27.9)	145 (72.1)	201 (100)		1
Functional capacity (Lawton Scale)					
Dependent	5 (31.3)	11 (68.7)	16 (100)	0.779**	1.17 (0.39 to 3.46)
Independent	80 (28.1)	205 (71.9)	285 (100)		1

* Pearson's Chi-squared Test; **Fisher's Exact Test.

Table 4. Logistic regression of prevalence of diabetes according to independent variables among elderly persons receiving care at a geriatric-gerontology service. Recife, Pernambuco, 2012.

Variable	OR (CI 95%) Univariate	Adjusted for model	*p* value
Gender			
Male	1.55 (0.89 to 2.68)	1.37 (0.75 to 2.50)	0.301
Female	1.00	1.00	
Age	1.02 (0.98 to 1.06)	1.00 (0.95 to 1.05)	0.985*
Study (years)			
Up to 8	1.00	1.00	
More than 8	1.20 (0.70 to 2.06)	1.28 (0.70 to 2.36)	0.479*
Never studied	2.08 (0.92 to 4.73)	1.61 (0.67 to 3.84)	
Income (minimum salary)			
<1	3.17 (0.86 to 11.65)	1.11 (0.09 to 13.18)	0.381*
1 to 2	1.86 (0.60 to 5.76)	0.61 (0.04 to 7.61)	
>2 to 4	1.36 (0.39 to 4.76)	0.39 (0.03 to 5.27)	
>4	2.79 (0.74 to 10.58)	0.83 (0.06 to 11.77)	
No income	1.00	1.00	
Contribution to household upkeep			
Yes, total	2.47 (0.89 to 6.87)	3.90 (0.40 to 38.01)	0.272*
Yes, partial	1.72 (0.61 to 4.86)	2.67 (0.28 to 25.49)	
Does not contribute	1.00	1.00	

to be continued

Continued from Table 1

Self-rated health			
Excellent/ Very good/ Good	1.00		
Fair/ Poor	1.44 (0.83 to 2.48)	1.32 (0.72 to 2.40)	0.368*
Regular physical activity			
Very active/active	1.00	1.00	
Irregularly active	1.05 (0.60 to 1.83)	0.96 (0.53 to 1.72)	0.799(**)
Sedentary	1.59 (0.78 to 3.22)	1.24 (0.57 to 2.72)	
Body Mass Index	1.05 (1.00 to 1.10)	1.05 (1.00 to 1.11)	0.071**

*Pearson's Chi-Squared Test; **Fisher's Exact Test.

DISCUSSION

In the present study, the prevalence of diabetes among the 301 elderly people who composed the sample was 28.2%. A lower prevalence (15.4%) was found in an epidemiological study carried out with 60 years and older elderly individuals receiving care in the outpatient service of a public hospital[3] and in a study which was part of the Health Surveys of the State of São Paulo (ISA-SP), which found a prevalence of 17.6%[5].

Data from the 2013 Sistema de Vigilância de Fatores de Risco e Proteção para Doenças Crônicas por Inquérito Telefônico (the Surveillance System for Risk Factors and Protection for Chronic Diseases by Telephone Inquiry) (VIGITEL) showed a frequency of prior medical diagnosis of diabetes for the adult population of the Brazilian capitals and the Distrito Federal of 6.9%[11]. The high prevalence found in the present study can be explained by the average age of the elderly participants, since in both genders the disease becomes more common with the advancing age[11,12].

In terms of the demographic variables, the ISA-SP[5] project found a statistically significant association between the prevalence of diabetes and marital status, and no significant association with any other demographic variable studied, corroborating the findings of the present study. It is worth noting, however, that while no statistical association was found, the study identified an increase in the prevalence of the disease with increasing age.

Regarding behavioral factors related to health, no significance was observed for the variables smoking and alcohol consumption, or their frequencies. Similar data regarding smoking were found in another study[3]. In a study related to the ISA-SP5 Project, significance was found in the variable frequency of alcohol consumption, but this was not the case when alcoholism was evaluated through the CAGE questionnaire, an instrument validated in Brazil since 1983, which is based on four questions (Cut-down, Annoyed By Criticisms, Guilty and Eye-Opener)[13].

Although scientific literature affirms the interference of the practice of physical activity on the prevalence of diabetes, this variable was not statistically significant in the present study even when adjusted for the logistic regression model (p=0.799). Despite this, it was observed that the proportion of those who have diabetes compared with those who do not was substantially higher in the group of elderly persons classified as sedentary (36.2%) with a 10% greater percentage than those classified as very active and/or active (26.3%) and irregularly active (27.3%).

A systematic review carried out from 1994 to 2006 analyzed published information on the adherence and motivation of people with diabetes mellitus participating in health programs aimed at stimulating the adoption of a healthy lifestyle. This review reinforced the theory that the practice of exercise is a coadjuvant in the prevention or delay of clinical manifestations of type 2 diabetes, but also described some of the behavioral and emotional difficulties that may influence the adherence of the diabetic elderly to the prescribed treatment[14].

In another systematic review that described a protocol of physical exercises for the primary care of type 2 diabetes, it was observed that the benefits

of exercise for disease are more visible when they are aerobic and resistance exercises, performed with moderate to high intensity, recommendations which were not found among the elderly participants of this study[15].

Also, according to this review, such exercises must use up to 80% of the maximum heart rate for aerobic training and up to 85% of a maximum repetition for resistance exercises for the exercise program to be classed as moderate and/or high intensity[14]. In the present study, physical activity was investigated considering the frequency and time spent in the performance of such activity, not taking into account characteristics such as type of exercise, systematization, intensity and specificity.

Thus, the statistical non-association between the prevalence of diabetes and the practice of physical activity found in this study can be explained by the fact that the activities cited by the elderly investigated are more related to walking for leisure and transportation purposes and for domestic tasks. The majority did not participate in a physical exercise program, and therefore did not perform systematically prescribed physical activities, which have well-established duration and intensity, in a specific manner.

Another important factor is that the group of professionals in the Elderly Care Center where the elderly participants of this study received care did not contain a physical educator. Therefore, counseling regarding the practice of exercise as an element of support for diabetes treatment was not very effective. Another study on the prevalence of diabetes and its associated factors also showed a similar finding[5].

In terms of nutritional status, based on a cutoff point for overweight of BMI>27kg/m^2, which is recommended for the elderly and takes into account the changes in body composition due to aging, such as bone, muscle and body water decrease, as well as the increase and redistribution of fat[11], no significant statistical association was observed in the bivariate analysis (p=0.204). When the BMI variable was analyzed continuously, it was around the level of significance (p=0.059), and remained close to an association with the prevalence of diabetes when adjusted for the logistic regression model (p= 0.076).

In contrast to this result, other cross-sectional epidemiological studies performed with the elderly population have found a statistically significant association between the presence of self-reported diabetes and body mass index[16,17]. It should be noted that in the present study the anthropometric parameters used for the calculation of BMI were measured at the time of the interview and self-reported data were not used, as these may be compromised by forgetfulness bias.

Although the association between obesity and the increased chance of developing diabetes is clearly identified in scientific literature[18], the present study did not identify this association. It is important to note, however, that the sample of elderly diabetics may have been underestimated due to a lack of the registration of the diagnosis of the disease in the medical records of the elderly.

Another important aspect observed was that as the average age of the elderly investigated was high, this non-association suggests the interference of obesity and associated pathologies as factors that may be contributing to the greater premature mortality of the obese elderly. This relationship, however, could not be proven because the present study did not address the presence of diseases other than diabetes.

An interesting finding of this research is that, despite the functional limitations and organ dysfunction that diabetes can cause[3], approximately one-quarter of the elderly diabetics (23.5%) self-rated their health as excellent, very good or good. This finding may be related to the fact that the elderly receive care at a service that offers weekly specialized professional care, involving educational practices aimed at the diabetic patient.

It is also worth noting that most of the diabetic elderly investigated were asymptomatic and did not have any reported complications. Nonetheless, it is known that chronic non-transmissible diseases have a significant impact on quality of life, with a direct influence on the self-assessment of health[19].

Even so, the percentage of elderly diabetics who self-rated their health as excellent, very good or good was lower than those who considered it regular or poor (30.7%). In terms of the comparison with the health of other people of the same age, the majority

of non-diabetic elderly patients evaluated their health as better or much better (72.5%), while the largest group of diabetics described their health as much worse or worse (41.2%), although this difference was not significant.

In terms of the assessment of functional capacity, while this variable was not associated with diabetes in this study, even when the logistic regression model was adjusted, the prevalence of the disease was greater among the elderly classified as dependent by the two scales used to measure this variable (Katz and Lawton). The classification of independence was higher among the non-diabetic elderly, also using the Katz (72.1%) and Lawton (71.9%) scales.

A study that used the same indexes found that most of the elderly had some degree of disability in the performance of instrumental activities, but were more independent in activities of daily living. However, corroborating these findings, this disability was not significantly associated with type 2 diabetes mellitus, and is therefore an occurrence connected to the aging process and the presence of other morbidities[20].

In contrast, another cross-sectional study showed that diabetes was associated with a twofold increase in the risk of disability in the performance of activities of daily living when compared with individuals without the disease, and that this limitation could reduce social interaction and interfere with the sense of well-being[21].

The present study measured the functional capacity of the elderly in a single moment, which may have compromised the evaluation of the relationship between functional decline and the presence of chronic noncommunicable diseases, which has been observed over years of follow-up[3]. It is also worth mentioning that, in this study, the elderly individuals drawn to make up the sample were invited to the outpatient service to participate in the study, which may have contributed to a possible selection bias, considering that those with some type of functional impairment may not have accepted such an invitation because of difficulty in moving around.

CONCLUSIONS

Although the variables studied were not found to be statistically significant, the results obtained in this study demonstrate the importance of using them in gerontological studies that address diabetes. New studies on the subject which consider the particularities and specificities of the elderly public, minimizing bias and maximizing the veracity of the results found, are required.

In this way, it will be possible to create educational intervention strategies adjusted to enable diabetic elderly persons to maximize self-care, thus contributing to the promotion of autonomy and improvement of the quality of life.

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Analysis of medication use by elderly persons with supplemental health insurance plans

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Abstract

Objective: To analyze the socio-demographic and pharmacotherapeutic profiles of elderly users of a private health plan. *Method:* A cross-sectional and descriptive study was conducted with 239 elderly users of a private health plan in a medium-size city in the state of São Paulo, Brazil. A structured questionnaire was used for data collection and absolute and relative frequencies were obtained. The pharmacotherapeutic survey estimated the prevalence and average number of medicines used in the 15 days prior to the interview, as well as adherence to treatment. *Results:* Of the respondents, 79% were female, with a mean age of 73 years. The main health problems reported were: arterial hypertension, rheumatism/arthritis, dyslipidemia and diabetes. A total of 97.1% of the elderly persons used medicine, and the most frequently used classes were for the cardiovascular and digestive systems. An average of 5.9 drugs/elderly person were used and 62.8% of the sample were undergoing polymedication. A total of 11.7% of the sample used medications that were unsuitable for the elderly, 51% had average adherence to medication and 12.1% had poor adherence. *Conclusions:* The majority of elderly people in the sample were female, lived with relatives and had a higher-level education. Despite the use of polymedication and the presence of multiple comorbidities, the percentage of elderly persons with low adherence to treatment was lower than that found in other studies. A high level of education and purchasing power, which facilitated the access to medication of the elderly patients under study, may be important predictors of adherence to treatment. The results support maintaining a model of care for the elderly centered on the treatment of diseases and pharmacotherapy.

Keywords: Supplemental Health. Elderly. Drug Utilization. Polypharmacy.

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INTRODUCTION

The aging process is in most cases accompanied by the onset of diseases, a finding confirmed by the Pesquisa Nacional de Saúde (the National Health Survey) (PNS) of 2013, in which the elderly were found to be the age group with the highest rates of noncommunicable chronic diseases (NCCD)[1]. Around 80% of elderly persons suffer from one or more NCCD and 36% suffer from three such illnesses[2]. In the 2008 Pesquisa Nacional por Amostra de Domicílios (the National Household Sample Study) (PNAD)[3], 77.4% of elderly persons said they suffered from a NCCD, and approximately 55% of individuals with Supplemental Health Insurance (SHI) had an NCCD[3].

Elderly persons are therefore expected to use multiple medications to control these diseases and to maintain quality of life and the quantity of years lived[4], as such treatment is a significant technological development designed for this purpose. Such use can cause harm to health however, especially when used improperly or to the detriment of non-drug treatment measures, which, as they require changes in behaviors that have been defined throughout life[5], demand great attention from both the elderly persons and the health team.

In addition to using multiple medications, the elderly are more exposed to the consequences of this use, as they undergo physiological changes that modify pharmacodynamics and pharmacokinetics, contributing to the toxicity of such drugs[6].

The most common errors in drug use among the elderly involve inappropriate medications, improper dosage, inadequate frequency, insufficient duration of use or exaggerated consumption, and the unsuitable combination with other drugs, causing unwanted interactions. Problems also arise from non-adherence to drug treatment [7].

Many countries have their own evaluative criteria to guide prescribers about the risks of indicating a large number of drugs for the elderly population, such as the PRISCUS criteria in Germany, the French consensus panel list, STOPP/START Screening in Ireland, the Beers criteria in the USA, and McLeod's list in Canada[8], among other protocols around the world. Brazil does not have its own consensus, with the Beers Criteria the most commonly used reference in the country. The first list of inappropriate drugs was published in 1991 and updated in later versions[8], and the latest version of the Beers Criteria, updated by the American Society of Geriatrics (AGS), was published in 2015[9].

Given the different conditions involving the use of drugs among the elderly, it is important to recognize the profile of drug use by this population in different life and health contexts, so that strategies can be designed for the rational prescription of drugs for this age group.

However, there are few studies that deal with elderly persons with SHI, who, despite their greater purchasing power, can present complex problems that require specific actions. Membership in a health plan results in ease of access to care and medical prescription and is associated with the increased use of medications[10]. The amount of medicines used and their financial cost therefore weigh significantly in the budget of this age group, while many older people with SHI also seek to obtain at least some of their drugs through the Sistema Único de Saúde (the Unified Health System) (SUS)[6].

The 2013 Pesquisa Nacional de Saúde (National Health Survey) (PNS)[11], published in 2015, found that 27.9% of the population surveyed had a health plan of some kind, with this rate rising to 28.4% among people aged 60 years or older. However, in 2016 the Agência Nacional de Saúde Suplementar (the National Agency of Supplemental Health) (ANS) stated that 48.8 million people (25.5%) in Brazil have SHI, of whom 12.3% are elderly, and who are predominantly women[12].

In view of the above and the lack of studies in the context of supplemental health, and considering the geographical and populational heterogeneity of Brazil, it is believed that the use of drugs among the elderly with SHI presents specific issues that require further elucidation. The present study aims to analyze the sociodemographic and pharmacotherapeutic profiles of elderly users of supplemental health plans.

METHOD

A cross-sectional quantitative study was carried out of the profile of the medication use of elderly people with supplemental health insurance, living in a town in the interior of the state of São Paulo, Brazil. This town has 224,637 inhabitants[13], with approximately 78,000 beneficiaries of health insurance, corresponding to 34.7% of the total population. Of these, 15.4% are over 60 years of age, according to ANS data[12]. The vast majority of these elderly people belong to the portfolio of beneficiaries of the health plan provider studied.

The study population included people who were 60 years of age or older, irrespective of gender, who were not institutionalized and were users of the health plan with the widest coverage in the town. The sample size was calculated using the following statistical parameters: an elderly population who used the health plan of 8,474 people, a prevalence of medication use of 83%[10], a margin of error of 5%, and a confidence level of 95%, resulting in 239 elderly people.

The data were collected through interviews at home, from May 2014 to January 2015, using a questionnaire applied by the principal researcher. From the list with names and addresses of the elderly provided by the health plan provider, a random draw was performed to enable data collection to be carried out. After three unsuccessful attempts to locate an interviewee the next elderly person was drawn.

The information was obtained directly from the elderly persons, and the elderly/caregiver were asked to provide the researcher with all medications used in the fifteen days prior to the date of the interview. In cases in which the elderly person presented difficulty in providing such information, the interview was performed with the caregiver/family member responsible for administering their medication.

The questionnaire was composed of demographic data (gender, ethnicity/color, marital status, age and religion); social data (occupation, medication expenses, educational level, with whom the elderly person lived and economic class according to the Critério de Classificação Econômica Brasil (the Brazilian Economic Classification Criteria)[14], health problems in the last six months; medications used, prescribed or otherwise; access to medications; adherence to medication use evaluated with the Portuguese version of the Morisky-Green Test (MGT), which consists of four questions through which the elderly are classified as having high, medium and low adherence[15]. The behavior of those with low adherence is also defined as intentional or unintentional.

The Beers Criteria, updated in 2015[9], were created to evaluate the inappropriate use of drugs. They include a list of pharmacological classes and sub-classes that help in the selection of appropriate medicines and the identification of Potentially Inappropriate Medications (PIM), or in other words, those that offer greater risks than benefits for the elderly. This list is divided into five categories: medications that are inappropriate for the elderly; those that should be avoided with determined illnesses or syndromes; medications that should be used with precautions among the elderly; medications that require an adjustment in dosage in accordance with renal function and medications that can cause medication-related hospitalization.

The drugs were classified according to the Anatomical Therapeutic Chemical Classification System (ATC) 2016[16], recommended by the World Health Organization for drug use studies. In this classification, medications are divided according to the anatomical group or system in which the drug and its active principle act. Descriptive statistics were used for the analysis of the data.

The present study was authorized by the manager of the Cooperativa dos Usuários Médicos (the Medical Users Cooperative) (UNIMED) and was approved by the Ethics Committee for Research involving Human Beings of the institution to which the principal investigator is affiliated, under Approval Number 607.824 dated March 31, 2014. The participants were informed about the nature of the study, its objectives, methods and possible inconveniences inherent in the interview process, and signed a Free and Informed Consent Form.

RESULTS

As shown in Table 1, of the 239 interviewees, the majority (79%) were women; 75.8% were aged between 60-79 years; 80.7% were of white/Caucasian skin color/ethnicity; 52.7% were married and 74.5% practiced the Catholic religion. The mean age for both genders was 73 (±8) years. In terms of occupation, the majority were retired (81.2%). Medication expenses were between R$101.00 and R$300.00 (40.1%). The most prevalent economic class was B, to which 51.1% of respondents belonged. The majority of the elderly lived with relatives (75.6%) and 27.2% had completed higher education. The respondent (61.5%) was the main person responsible for paying for the health insurance.

A total of 955 health problems were reported by the elderly, with arterial hypertension the most prevalent, affecting 17.5% (167) of the interviewees, followed by rheumatism or arthrosis (8.6%), dyslipidemia (8.4%) and diabetes (7.6%). On average, the elderly described suffering from four health problems.

Among the elderly interviewed, 97.1% (232) had used some type of medication in the 15 days prior to the interview, while 62.8% (150) consumed five or more drugs. The average number of medications used by the elderly was 5.9 (± 4.1), with men consuming 5.4 (±3.3) medications on average and women 6.1 (± 4.2). The maximum number of drugs consumed by the elderly was 15. In terms of access to medicines, 48.9% (117) purchased them in commercial pharmacies with their own resources, 36.5% (87) bought some of their medicines in a commercial pharmacy, while others used public health units where medications are dispensed free of charge. Of the elderly persons interviewed, 51% (122) exhibited medium adherence and 12.1% (19) low adherence to medication use (Table 3). Among the elderly who did not adhere to medication, 47.4% were found to be in the condition of intentional non-adherence, that is, even if they feel better when taking medication, the patient stops using it.

Table 1. Distribution of demographic characteristics of the 239 elderly users of the Supplemental health plan. Marília, São Paulo, 2015.

Variables	n (%)
Gender	
Male	50 (21.0)
Female	189 (79.0)
Age (years)	
60 - 69	90 (37.7)
70 - 79	91 (38.1)
80-89	52 (21.7)
90 or more	6 (2.5)
Ethnicity/skin color	
White	193 (80.7)
Black/Brown	18 (7.5)
Yellow	28 (11.8)
Marital status	
Unmarried	20 (8.4)
Married	126 (52.7)
Widower	91 (38.1)
Separated	1 (0.4)
Common Law Marriage	1 (0.4)

to be continuous

Continuação da Tabela 1

Variables	n (%)
Religion	
Catholic	178 (74.5)
Evangelical	20 (8.4)
Spiritism	20 (8.4)
Buddhist/Other	21 (8.70)
Occupation	
Retired	194 (81.2)
Housewife	23 (9.6)
Others	22 (1.2)
Spending on medicines	
Up to 100.00	65 (27.1)
From 101.00 to 300.00	96 (40.1)
From 301.00 to 500.00	41 (17.2)
More than 500.00	13 (5.5)
Nothing / Do not know	24 (10.1)
Lives	
Alone	58 (23.6)
With friends	2 (0.8)
With relatives	179 (75.6)
Economic Classification	
Class A	15 (6.2)
Class B	122 (51.1)
Class C	90 (37.6)
Class D	10 (4.3)
Did not answer	2 (0.8)
Education	
Illiterate/Incomplete elementary	59 (24.7)
Complete elementary/Incomplete high school	54 (22.6)
Complete high school/Incomplete higher education	60 (25.1)
Graduate	65 (27.2)
Did not inform	1 (0.4)
Responsible for paying for health plan	
Interviewee themselves	147 (61.5)
Family (child/spouse)	78 (32.7)
Others	14 (5.8)

Table 2. Health problems described by interviewees. Marília, São Paulo, 2015.

Health problems described	n (%)
High pressure	167 (17.5)
Rheumatism or arthrosis	82 (8.6)
Dyslipidemia	80 (8.4)
Diabetes	73 (7.6)
Restless or troubled sleep	66 (7.0)
Infarction, angina	59 (6.2)
Hypothyroidism	50 (5.2)
Bronchitis, influenza, pneumonia	34 (3.5)
Varicose veins	26 (2.7)
Osteoporosis	25 (2.6)
Visual impairment	19 (2.0)
Labyrinthitis	18 (1.9)
Itchy, sore skin	17 (1.8)
Depression	16 (1.7)
Urinary infection	14 (1.5)
Kidney problems	9 (1.0)
Cancer	9 (1.0)
Diverticulitis	7 (0.7)
Uric acid	7 (0.7)
Osteopenia	6 (0.6)
Panic Syndrome	6 (0.6)
Falls	6 (0.6)
Benign prostatic hyperplasia	6 (0.6)
Others	153 (16.0)
Total	955 (100.0)

Table 3. Use of medications in the fifteen days prior to the date of the interview, way of obtaining medicines, and degree of adhesion of elderly persons interviewed. Marília, São Paulo, 2015.

Variables	n (%)
Use of medications in 15 days prior to the interview date	
Yes	232 (97.1)
No	7 (2.9)
Number of medicines	
0	7 (2.9)
1 to 4	82 (34.3)
5 or more	150 (62.8)
Medicines obtained from	
Health unit	15 (6.3)
Pharmacy	117 (48.9)
Third parties	0 (0)
Health unit + pharmacy	87 (36.5)
Pharmacy + Third Parties	11 (4.5)
Health Unit + Pharmacy + Third Parties	2 (0.8)
Does not use medicines	7 (2.9)

to be continuous

Continued from Table 3

Degree of adhesion	
High	69 (28.9)
Average	122 (51.0)
Low	19 (8.0)
Not applicable	29 (12.1)
Low adhesion behavior	
Intentional	9 (47.4)
Not intentional	7 (36.8)
Both	3 (15.8)

A total of 1358 drugs were consumed (Table 4), with medications for the cardiovascular system appearing most frequently (30.2%), and antihypertensive drugs the most used (8.10%). Drugs for the digestive system and metabolism were the next most common (22.60%), predominantly vitamins (8.9%), followed by those for the nervous system (18.19%), where analgesics were the most used (5.54%).

Of the drugs used, 11.7% (159) were considered to be potentially inappropriate for the elderly, with musculoskeletal relaxants (27%) and proton pump inhibitors (22%) the most commonly used (Table 5).

Table 4. Anatomic classification of medications used by the elderly, according to the Anatomical Therapeutic Chemical (ATC) Classification System[16], 2016, Marília, São Paulo, 2015

Anatomical Classification	n (%)
Cardiovascular apparatus	410 (30.2)
Digestive system and metabolism	307 (22.6)
Nervous system	247 (18.2)
Musculoskeletal system	130 (9.6)
Blood and Hematopoietic Organs	71 (5.2)
Systemic hormonal preparations, other than sex hormones and insulins	56 (4.3)
Herbal medicines	42 (3.1)
Respiratory Device	36 (2.6)
Sensory organs	20 (1.5)
Genito-urinary tract and sex hormones	16 (1.2)
Antimicrobials for systemic use	14 (1.0)
Dermatological	5 (0.3)
Others	4 (0.3)
Total	1358 (100.0)

Table 5. Inappropriate medications for elderly persons according to the Beers Criteria, 2015. Marília, São Paulo, 2015.

Group/medications	n (%)
Musculoskeletal system	54 (34.0)
Musculoskeletal relaxants	4 (27.0)
Non-steroidal anti-inflammatory drugs	11 (7.0)
Digestive system and metabolism	36 (22.6)
Proton Pump Inhibitor	35 (22.0)
Metoclopramide	1 (0.6)
Central Nervous System	33 (20.8)
Benzodiazepines	17 (10.8)
Amitriptyline	8 (5.0)
Paroxetine	4 (2.5)
Phenobarbital	3 (1.0)
Non-benzodiazepine hypnotics	1 (1.0)
Endocrine	16 (10.1)
Insulin	9 (5.7)
Estrogen	5 (3.2)
Long-lasting sulphonylureas	2 (1.2)
Cardiovascular	14 (8.8)
Amiodarone	9 (5.8)
Nifedipine	2 (1.2)
Digoxin	2 (1.2)
Methyldopa	1 (0.6)
Antimicrobial	3 (1.9)
Nitrofurantoin	3 (1.9)
Antithrombotics	2 (1.2)
Ticlopidine	2 (1.2)
Antihistamines	1 (0.6)
Hydroxizine	1 (0.6)
Total	159 (100.0)

DISCUSSION

In terms of the sociodemographic data of the interviewees, the majority were female, confirming the findings of another study[17], as well as data from the Instituto Brasileiro de Geografia e Estatística (the Brazilian Institute of Geography and Statistics) (IBGE) which describe the feminization of old age[18], as women are less exposed to the risk of illness and death[17]. Nevertheless, in the present study, the predominance of women (79%) was greater than that found in general studies, which have described this proportion as around 55%, coinciding with the PNAD 2008[3] and IBGE projections for the elderly population of Brazil in 2016.[19] In a study carried out in the same locality by Marin et al.[20], it was found that among users of the Family Health Strategy (FHS), 61.8% of the elderly population was female. In terms of the elderly who use health insurance, it has been found that for every 100 men aged 60 years or over, there are 143 women[21]. In addition, women are more likely to agree to data collection, as was the case in the present study.

The most prevalent age range in the present study was 70-79 years (38.1%). This older profile was also observed in elderly beneficiaries of health insurance when compared with those without health

insurance[21]. However, among elderly persons with SHI in Brazil, the largest age group was 60-69 years[12]. The predominance of white/Caucasian skin color/ethnicity, the Catholic religion, and a marital status of married corresponded to data from the 2010 Demographic Census[22]. Among women, however, there was a predominance of widows, which is explained by male over-mortality and by the fact that older men seek to remarry, often with younger women[18].

The majority of the elderly persons were retired, an index similar to those found in social indicators of the Brazilian population[18], in which 77.4% of the elderly population were found to be retirees and/or pensioners.

When applying the Brazilian Economic Classification Criteria 2015[14], most of the elderly persons interviewed belonged to class B, in line with PNAD 2008[3], which confirms that elderly people with health insurance are from the most socially favored classes. It is important to emphasize that this social class represents only 25.5%[12] of the Brazilian population.

A study carried out in Rio de Janeiro[6] found an association between having health insurance and greater spending on medicines. The average expenditure on medicines accounts for approximately one quarter of the average monthly income of more than half of the Brazilian elderly population[23].

Most of the elderly interviewed lived with relatives, but many lived alone, which is considered a justification for pharmacological monitoring, as there is an indication that these elderly people are more prone to problems related to medication use[6].

Another finding of the present study which differs from results observed in the general elderly population was schooling, as 52.3% of participants in the present study had completed secondary or higher education. Even so, almost a quarter (24.7%) had no education or incomplete elementary schooling only. A study by Marin et al.,[20] of elderly users of an ESF (Family Health Strategy) (Estratégia Saúde da Família) in the same city[19] found that 68.1% of individuals did not have an education or only had incomplete elementary schooling, as opposed to 24.7% who did. The PNS 2013[24] found that the higher the level of education, the greater the health plan coverage, with figures ranging from 16.4% for individuals without education or with incomplete elementary schooling to 68.8% for those with complete higher education.

As has also been found among the general population, the present study reported an average of four health problems per elderly person, with the distribution of diseases that most affected this age group very similar to that found in the PNS 2013[24], although depression was found to be the 14th most common disease affecting the elderly in the present study, while it was the 4th most prevalent chronic disease among the Brazilian population in the PNS 2013. In the present study, the 4th ranked CNCD was diabetes, which was closer to the results of PNAD 2008[3] and the findings of a study of elderly SUS users in the same locality[20]. In a study carried out in Belo Horizonte, in the state of Minas Gerais[17], it was concluded that although the morbidity and mortality profile of the SHI beneficiaries was similar to that observed for SUS users, the average diagnosis of disease described by the elderly in this study was 2.5 times greater than the results of a study with SUS users[20].

The prevalence of drug use in the study population was 97.1%, surpassing the rates found in other regions of the country, such as 79.4% in the south[25] and 85.5%[26] in the northeast regions These data are in line with the study by Silva et al.[10], in which it was found that enrollment in a health plan was positively associated with the use of medication, due to the greater ease of access to doctors from different specialties, resulting in a greater number of prescriptions.

Polypharmacy was practiced by 62.8% of the elderly participants of the study. National studies have found a variation ranging from 15.97% to 36%[27,28]. This variation can occur due to methodological differences (populations studied, recall period) and even to the interpretation of the concept of polypharmacy. However, it is known that the use of six or more drugs raises the risk of serious drug interactions by as much as 100%[29].

The therapeutic classes most used by the study population were antihypertensive drugs, followed by

vitamins and analgesics. The frequent use of drugs that act on the cardiovascular system in this age group has also been found in other studies10,17 and is consistent with the PNS-2013, which highlights cardiovascular disorders as having a higher occurrence of CNCDs.

The simultaneous occurrence of multiple diseases, associated with the use of large quantities of drugs, the lack of a private health plan, a low level of schooling and the aging process itself, with loss of independence and cognitive capacity, are factors that limit adherence to medications[30]. Good schooling, a health plan and good functional and cognitive capacity are factors that likely contributed to the fact that only 12.1% of the elderly in the present study had low adherence to treatment. However, the data from the sample diverge regarding the occurrence of comorbidities and the use of large quantities of drugs as limiting factors of adherence to treatment. In spite of the use of polypharmacy and the presence of several comorbidities, low adherence to treatment occurred in a smaller proportion of the elderly persons in the present study than generally found in literature. It is possible that a high level of schooling and purchasing power, facilitating access to medication among the elderly studied, are important predictors of adherence to treatment.

According to the Beers Criteria 2015[9], 11.7% (159) of the drugs used by the elderly persons in this study were inappropriate, a prevalence lower than those found in other studies, which ranged from 13% to 44.73%. It is important to note that the Beers Criteria revised in 2015 includes consistent modifications over previous versions, such as the withdrawing or changing of the groups of many inappropriately used medications for the elderly, regardless of disease.

In Brazil, as in many countries around the world, a national consensus is being developed on medicines that are inappropriate for the elderly[32,33], considering existing medicines in the domestic market and the possibility of replacing inappropriate drugs with other drugs with a lower risk/benefit ratio.

Among the drugs considered to be inappropriate for the age group of the present study, musculoskeletal relaxants (carisoprodol, Cyclobenzaprine and orphenadrine) were the most frequently used. These drugs are tolerated poorly by the elderly as they cause anticholinergic effects, sedation and weakness. They are sold in Brazil in combination with dipyrone, diclofenac, paracetamol and caffeine and without the need for medical prescription, allowing their use as self-medication[34]. In the USA, the use of muscle relaxants among the elderly aged over 65 years increased 136% between 1999 and 2012[34]. Proton pump inhibitors, meanwhile, elevate gastric pH, increasing the risk of infection by *Clostridium difficile*, bone loss, fractures, pneumonia and malabsorption[35], and so the Beers Criteria 2015 recommends avoiding their use for more than eight weeks[9]. The medications used by the participants of the present study differed from those seen among elderly Family Health Strategy users[20]. Among such individuals, the use of muscle relaxants was not observed, whereas proton pump inhibitors represented the 5th most used group of medicines. It should be considered that this difference in data may be related to the recall period used. In addition to this variable, it is important to point out that 85% of the patients receiving care via the SUS obtain most of their medication from within the system itself or from a Farmácia Popular (Popular Pharmacy) (21.9%)[24]. Muscle relaxants associated with non-steroidal anti-inflammatory drugs (NSAIDs) are not among the medicines provided by city authorities and are not listed in the Relação Nacional de Medicamentos (National Medications List) (RENAME). Many of the participants in this study (48.3%) bought their medicine from a commercial pharmacy, as was also demonstrated by PNAD 2008[3].

However, it should be considered that the PIM list for the elderly, according to the 2015 Beers Criteria[9], continues to disregard the heterogeneity of the elderly population and the availability of pharmaceutical specialties in the markets of each country[29,32], as it is designed for use in the USA. The new version, however, puts greater emphasis on clinical judgment in decision-making regarding the pharmacotherapy of the elderly. However, while the lack of specific criteria in Brazil continues, the application of the 2015 Beers Criteria facilitates clinical practice and improves the quality of care.

Among the limitations of this study are difficulty of access to the population of elderly SHI users, as there was a great deal of refusal, especially among elderly men.

CONCLUSIONS

The sociodemographic profile showed that the majority of the sample was female, who lived with relatives. There was an older mean age than in other similar studies, and most of the sample had a higher level of education, differing from the general level of schooling of the Brazilian elderly population.

Regarding pharmacotherapeutic profile, the disease/elderly person ratio of the sample was similar to many studies on the subject, although indices of the use of polypharmacy, the mean medication use/elderly person and the prevalence of medication use were higher than in literature. The use of potentially inappropriate medications was lower than the majority of Brazilian studies. This variation may be associated with changes made in the updated 2015 Beers Criteria, which is significantly different from previous versions, as well as demographic differences among the elderly, local medical and pharmaceutical care, access to health services and the recall period of the study. Regarding adherence to treatment, 12.1% of the elderly had low adherence. Despite the use of polypharmacy and the presence of several comorbidities, the proportion of low adherence to treatment among the elderly was smaller than that found in literature. It may be that the higher level of schooling and purchasing power, favoring the access to medication of the elderly studied, are important predictors of adherence to treatment.

The results regarding medications suggest that an elderly care model focused on the treatment of diseases and pharmacotherapy continues to predominate, even among individuals with greater purchasing power, higher levels of education and access to a supplemental health plan. Therefore, in order to better understand this issue, it is important that new studies are carried out, evaluating the training of those who prescribe medicine and their knowledge regarding the risks/benefits of medications, to better define criteria and proposals that can rethink the model of patient care for the elderly population, given the increase in the life expectancy of this population.

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Development of enteral homemade diets for elderly persons receiving home care and analysis of macro and micronutrient composition

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Abstract

Objective: the development and analysis of the macro and micronutrient composition of homemade enteral diets. *Method:* A standard homemade enteral diet was developed at three caloric concentrations - 1500, 1800 and 2100 Kcal. After preparation and testing of viscosity, stability, odor and color, plus evaluation of cost, the chemical composition of the nutrients of the diets were analytically determined. Folic acid, vitamin D and vitamin B12 values were calculated using chemical composition tables. The results were compared with recommended nutritional standards for the elderly. *Result:* The diets exhibited normal macronutrient distribution. The 1500 caloric level presented some mineral and vitamin deficiencies. Suitable values were obtained at the other caloric levels for all minerals except magnesium. There were appropriate levels of all the vitamins in the 2100 Kcal diet, while vitamin E, D and B6 levels were below the recommended dietary allowances in the 1800 Kcal diet. *Conclusion:* The standard homemade enteral diets studied can contribute to the food and nutritional safety of elderly persons undergoing home care, if all are supplemented with magnesium and the 1800 Kcal diet is supplemented with vitamin E, D and B6. The 1500 Kcal diet was not nutritionally safe in terms of micronutrients.

Keywords: Home Care Services. Enteral Nutrition. Food Analysis. Elderly. Food and Nutrition Security.

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INTRODUCTION

The demographic transition caused by population aging in Brazil, which is now in its advanced stages[1] has consequences for the structuring of health care networks, resulting in the need for increased investment not only in basic and hospital care, but also in home care and in long-term care facilities[2].

Elderly persons have a high prevalence of chronic noncommunicable diseases such as hypertension, type II diabetes, cardiovascular diseases and neurological diseases, which impose the burden of surviving with disabilities on the individual and society[3]. These increase the frailty of the elderly, resulting in greater vulnerability and functional decline[4]. Such individuals are susceptible to malnutrition and sarcopenia, especially due to the permanent presence of dysphagia, with the inability to meet nutritional needs via the oral route[2,5]. In such cases, one treatment approach is home-based enteral nutritional therapy (ENT)[2,5,6].

Home-based ENT has a satisfactory cost-benefit ratio as it reduces the risk of infection by avoiding prolonged hospital stays, and is cheaper than hospital enteral therapy[6]. It also improves nutritional status[5,6] and allows coexistence with the family, favoring comfort and quality of life[7], contributing to an adequate and healthy diet.

The type of diet administered represents one of the most controversial aspects of home ENT. The majority of industrialized formulas provide a balanced nutritional composition, controlled osmolality, adequate stability and microbiological safety. They may be impracticable, however, due to high costs and the difficulty of making such products available free of charge within the public health system.

Homemade and semi-homemade enteral diets are those exclusively made from *in natura* foods, or those made from such foods combined with modules or supplements[8], respectively. These formulas require special care not only in the planning and calculation of their nutritional composition, but also in the technique of pre-preparation and cooking, standardization of measures, observation of physical-chemical characteristics and especially in the care of food hygiene and handling during the processes of preparation and administering[9-11].

They also have economic, cultural and social benefits. A US study found that the majority of patients receiving home-based ENT chose non-industrialized diets as they are composed of more natural foods, are made at home with foods usually also used by the family, and present greater gastrointestinal tolerance than industrialized enteral diets[12].

When using a homemade or semi-homemade diet, it is important to use formulas that provide the correct amounts of macro and micronutrients required to maintain or recover nutritional status, and which are low cost and easy to prepare. Considering the need for the development of these formulas, as well as the lack of studies that contain analytical measurements of minerals and vitamins, the present study aimed to elaborate and evaluate the macro and micronutrient composition of semi-homemade enteral diets created with the potential to become a prescription standard for elderly persons undergoing home-based ENT.

METHOD

This work was based on a previous study involving the bromatological analysis and evaluation of the composition of macronutrients and minerals of semi-homemade enteral diets prescribed at the moment of hospital discharge from five public institutions and recommended in home care provided by the Family Health Teams of a state capital in southeast Brazil. The results of this recently published analysis[11] indicated that the formulations were inadequate in terms of dietary fiber, potassium and magnesium composition. Calcium and sodium were high in 16.7% and 83.3% of the diets, respectively, while zinc, phosphorus, copper, manganese and selenium were low in up to 66.7% of the formulas. The study did not evaluate vitamins.

From these results, and aimed at improving the nutritional adequacy of the analyzed diets, new recipes of the standard semi-homemade enteral diets were developed, with three caloric concentrations of 1500, 1800 and 2100 Kcal, all of which had lactose and lactose-free options. The normocaloric and normoproteic formula, without nutrient restrictions other than lactose in the lactose-free diets, was considered the standard diet. Each diet was composed of a formula and a juice and

was developed considering the stomatal position of the catheter.

The process of developing these recipes involved calculating and adjusting the nutrients of the original recipes evaluated in the previous study. The preparation of the diets and the viscosity, stability, odor and color tests were carried out in a technical-dietary laboratory, and cost was also analyzed. This process was continued until adequate diets were obtained. The ingredients of recipes for the semi-homemade enteral diet are shown in Chart 1.

Chart 1. Ingredients of standard and standard lactose-free semi-homemade enteral recipes. Belo Horizonte, Minas Gerais, 2016.

Ingredients	Formulas		
	1500 kcal	1800 kcal	2100 kcal
Whole milk (mL) *	-	500.00	500.00
Skim milk (mL) *	1000.00	500.00	500.00
Egg (g)	45.00 (2x /week)	45.00 (2x /week)	45.00 (2x /week)
Pure albumin powder (g)	17.40 (5x /week)	17.40 (7x /week)	29.00 (7x /week)
Oat flour (g)	45.00	45.00	50.00
Enriched Rice Cream (g)	50.00	55.00	55.00
Potato (g)	280.00	280.00	280.00
Brazil nut (g)	2.00	2.00	2.00
Canola oil (ml)	26.00	26.00	26.00
Soybean oil (ml)	13.00	13.00	26.00
Corn-based commercial cereal (g) **	5.00	15.00	25.00
Cinnamon powder (g)	12.00	12.00	12.00
Granulated sugar (g)	13.80	27.60	27.60
Iodized salt (g)	2.00	2.00	2.00
Ingredients	Juice		
Carrot, raw (g)	55.00	55.00	55.00
"Pera Rio" (Rio Pear) orange juice (g)	180.00	180.00	180.00
Granulated sugar (g)	-	13.80	13.80

*The lactose-free option used reduced lactose content milk; **Ingredients of enriched corn-based commercial cereal: Corn flour, sugar, enriched with iron, phosphorus, calcium zinc, folate, niacin, vitamins A, D, E, C, B1 and B6.

For the preparation of formulas, the solid ingredients were weighed in a BS3000A model semi-analytical scale (Bioprecisa® - São Paulo), with a maximum capacity of 3Kg and 0.1g divisions. After this process, the eggs and vegetables were washed in running water, and the latter were sanitized in a solution of 200 ppm of chlorine solution, suitable for food, for 20 minutes, according to the manufacturer's instructions. The milk and oil were fractionated in volumetric flasks. All ingredients were separated into identified containers for convenience during preparation.

The potatoes were cooked in their skins until soft. The eggs were brought to the boil and cooked for approximately 5 minutes after boiling began to ensure the firm consistency of the yolk. In order to avoid possible microbiological contamination of the diet, cinnamon was toasted at a medium heat for three minutes in a sufficient quantity for all preparations.

The ingredients that underwent the pre-preparation and cooking process were weighed again and, finally, mixed and beaten in a mixer with the

other ingredients until a homogeneous solution without residues was obtained.

For the preparation of the juice, the pulp of previously sanitized "Pêra Rio" oranges was extracted using an electric juicer, and then mixed with the other ingredients, blending the solution. Samples of 300 ml of each formula and the sucrose and sucrose were separated and frozen at below 20°C.

Finally, the macro and micronutrient chemical composition of the formulas and the juice was analyzed in the laboratory.

The results obtained in the analyzes were compared to the nutritional requirements recommended by the Dietary Reference Intake (DRI) for elderly males[13]. This gender was chosen as the recommendations of minerals for males are greater than those for females, thus covering the needs of both.

For macronutrients, values between 1.0 and 1.2 g/kg/weight/day of proteins, at least 50% of which were of high biological value[14], were considered normoproteic, diets with carbohydrate values of 45-65% were considered normoglycemic, and diets with 20-35% were considered normolipidic[13]. The calculation of protein adequacy per kilogram of body weight considered the median weight of a 65-74-year-old male, which according to the 2008/2009 Pesquisa de Orçamentos Familiares (Household Budgets Survey) (POF) is 70.3Kg[15]. A proportion of 14 grams for every 1000 calories of diet was considered adequate dietary fiber content[13].

Micronutrients were considered adequate when they had concentrations above the Recommended Dietary Allowance (RDA) and below the Tolerable Upper Intake Level (UL), with inadequate results below the Estimated Average Requirement (EAR) or above UL. For micronutrients that do not have a RDA, Adequate Intake (AI) was considered valid[13].

The viscosity test was conducted by administering the diets by French 12 (1 French =0.33mm) silicone catheters using the gravitational and *bolus* method. The administration of the diets by both methods was considered of adequate viscosity as there was no clogging of the catheter. The stability of the diets was tested by visual inspection of the phase separation process over a period of 12 hours of refrigerated storage. Olfactory and visual inspection evaluated odor and color. An acceptable cost was considered a monthly expense of up to R$312.00, which corresponds to one third of the minimum wage in force in 2017, based on daily totals of 1800 kilocalories.

The standard lactose-free diet, elaborated from the substitution of milk with milk with a reduced lactose content, was not analyzed, as the only modified ingredient was lactose, which did not impact the nutrients analyzed in this study.

Protein and lipid analysis was performed following standard procedures adopted by the Association of Analytical Chemists (AOAC)[16]. Fibers were analyzed by treatment with digestive enzymes (amylase, pepsin/pancreatin), alcoholic precipitation of the soluble fraction, incineration and gravimetric determination. Ash content was obtained by incineration in an oven at 550ºC and moisture determined in an oven at 105ºC. The summation of proteins, lipids, ash, moisture and fibers and the subtraction of 100 as an integer allowed total carbohydrates to be calculated[17].

The minerals zinc (Zn), iron (Fe), copper (Cu), calcium (Ca), phosphorus (P), potassium (K), magnesium (Mg), manganese (Mn) and selenium were quantified with Varian® brand ICP-OES equipment (720 ICP-OES, Varian Inc, California, USA) using the following spectral lines: 206.2 nm, 238.2 nm, 327.4 nm, 317.9 nm, 213.6 nm, 766.4 nm, 285.2 and 257.6. The choice of the analytical spectral lines was based on the sensitivity and interference levels of each mineral. Linear concentration ranges for each element varied between their detection limit and the maximum concentration values recommended by the manufacturer's manuals. The detection limits (3 x the standard deviation of 10 measurements of the analytical blank divided by the inclination of the calibration curve) were determined for all the elements read.

All aqueous solutions and sample dilutions were prepared with ultrapure water (18 MΩ cm^{-1}), Milli-Q (Millipore®, Bedford, MA). Certified reference material - NIST - Total Diet SRM 1548® (National Institute of Standards Technology - Gaithersburg, MD) was determined to validate the spectrophotometric measurements.

The vitamins A, C, E, Thiamine (B1), Riboflavin (B2) and B6 were analyzed by high performance liquid chromatography (HPLC) using a Shimadzu® apparatus, model LC-10AT VP. The methods described by the AOAC[15] were used for the chromatographic runs and standardization of the analytical conditions. The following columns and detection conditions were used 1) Vitamins B1 and B2: Spherical RP-18 reverse phase C18 column 5 µm/125 x 4.0 mm, with a Lichrospher 5 µm/4x4 mm pre-column; fluorescence detection: Ex 368 nm; Em 440 nm (B1) and Ex 450 nm; Em 530 nm (B2). 2) Vitamin B6: Superspher 100 RP-18 endcapped reverse phase C18 column 5 µm/250 x 4.0 mm, with a Lichrospher 100 RP-18 pre-column 5 µm/4x4 mm and fluorescence detection: Ex 296 nm; Em 390 nm. 3) Vitamin C: Microsorb-MV C18 column, 5mm, 250mm x 4mm, and detection at 238nm. 4) Vitamin E: C18 reverse phase, isocratic system, 5 µm, 250 mm x 4.6 mm, Bakerbond brand and ultraviolet (UV) detection at 292 nm. 5) Vitamin A: Shimpack CLC-ODS (M) 4.6 mm x 25 cm, using the 325 nm wavelength for detection.

Vitamin B12, folate and vitamin D were not analyzed as concentrations were below the detection limits for liquid chromatography. The values presented in the results were estimated using chemical composition tables[18].

RESULTS

All formulas and juice were tested for viscosity, stability, odor, color and cost. The diets developed presented a normocaloric (0.9 to 1.2 Kcal / ml), normoproteic, normolipidic and normoglycidic nutritional composition. Carbohydrates represented 55, 53 and 52%, lipids, 28, 31 and 33% and proteins 69.6, 70.3 and 80.8 grams in the 1500, 1800 and 2100 Kcal diets, respectively, corresponding to 0.99 g/Kg of weight, 1.00 g/kg of weight and 1.15 g/kg of weight, based on a man weighing 70.3 kg. All diets contained more than 50% of proteins of high biological value (between 68% and 71%).

The total amount of dietary fiber was 17.22 g in the 1500 Kcal diet, 22.65 g in the 1800 Kcal diet and 24.10 g in the 2100 Kcal diet. It was observed that the inclusion of dietary ingredients that were sources of fiber elevated the adequacy of this nutrient to average levels of 85%. There was a predominance of insoluble fibers, except in juice (Table 1).

Table 1. Centesimal composition (g.100g-1, wet basis), chemical analysis results of semi-homemade enteral diets. Belo Horizonte, Minas Gerais, 2016.

Nutrients (g)	Formulas			
	1500 Kcal Mean (sd)	1800 Kcal Mean (sd)	2100 Kcal Mean (sd)	Juice with sucrose* Mean (sd)
Humidity[1]	79.77 (9.22)	76.80 (10.07)	76.78 (8.81)	81.91 (9.48)
Proteins[2]	4.48 (0.29)	4.18 (0.36)	4.15 (0.31)	1.82 (0.09)
Lipids[2]	3.33 (0.43)	3.84 (0.47)	4.27 (0.38)	0.23 (0.03)
Carbohydrates[3]	12.68 (2.09)	13.15 (2.21)	12.85 (2.11)	13.67 (1.98)
Fibers[2]				
Insoluble	0.95 (0.06)	1.07 (0.13)	0.99 (0.08)	0.67 (0.05)
Soluble	0.15 (0.01)	0.19 (0.01)	0.14 (0.01)	1.18 (0.08)
Ash[2]	0.64 (0.06)	0.77 (0.05)	0.82 (0.04)	0.52 (0.07)

[1]with raw food; [2]with cooked and lyophilized foods; [3]by difference: 100 g (moisture + protein + lipids + total dietary fiber + ash)[16]; *Juice without sucrose provided different results only in moisture and carbohydrates, which were 88.85 (9.05) and 7.23 (0.94) respectively.

Correction with source foods also improved the computations for minerals (Table 2). All the diets were adequate for calcium, phosphorus, iron, zinc, manganese and selenium, although not even the 2100 Kcal diet was able to reach more than 78% of recommended levels of potassium. Similar results were found for magnesium, the maximum adequacy of which was 63%. Only the 1500 Kcal diet failed to provide an adequate supply of copper. In terms of electrolytes, the sodium concentrations of all diets reached the recommended levels after the modifications.

Regarding the analysis of vitamins (Table 3), the diets achieved adequate concentrations of vitamin A, C and Riboflavin at all the caloric concentrations proposed. Vitamin E, thiamine and vitamin B6 met the EARs from the caloric concentration of 1800 Kcal and upwards. In the 2100 Kcal diet all these vitamins were provided in sufficient quantities. Vitamin B12 was adequate at all caloric levels and there were recommended levels of folate in the 1800 and 2100 Kcal diets, while vitamin D was not provided in adequate amounts at any of the caloric concentrations, although it should be noted that these three vitamins were estimated rather than analyzed.

Table 2: Mineral composition of semi-homemade enteral diets with three caloric levels (1500, 1800 and 2100 Kcal (formula and juice)) and comparison with Dietary Reference Intake (DRI) for elderly men[13]. Belo Horizonte, MG, 2016.

Minerals	EAR (mg/day)	RDA/AI* (mg/day)	UL (mg/day)	1500 kcal	1800 kcal	2100 kcal
Calcium (mg / day)	1000	1200	2000	1282.19	1570.06	1724.95
Phosphorus (mg / day)	580	700	4000	904.60	1258.57	1645.30
Iron (mg / day)	6	8	45	16.62	22.47	24.79
Sodium (mg / day)	ND	1200*	2300	1584.69	1759.71	2033.63
Magnesium (mg / day)	350	420	350	227.82	265.12	259.55
Copper (µg / day)	700	900	10000	790	930	960
Potassium (mg / day)	ND	4700*	ND	2615.17	3056.47	3648.10
Zinc (mg / day)	9.4	11	40	9.86	11.97	12.31
Manganese (mg / day)	ND	2,3*	11	2.63	3.01	3.26
Selenium (µg / day)	45	55	400	109.81	114.48	117.67

RDA = Recommended dietary allowance; * AI = Adequate intake; UL = Tolerable Upper Intake Level; EAR = Estimated Average Requirement; ND = Not Determined.

Table 3: Composition of vitamins of semi-homemade enteral diets with three caloric levels (1500, 1800 and 2100 Kcal (formula and juice)) and comparison with Dietary Reference Intake[13] for elderly men. Belo Horizonte, Minas Gerais, 2016.

Vitamins	EAR	RDA	UL	1500 kcal	1800 kcal	2100 kcal
A (µg RAE/day)	625	900	3000	1168.66	1.700.65	2628.61
C (mg/day)	75	90	2000	139.83	168.54	285.33
E (mg/day)	12	15	1000	8.28	12.00	21.33
Thiamine (mg/day)	1	1.2	ND	0.95	1.27	1.25
Riboflavin (mg/day)	1.1	1.3	ND	2.85	3.13	5.20
B6 (mg/day)	1.4	1.7	100	1.34	1.43	2.74
B12 (mg/day) *	2.0	2.4	ND	6.36	6.31	6.31
Folate (µg/day) *	320	400	1000	390.97	662.11	662.11
D (µg/day) *	10	15	100	5.87	13.12	14.88

RAE = Retinol Activity Equivalent; RDA = Recommended dietary allowance; UL = Tolerable Upper Intake Level; EAR = Estimated average requirement; ND = Not Determined; * Estimated values by means of food composition table[18]

DISCUSSION

The decision to use ENT with the elderly is complex due to controversies regarding its ability to recover or maintain nutritional status and impact on survival[2,19]. When ENT is used, the diet must have adequate physical and chemical characteristics, even if using homemade or semi-homemade diets[9,10].

The semi-homemade diets developed in this study had similar viscosity, stability, odor and color characteristics to other studies[9,20]. The infusion of enteral diets by thin caliber nasogastric catheters (French 10 to 12) is common in home care in Brazil, unlike other studies in which gastrostomy[6] or the oro-gastric position was more common[5]. Homemade diets usually have higher viscosity than industrialized ones. Therefore, adequate fluidity is required to avoid the clogging of the catheter or the need to exert excessive pressure on the syringe plunger when the infusion is in *bolus*, with risk of catheter displacement[21].

Regarding chemical characteristics, the diets developed had an adequate macronutrient profile[13,14] for the elderly, except for the dietary protein of 1500 Kcal, which provided 0.99 g/kg/day when considering an individual of 70.3Kg[15], however it is probable that an elderly person weighing 70.3Kg has a caloric requirement greater than 1500Kcal.

In a recent publication, the PROT-AGE *Study Group* recommended protein ingestion greater than the RDA (0.8g/Kg/day) for healthy elderly persons, with the intake of 1.0-1.2g of protein/kg/day, at least 50% of which is of high biological value, aimed at maintaining the skeletal muscle structure and functional capacity[14]. Another important recommendation is related to the quality of proteins and their adequate distribution throughout the day, aimed at the prevention or control of sarcopenia. The greatest anabolic effect has been demonstrated in diets with at least 20g of protein per meal, containing 2.5g to 2.8g of leucine[14,22]. In the case of the proposed diets, which have a recommended distribution of five meals per day in addition to juice, the protein distribution at each meal does not reach this recommendation, despite the fact that the protein quality and leucine content are high[14]. This high protein quality was affected by the presence of milk, egg and albumin as the main sources of protein, while the division into five meals aims to reduce the volume infused at each meal, as a way of reducing gastrointestinal symptoms[23].

Lipids, which are present in the diets in up to 33% of the total calories, have a protective and therapeutic role in cardiovascular health[24], as their main sources are soybean and canola oil, vegetable fats with the presence poly and mono unsaturates. The choice of skim milk was aimed at reducing saturated fatty acids. The calculation of fatty acids by means of a food composition table[18] revealed that saturated fatty acid made up less than 10% of all the diets.

As for carbohydrates, when developing the new enteral diets, we chose to include complex carbohydrates such as potatoes, oat flour, rice cream and corn-based cereal. The acceptable sucrose component in a standard diet, present in sugar and corn-based cereal (20%), represented 4.0%, 9.9% and 8.8% of the total calories in the 1500, 1800 and 2100kcal diets, respectively, values which are considered acceptable[13]. Lactose can be removed by replacing milk with reduced lactose content milk, making the diet suitable for elderly persons with reduced lactase production.

The adequacy of fiber in non-industrialized enteral diets is a challenge, as most of the food sources of this nutrient contribute to an increase in dietary viscosity with consequent catheter occlusion. The developed diets contained an average of 85% of recommended fiber content. The use of powdered cinnamon and oat flour was fundamental in the supply of fiber without the excessive thickening of the formula. Araújo et al.[25] showed that powdered cinnamon contributed 50.11% of the total dietary fiber of an enteral diet, at a proportion of 25 g of powder to 2 liters of diet.

Few studies published in literature that analyze non-industrialized diets describe fiber content. Araújo and Menezes[26] did not achieve the recommended values, with the highest level reached 8.16g in two liters of diet, while Menegassi et al[20] recorded fiber values above the recommended level of 2 liters, which may alter the absorption of minerals, such as calcium, magnesium, iron or zinc, especially in the presence of phytates[13].

Fibers have an important role in intestinal functioning. A study showed that in partially institutionalized elderly people, the prevalence of constipation was 67%[27]. In addition, fibers are involved in improved postprandial glycemic response, cholesterol control and cardiovascular risk reduction[13]. The soluble fiber component, in turn, is linked to the processes of colonic fermentation in which short chain fatty acids, capable of promoting intestinal trophism and maintaining the symbiotic microbiota, are produced[13]. A study evaluating the association between fiber consumption and the presence of fecal short chain fatty acids in elderly persons aged between 76 and 95 years old found that potato consumption, present in the proposed diets, was associated with the presence of these fatty acids[28].

Although energy needs are lower in this life cycle compared to adults, micronutrient requirements are not. There is a high risk among this population of deficiency in vitamins A, C, D, E, B12, thiamine and folate, and minerals such as calcium, iron and zinc, all of which are related to deterioration of functionality, body composition and health[29]. Micronutrient content was found to be less adequate in the 1500 calorie formula due to the limited addition of *in natura* foods or industrialized products, which should be evaluated with caution in the prescription of this caloric profile.

Of the minerals, only magnesium was below the EAR in all diets. Von Atzingen et al.[30] also observed inadequacies for this mineral in homemade enteral diets. Magnesium acts as an important cofactor in several enzymatic reactions, contributing to protein synthesis and energy metabolism[13]. Initially, the adequacy of magnesium was sought through the addition of dehydrated parsley (400mg Mg in 100g of parsley), however, the cost of the diet and greater risk of contamination meant this possibility was rejected.

Potassium, although below AI, may not be inadequate. AI is recommended when there is insufficient and adequate scientific evidence to determine the RDA, and so is an approximation or estimate of consumption. In this case, although it is used for individual recommendations, its evaluation of the adequacy of food is limited, and estimates of the probability of nutrient inadequacy cannot be made[13].

Potassium stimulates natriuresis and participates in the regulation of the renin angiotensin system, contributing to the reduction of blood pressure, counteracting the action of sodium. However, the definition of the recommendations of potassium take into account a higher sodium consumption than that found in the analyzed diets. The sodium/potassium ratio (Na^+/K^+) should be one at most[31]. The proposed diets exhibited a ratio (Na^+/K^+) of 0.61; 0.58 and 0.56 at the caloric levels of 1500, 1800 and 2100 kcal respectively, and were therefore within recommended levels.

The iron content of the elaborated diets reached the recommended amounts at all caloric levels. According to Patel[32], approximately one third of the anemias developed in the elderly are caused by nutritional deficiencies attributed to iron, folate and vitamin B12, and of these, iron accounts for almost half of the cases. The addition of enriched rice cream made an important contribution to the values found.

Only the 2100 Kcal diet contained all vitamins in adequate quantities. Vitamins A, C, B12 and riboflavin were sufficient in the 1500 kcal diet. Although vitamin E, B6 and D were below the RDA but between the EAR and RDA in the 1800 Kcal diet, which is considered probably inadequate[13].

Vitamin E has an important natural antioxidant function through its reaction with free radicals that are soluble in lipid membranes[13,29]. Deficiency of this vitamin, along with vitamin C and carotenoids, is associated with cognitive decline in the elderly[33]. Vitamin D, which is important not only in the bone health of the elderly[13], but also associated with muscle strength, functional capacity[34] and prevention of chronic degenerative diseases[13], was low in 2/3 of the diets. As the solar exposure of individuals in home ENT is normally impaired due to the bedridden status of most of these elderly people, it is necessary to supplement this vitamin in the 1500 and 1800 Kcal diets.

Among the B complex vitamins analyzed, Riboflavin and vitamin B12 were adequate in all diets. Vitamin B12 deficiency is common in the elderly due to atrophic gastritis or low consumption[29]. Thiamine acts as a coenzyme in the metabolism of

carbohydrates and branched-chain amino acids[13]. Folate and vitamin B12, when deficient, are associated with megaloblastic anemia and elevated levels of homocysteine[29]. In addition to its relationship with cardiovascular diseases, a recent study showed that high concentrations are associated with lower bone mineral density among the elderly[35].

The findings of the present study demonstrate the importance of the use of dietary techniques based on the bromatological data of the centesimal composition of macro and micronutrients. In addition, no studies were found in literature that evaluated the composition of vitamins from non-industrialized enteral diets for home use.

Seasonality in the nutrient content of the *in natura* foods used in the diet is a limiting factor that should be considered in this study. However, its concentration is approximately 30% of the content of solids, which maintains composition at generally acceptable levels of variability. In the case of industrialized products enriched in vitamins and minerals, such grades are generally standardized. The analytical limitation imposed by the low levels of detection of vitamins B12 and D and folate justifies the use of food composition tables, with the assumption that the values may be greater or smaller within an acceptable variability. The need for the supplementation of some micronutrients, while it represents an additional unitary operation in the formulation, has a low impact on the final price of the diet, as the dosages of the supplements are very low, increasing the cost of the 1800 Kcal formulation, for example, by one *real* per day.

It should be pointed out that, due to the need for exhaustive manipulation in the pre-preparation and preparation of the diets, their microbiological safety becomes fragile. The training of food handlers and caregivers, as well as the establishment of simple routines such as the washing and disinfection of hands and *in natura* food, in addition to cooking, can minimize the possibility of contamination. The pre-mixing of the ingredients in powder form to prepare the diet for an entire day is also recommended, as this facilitates incorporation with the other ingredients at the time of preparation, and reduces handling and manipulation.

CONCLUSIONS

The analysis of the macro and micronutrients of the enteral diets developed showed that these can contribute to guaranteeing the right of the elderly in home enteral therapy to food. Magnesium should be supplemented in all diets and vitamin D, E and B6 supplementation is required in the 1800 Kcal diet. The 1500 Kcal diet did not demonstrate nutritional safety for the elderly with respect to micronutrients.

Bromatological analysis is of great importance for the evaluation of homemade and semi-homemade enteral formulas, considering the possible losses during the preparation of food, which is not always observed in analysis by food composition tables.

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Functional capacity and reported morbidities: a comparative analysis in the elderly

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Abstract

Objective: To evaluate the influence of chronic morbidities on the functional capacity of elderly persons living in the municipal region of Herval d' Oeste, in the state of Santa Catarina, Brazil. *Methods:* An analytical cross-sectional study was carried out with a sample of 272 elderly people registered in the Family Health Strategy of the municipality of Herval d' Oeste, Santa Catarina. A socio-demographic questionnaire, Katz's Basic Activities of Daily Living Scale and Lawton's Instrumental Activities of Daily Living Scale (IALD) were used as instruments to gather data. The socio-demographical variables were estimated in frequencies and percentages. The associations were analyzed through the chi-square test. *Results:* Significant statistical associations for dependence were only found in the IADL assessments. Hypertension and Diabetes Mellitus were not found to influence the dependence of the elderly. However, a greater number of elderly persons who reported pathologies of the gastrointestinal system were classified as dependent. While the number of morbidities did not influence dependence in IADL, there was a smaller percentage difference between dependent and independent individuals among those with more than three morbidities. *Conclusion:* No relationship was found between the number of morbidities and the functional and instrumental capacity of the elderly. However, diseases of the gastrointestinal system demonstrated an influence on the dependence of elderly persons of Herval d'Oeste, Santa Catarina.

Keywords: Chronic Disease. Aging. Health Services for the Aged. Frail Elderly. Interdisciplinary Studies.

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INTRODUCTION

Brazil is undergoing a process of population aging, caused mainly by a reduction in the birth rate and an increase in life expectancy[1]. When they reach old age, human beings undergo significant physical changes that if unstructured can characterize a strong risk factor for the development of disabilities[2].

The assessment of individual levels of independence in Activities of Daily Living (ADLs) and Instrumental Activities of Daily Living (IADLs) determine the ability of an individual to take care of themselves and to live independently, respectively. ADLs explore the individual's abilities to meet basic hygiene, dressing, using the bathroom and movement and transfer needs. IADLs, meanwhile, examine activities that characterize independence in the community such as preparing meals, using the telephone, shopping, using medications safely, cleaning, walking, and managing finances[3].

The presence of chronic disease is commonly observed in the elderly. It does not necessarily characterize the appearance or otherwise of disabilities, however, but represents a relevant factor for their development. Despite the physiological aspects of the development of morbidities, the identification of factors that can accelerate the loss of functional capacity constitutes an effective tool for the development and implementation of actions directed towards the elderly[4].

From a preventive perspective, primary health care functions as a key tool in the maintenance of functional capacity, since it represents the main strategy in the prevention of chronic disease related damage to health, which can lead to loss of functional capacity. Family Health Strategies support the prevention of disabilities by assessing, monitoring, preventing and, if necessary, intervening in the cases of elderly persons who are at a greater risk for loss of autonomy[1].

Due to the population aging process, and the demands on health services to meet the growing range of chronic diseases, there is a need for a study focusing on functional disability and its relation to the physical characteristics and morbidities of the aging process.

The evaluation of the functional and instrumental capacity of the elderly and knowledge of their chronic morbidities is one of the tools that can support the actions of the health services, as maintaining independence results in the improvement of the living conditions of this population.

In view of the above, the present study aimed to evaluate the influence of chronic morbidity on functional capacity among the elderly living in the municipal region of Herval d´Oeste, in the state of Santa Catarina, Brazil.

METHODS

The data were obtained through a quantitative, analytical, cross-sectional study of people over 60 years of age enrolled in the Family Health Strategy (FHS) units of the municipal region of Herval d'Oeste, Santa Catarina, Brazil, in the period May to October 2015.

The municipal region is located in the middle of the state of Santa Catarina, and is an important producer of alfalfa with a strong economic base in agriculture and agribusiness. According to IBGE[5] estimates for the year 2013, it has 22,083 inhabitants, of whom 2,923 are over 60 years of age. To calculate the sample size, a margin of error of 5% was considered, with a 95% confidence interval and a 50% response distribution, resulting in 272 elderly subjects to be interviewed. A simple draw method was used for selection, giving the same opportunity of inclusion to the entire population.

The inclusion criteria were: age 60 years of age or older, of both genders, assigned to a Family Health Strategy (FHS) unit in the municipal region. The responses of subjects who met the inclusion criteria but who had accentuated cognitive and/or intellectual deficits, were bedridden, in a vegetative state or, due to any pathological process, were unable to respond to the instruments, were given by their caregivers.

A questionnaire with sociodemographic, epidemiological and morbidity information of the Projeto Porto Alegre (the Porto Alegre Project), of the Pontífica Universidade Católica of Rio Grande do Sul (the Pontifical Catholic University of Rio Grande do Sul) was used for data collection. It included

data on the health, profile and morbidities used for the study. The dependent variables were the functional capacity of the elderly, measured using the Katz Scale of Basic Activities of Daily Living (BADLs) and the Lawton Instrumental Activities of Daily Living Scale (IADLs), which were classified as dependent or independent for both dimensions. The elderly were classified as independent if they did not report difficulties in the performance of any of the BADL and IADL, and dependent when they determined a difficulty in at least one activity in any of the dimensions.

The independent variables were the socio-demographic data and the chronic morbidity factors identified. Gender, marital status, age and schooling were considered. Age was assessed as a continuous variable. Marital status was described as married, widowed, single, separated. Level of schooling was characterized as illiterate, out of school literacy, 1st to 4th grade of fundamental level, 5th to 8th grades of fundamental level, high school, higher education and additional education. Chronic diseases were characterized based on previously diagnosed pathologies receiving treatment in basic care. Measurements were made based on affirmative answers regarding the presence or absence of hypertension, diabetes mellitus, dyslipidemias (cholesteremias), gastrointestinal disorders, thyroiditis and other related morbidities. The diseases of the gastrointestinal tract considered were: gastritis, peptic ulcer, neoplasia of the gastrointestinal tract, diseases of the intestinal tract. Thyroiditis was considered as hypo and hyperthyroidism. The other morbidities group includes those that were reported by a maximum of three subjects in the research.

The interviews took place at the homes of the selected subjects, with the participation of two assistant researchers, in addition to the principal investigator, to carry out data collection. The assistants received prior training in the methods and application of each instrument.

To estimate the association between functional capacity, the analysis of basic and instrumental activities of daily living, and chronic diseases, association and independence tests were used.

The socio-demographic variables were initially calculated in frequencies and percentages. The association between the dependent and independent variables was analyzed through the chi-square test, with reliability tested by Cronbach's Alpha and the normality of the total score with the Kolmogorov-Smirnov test.

The results of the model were presented as the percentage ratio, divided into dependents and independent, seeking the association between the presence of dependence and the morbidity reported by the subject. The results obtained from the BADL and IADL analyzes were classified by statistical significance analysis models and compared with the number and types of reported morbidity. In all tests the level of significance considered was 5%. The present study was approved by the Research Ethics Committee of the Universidade do Oeste de Santa Catarina de Joaçaba (the University of West Santa Catarina in Joaçaba), Santa Catarina (protocol nº 917.074). All the participants signed a Free and Informed Consent Form (FICF).

RESULTS

A total of 272 elderly people living in the municipal region of Herval d'Oeste, Santa Catarina, were interviewed regarding demographic and social variables. There were 68.8% (n=187) females and 31.2% (n=85) males. Age ranged from 60 to 98 years among women, with a mean age of 73.1 (±8.3 years), and 60 to 100 years among men, with a mean age of 71.1 (±8.1 years). There was a higher prevalence of married individuals (n=152) and those with an elementary school education (n=176).

Table 1. Characterization of sample in terms of demographic and social variable of elderly persons. Herval d´Oeste, Santa Catarina, 2015.

Variables	n (%)
Sex	
Female	187 (68.8)
Male	85 (31.2)
Marital status	
Married	152 (55.9)
Widower	81 (29.8)
Not married	20 (7.4)
Separated	19 (7.0)
Age Range (years)	
60-69	112 (41.2)
70-79	105 (38.5)
80-89	48 (17.6)
90 or more	7 (2.7)
Schooling	
Illiterate	23 (8.5)
Out of school literacy	13 (4.8)
1st to 4th grade of elementary school	176 (64.7)
5th to 8th grade of elementary school	43 (15.9)
High school	8 (3.0)
Incomplete higher education	7 (2.5)
Additional	2 (0.6)

The prevalence of independence was 84.2% in BADL and 70.2% in IADL, demonstrating that the elderly in this study are mostly independent in these two assessments.

In terms of the differences in the degrees of dependence for BADL and IADL between genders, men were most dependent in the dressing function (8.2%), while women were most dependent in the continence function (13.9%). In the frequency distribution of the degree of dependence according to the Katz and Lawton scales (BADL and IADL), the frequency of independence was higher in BADL, varying from 91.8% to 96.5%, than in IADL, where it ranged from 75.7% to 88.2%.

The greatest prevalence of totally dependent elderly persons was for the bathing activity (4.8%) of BADL, and the managing finances activity (12.8%) of IADL. In the association between chronic conditions and degree of dependency in BADL and IADL, the most frequent chronic condition was Arterial Hypertension, which was the most prevalent morbidity among dependent elderly persons, with 11.8% in BADL and 22.8% in IADL. Systemic arterial hypertension (p=0.018) and diabetes mellitus (p=0.023) had no influence on IADL, with most elderly persons with these morbidities being considered independent. However, the majority of the elderly who reported gastrointestinal system disorders (4%) were dependent in the instrumental evaluation (IADL) (p=0.015).

Table 2. Distribution of dependency by gender according to Katz Scale. Herval d´Oeste, Santa Catarina, 2015.

Variables	Men Independent n (%)	Men Dependent n (%)	Women Independent n (%)	Women Dependent n (%)
Function				
Bathing	79 (92.9)	6 (7.1)	166 (88.8)	21 (11.2)
Dressing	78 (91.8)	7 (8.2)	173 (92.5)	14 (7.5)
Go to the bathroom	81 (95.3)	4 (4.7)	177 (94.6)	10 (5.3)
Transfer	81 (95.3)	4 (4.7)	173 (92.5)	14 (7.5)
Continence	80 (94.1)	5 (5.9)	161 (86.1)	26 (13.9)
Feeding	82 (96.5)	3 (3.5)	178 (95.2)	9 (4.8)

Table 3. Distribution of the frequency of degree of dependence according to the Katz and Lawton Scales (Activities of Daily Living and Instrumental Activities of Daily Living) in the elderly. Herval d´Oeste, Santa Catarina, 2015.

Activity	Independent n (%)	With some type of assistance n (%)	Totally Dependent n (%)
Basic Activities of Daily Living			
Bathing	245 (90.1)	14 (5.1)	13 (4.8)
Dressing	250 (91.9)	10 (3.7)	12 (4.4)
Go to the bathroom	258 (94.9)	8 (2.9)	6 (2.2)
Transfer	254 (93.4)	14 (5.1)	4 (1.5)
Continence	241 (88.6)	30 (11)	1 (0.4)
Feeding	260 (95.6)	6 (2.2)	6 (2.2)
Instrumental Activities of Daily Living			
Use the phone	240 (88.2)	21 (7.7)	11 (4.0)
Use means of transport	219 (80.5)	32 (11.8)	21 (7.7)
Shopping	217 (79.8)	27 (9.9)	28 (10.3)
Preparing Meals	237 (87.1)	11 (4.0)	24 (8.8)
Clean the house	232 (85.3)	12 (4.4)	28 (10.3)
Manual Tasks	225 (82.7)	21 (7.7)	26 (9.6)
Laundry	231 (84.9)	10 (3.7)	31 (11.4)
Taking Medication	225 (82.7)	19 (7.0)	28 (10.3)
Managing Finances	206 (75.7)	31 (11.4)	35 (12.9)

In the association between degree of dependence for BADL and IADL and number of referred morbidities, the evaluation of BADL did not present a significant result (p=0.097). There was greater dependence in BADL for those who had two morbidities (7%).

In the evaluation of IADL, no relationship was found between dependence and the morbidities reported by the elderly (p=0.002), and there was a predominance of independent elderly persons in all the associations analyzed. The highest percentage of dependent elderly persons in this evaluation were those who reported two morbidities (9.9%). It was observed that elderly persons with three or more morbidities exhibited greater dependence, as the percentage difference between dependent and independent individuals fell as the number of reported morbidities increased.

Table 4. Association between chronic condition and degree of dependence in the performance of Activities of Daily Living and the Scale of Instrumental Activities of Daily Living among the elderly. Herval d´Oeste, Santa Catarina, 2015.

Chronic Condition	Basic Activities of Daily Living			Instrumental Activities of Daily Living		
	Dependent. n (%)	Independent. n (%)	*p**	Dependent. n (%)	Independent. n (%)	*p**
Arterial Hypertension						
Yes	32 (11.8)	159 (58.6)		62 (22.8)	129 (47.4)	
No	11 (4.0)	70 (25.7)	*0.236*	19 (7.0)	62 (22.8)	*0.018*
Diabetes *Mellitus*						
Yes	13 (4.8)	38 (14.0)		20 (7.4)	31 (11.4)	
No	30 (11.0)	191 (70.2)	*0.082*	61 (22.4)	160 (58.9)	*0.023*
Dyslipidemia						
Yes	9 (3.3)	60 (22.1)		23 (8.5)	46 (16.9)	
No	34 (12.5)	169 (62.1)	*0.429*	58 (21.3)	145 (53.3)	*0.06*
Gastrointestinal						
Yes	5 (1.8)	15 (5.5)		11 (4.0)	9 (3.3)	
No	38 (14)	214 (78.7)	*0.158*	70 (25.7)	182 (66.9)	*0.015*
Thyroiditis						
Yes	8 (3.0)	17 (6.3)		12 (4.4)	13 (4.8)	
No	35 (12.7)	212 (78.0)	*0.219*	69 (25.4)	178 (65.4)	*0.078*
Others						
Yes	19 (7.0)	40 (14.6)		57 (21.0)	32 (11.8)	
No	24 (8.9)	189 (69.5)	*0.219*	50 (18.4)	133 (48.9)	*0.078*

* Chi-square test.

Table 5. Association between degree of dependence (for the realization of Activities of Daily Living and the Scale of Instrumental Activities of Daily Living) and the numbers of morbidities reported by the elderly. Herval d´Oeste, Santa Catarina, 2015.

Number of morbidities reported	Functional Capacity			Instrumental Capacity		
	Dependent. n (%)	Independent. n (%)	*p**	Dependent. n (%)	Independent. n (%)	*p**
None	5 (1.8)	36 (13.2)	*0.097*	6 (2.2)	35 (12.9)	*0.002*
One	10 (3.7)	83 (30.5)		23 (8.5)	70 (25.7)	
Two	19 (7.0)	64 (23.5)		27 (9.9)	56 (20.6)	
Three or more	10 (3.7)	45 (16.5)		23 (8.5)	32 (11.7)	
Total	43	229		79	193	

*Chi-square test.

DISCUSSION

It is important to start this discussion by stating that the elderly represent 12% of the Brazilian population. However, projections indicate that this group will reach 38% in 2060, demonstrating a strong trend in the increase of life expectancy of Brazilians and the number of elderly people[4,5].

The elderly in this study were predominantly aged 60 to 69 years, 20.3% of whom were older than 80 years. This result characterizes a long-lived

population. Increased longevity may imply a greater number of elderly individuals at risk for disability and the development of morbidities[6,7].

The present study found a higher percentage of elderly women. This result is higher than the average for Brazil and for the state of Santa Catarina [5]. However, it is consistent with the samples of several other studies, where the average proportion of women was always above 60%[1,6,8].

This characterizes what gerontology scholars call the "feminization of old age," which especially occurs in more advanced ages. Factors such as behavior, work characteristics and genetic characteristics can be highlighted as preponderant for the greater numbers of women at these ages, although the main reason for this phenomenon is the care that women take of their health. Women seek health services more often and are able to live longer with disabilities and diseases, resulting in lower mortality[9-12].

In general, the participants in this study were more dependent in IADL than BADL. It was found that few elderly people exhibited total dependence in their evaluations, which is similar to other studies in this area[13-16].

Camargos et al.[4] considered the evaluation of functional and instrumental capacity as important tools in health planning, as such analysis makes it possible to identify and improve the expectancy of years of live without disabilities, aiming not at treatment but at improving the quality of life of the person being evaluated.

The activities in which the elderly most described dependence in the evaluation of BADL were bathing, dressing and continence. Women exhibited greater dependence than men. Women were more dependent in continence while men were more dependent in dressing.

Barbosa et al.[14] found that women are usually more dependent, especially in BADL. This result was similar to that obtained by Fernandes[17] and Gasparini[18], who identified a greater dependence in continence in both genders. Other studies also highlight incontinence, especially urinary incontinence, as an important factor of dependence in women[14,15].

Incontinence is a change that affects women more frequently, becoming a constant problem in clinical practice, especially in elderly women. It is commonly due to several interventions in the perineal region, especially due to multiple births[19].

In terms of the evaluation of men, there was greater dependence in the activity of self-care. This type of relationship of dependence was not observed in men in other research. These studies found that while women are more dependent than men, the forms of male dependence result in a greater need for direct care from a caregiver, as they are more severe levels of dependence[20,21].

Britto et al.[20] found that women have a 1.5 times greater rate of dependency than men, with this outcome attributed to longer life expectancy and a greater ability to live with non-fatal disabilities such as depression, fractures and osteoporosis.

The BADL where the elderly persons of Herval d'Oeste, Santa Catarina, exhibited greater dependence was bathing. Costa et al.[22] found a similar result in their study, where the highest levels of dependence in the evaluation of functional capacity were for bathing. However, the proportion of dependent individuals in this study was higher than in the present study.

While the dependency profile of the present study was similar to other studies in this field[22,23], the percentage of dependents was lower.

The elderly were most dependent in the instrumental activities managing their own finances and making purchases alone. This finding differed from the result obtained by Barbosa et al.[14], where the items of greatest dependence were travelling distant places alone, followed by washing the dishes, ironing and using the telephone (to make calls).

Fialho et al.[13], meanwhile, also identified a reduced capacity for the activity of making purchases, with limitations in domestic tasks the second most dependent item.

Some studies identified a significant prevalence of dependence in the management of finances and the obtaining of consumer goods activities. The elderly tend to begin the process of dependency when they

need help to take care of their money or buy some type of consumer product[20,24-26].

From this it can be affirmed that the elderly of the present study require care from health teams both in terms of their access to services and the preservation of their financial autonomy. These dependencies may also be related to the low level of schooling identified, since, as Santos and Cunha[24] state, financial dependence is directly related to knowledge of the use of technologies that give access to the withdrawal of money and its use in commercial locations. They further add that the extent to which an elderly person becomes dependent in these items reflects in the loss of their autonomy.

In comparison between chronic conditions and the dependence of the elderly in BADL, no statistical significance was found in the evaluations performed. For IADL, a significant result was observed for systemic arterial hypertension (p=0.018) and diabetes mellitus (p=0.023), where the majority of the elderly were classified as independent. On the other hand, the elderly who reported gastrointestinal system disorders (p =0.015) were considered to be dependent.

While none of the studies analyzed compared gastrointestinal problems with functional and instrumental capacity, a relationship was identified with the cardio and cerebrovascular conditions of the individuals surveyed[11,24,27]. Paiva et al.[28], meanwhile, did not find a significant relationship between the presence of a morbidity and the functional capacity of the elderly.

When assessing the amount of morbidities reported by the elderly in relation to the presence of functional dependence in BADL (p=0.097), greater dependence was observed in elderly persons with two morbidities and greater independence in individuals with one morbidity. Thus, it was not possible to identify the influence of number of morbidities on functional dependence.

This result differed from that obtained by Tavares and Dias[29] who observed that a greater number of morbidities, as well as causing decline in the functional capacity of the elderly, directly affected their quality of life, especially in the psychological domain, due to the presence of negative feelings related to their physical state. It should be noted that the Tavares and Dias study was carried out with a much larger sample of 2,142 elderly persons, and focused on morbidity and dependence as a component of the quality of life of the elderly.

The evaluation of the elderly regarding the presence of dependence in IADL related to number of morbidities revealed significant results (p=0.002). It was noted that all those who reported up to two morbidities were characterized, for the most part, as independent, while there was a smaller percentage difference between dependence and independence among those who had more than three morbidities.

Although the cross-sectional design does not allow us to establish that the morbidities caused dependence in IADL, it was noted that the percentage difference between dependent and independent individuals drops substantially as the number of reported morbidities increases.

This result is due to the number of elderly people who made up this research, as a larger sample is required to effectively identify such a relationship.

A study by Barnett et al.[30] of 1,715,841 people in the United Kingdom that evaluated the epidemiology of multi-morbidity, found that the greater the number of morbidities, the greater the decline in the physical abilities of the elderly. Pedrazzi et al.[27], meanwhile, performed a study with 244 elderly persons living in the city of Ribeirão Preto, and found no relationship between the amount of morbidities and the functional capacity of people. There is therefore a need for larger samples to indicate an effective relationship between the number of morbidities and the functional capacity of the elderly.

Another limitation observed in this study was related to the types of morbidities found, as the study was performed based on the reports of the elderly about their morbidities. This type of data limits the analysis to perception, potentially masking morbidities that are often not considered by the elderly. It is suggested that an analysis of the elderly is performed with data from the medical records

of health units to effectively identify more precise information about the subject.

However, there is a limitation in terms of the analysis of age of the present study. The age range remained very large (± 40 years), establishing a major difference between the minimum and maximum age. It is therefore necessary to carry out a more profound analysis, stratifying the age groups to obtain a more detailed result on the subject.

CONCLUSION

According to the results obtained by the present study it is possible to conclude that elderly people living in the municipality of Herval d'Oeste, Santa Catarina are mostly independent.

The majority of the elderly (86.1% of women and 82.4% of men) have at least one chronic disease undergoing treatment and elderly persons with more than two morbidities are more dependent in functional and instrumental activities of daily living.

The functional capacity activities in which the elderly persons demonstrated dependence were bathing, dressing and continence. Women were more dependent than men in all activities, and were most dependent in continence, while men are most dependent in dressing. There was a greater number of totally dependent elderly people in the bathing and dressing activities in functional evaluation and the managing finances and cleaning the house activities in the instrumental evaluation.

In the instrumental activities, the elderly were found to be most dependent in managing finances and making purchases alone, with similar results for both genders.

Considering the characteristics of the aging process, with its multiple facets, the frailties imposed by this condition and the evaluation of the levels of independence of the elderly, there is a need for interventions from other areas in addition to health in the development of strategies to improve the process of caring for the elderly.

The present study encourages a wider discussion among health professionals regarding the prevention of and coping with dependencies. The challenge of learning to work in an integrated manner involves understanding the predisposing factors and focusing on one goal, which is the prevention of disability.

This study characterizes chronic diseases as a predisposing factor for dependence among the elderly. However, evaluating the elderly in an integral manner remains the most influential factor in the construction of cohesive care plans capable of preserving autonomy for a longer period.

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Health profile of family caregivers of the elderly and its association with variables of care: a rural study

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Abstract

Objective: to analyze the profile of a population of caregivers from a city in a rural area of the state of São Paulo, Brazil, and identify their health complaints and the characteristics of care provided. *Method:* a prospective cross-sectional study was performed based on a domicile survey of 99 caregivers and their elderly care recipients. Information about the profile, context of care and health complaints of the caregivers was collected. The caregivers responded to the Zarit Burden Inventory and the Geriatric Depression Scale-15 and the elderly underwent a cognition and functionality assessment. The chi-squared test with odds ratio (OR) was performed to test associations. *Result:* the majority of the caregivers were women (n=76), elderly (n=83), with a median age 65.8 (±10.4) years and 4.9 (±4.2) years of formal schooling. The most frequent health complaints were pain, systemic hypertension, insomnia, back problems and vision problems. The elderly care recipients were men (n=75), with an average age of 72.0 (±8.2) years. Analysis of associations revealed that caregivers who received emotional support had a lower chance of being highly overburdened (OR=0.37; CI95% 0.15-0.90). Caring for over five years was associated with arthritis (OR=2.50; CI95% 1.0-6.56). Caring of an elderly person with cognitive impairment was strongly associated with peripheral vascular diseases (OR=2.70; CI95% 1.11-6.85) and other diseases (OR=6.94; CI95% 1.43-33.63). *Conclusion:* A better understanding of the reality of care in rural and remote areas and the identification of factors related to the health care of caregivers provides better care management for the elderly and caregivers, who themselves are aging.

Keywords: Elderly. Caregivers. Rural Population. Family Health Strategy.

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INTRODUCTION

The chronic stress, depression and anxiety that result from the daily care given to a dependent elderly person can contribute to the detriment of a caregiver's own health and well-being. Damage to health may pose a risk to the quality of care provided to others and to oneself. A meta-analysis has shown that caregivers, especially women and spouses, have higher levels of depression and overburden from the commitment of caring, and lower levels of subjective well-being and perceived health. These caregivers report a greater number of behavioral problems in the recipients of care, and provide more hours of care and carry out more tasks[1,2].

Literature states that factors that make up the context of care can lead to impairments in the health of caregivers. The time spent providing care, the level of dependence in activities of daily living and the degree of cognitive disorders of the elderly exert significant influences on the perception of health and the overload of the caregiver[3–5].

In Brazil, data from the Pesquisa Nacional por Amostra de Domicílios (National Household Sample Study) (PNAD) of 2007 showed that approximately 13% of rural Brazilian adults described a restriction in daily activities due to health reasons and the prevalence of moderate functional disability increases with age[6], thus highlighting the need for care.

Studies with rural populations have shown that complaints of health impairment such as pain, visual and auditory problems and morbidities such as arthritis, diabetes mellitus and hypertension are prevalent, especially in the elderly[7,8].

Human longevity has evinced other sociocultural roles. At the family level, as people age, the probability of becoming a caregiver for an elderly relative increases considerably. However, studies with community caregivers are scarce, especially when such individuals are elderly themselves[9] and live in remote areas[9-11].

When discussing evidence of the health of caregivers of rural elderly persons, there seems to be a similarity with the findings in literature related to caregivers in general[10,11]. On the other hand, the findings of studies comparing rural and urban contexts do not corroborate. The rural population has been described as suffering due to the distance from health equipment[12], while the high crime rates, dense, populous and polluted environments that are typical of urban areas increase the risk of health problems[13]. There are often no differences between urban and rural caregivers, making it difficult to characterize the epidemiological profile of these specific populations[14,15].

The lack of methodological rigor, especially in terms of standardized evaluation tools, coupled with the lack of studies in the rural context and in remote areas, has affected the number of studies with greater power and level of evidence[16]. Therefore, the present study aimed to analyze the profile of the health complaints of family caregivers of elderly people and to identify the characteristics of the context of care provided by caregivers of the rural elderly. The hypothesis was that care characteristics may be associated with a greater number of health complaints in rural caregivers.

METHODS

The study site comprised the rural area covered by the Family Health Strategy (FHS) of a municipal region in the interior of São Paulo. The municipal region had 18 Family Health Units (FHUs), two of which were located in two rural districts. The municipal region is located in the mid-west of the state of São Paulo, Brazil. It's Human Development Index is 0.805. According to the 2010 census, the total population was 222,000, with an estimated 58650 people covered by the FHS. The rural population was 8,870 people and the elderly population exceeded 13% of the total population of the region[17].

The study participants were all caregivers and their respective elderly care recipients enrolled in two FHU from two rural districts.

The quantification of the potential participants for composition of the sample was carried out by the healthcare team of the FHU. The criteria established for inclusion in the sample were be a family caregiver

of an elderly person (≥60 years old), live in the rural area, be aged 18 years or older, be more independent than the elderly person, and be primarily responsible for providing assistance in the basic (BADL) and instrumental (IADL) activities of daily living of the elderly. A total of 127 caregivers were registered in the FHU. Of this total, 28 caregivers were excluded because of: change of address (n=3), death (n=3), unable to be located (n=15), refusal to participate (n=6), and age under 18 years (n=1). The response rate was 77.9% (n=99).

Data collection took place during the months of April and December 2014, at the homes of the participants. Caregivers and their respective elderly care recipients were visited only once and invited to participate in the study. The interviews lasted approximately two hours and were always performed with two interviewers, one for the caregiver and one for the elderly person, in separate environments. The interviewers were Gerontology or Nursing graduates and were properly trained to collect information and measure the variables of the study, which occurred through the application of questionnaires and detailed instruments described below.-

Caregiver variables and information

- Sociodemographic information: gender (male, female), age (continuous and categorized in age groups of ten years), schooling (continuous and categorized in groups of four years of study), marital status (married, unmarried), occupation (categorized according to the sample responses), religion (categorized according to the sample responses), skin color (categorized according to the sample responses), family income (continuous and categorized into number of minimum wages), number of co-residents (continuous), owner of residence (yes, no) and if had private health insurance (yes, no).

- Health conditions: the respondents were asked about health complaints and problems/self-reported morbidities from a list of possible morbidities - anemia, anxiety, arthritis, impaired hearing, cancer, constipation, pain, diabetes *mellitus*, dyslipidemia, systemic arterial hypertension, hypothyroidism, urinary/fecal incontinence, insomnia, obesity, osteoporosis, heart problems, spinal problems, gastrointestinal problems, vision problems, lung problems, falls, dizziness/vertigo, varicose veins (yes, no), use of medications (yes/no), calculation of Body Mass Index (BMI), from the assessment of the weight (kg) and height (m) of the caregivers, (with BMI between 22 and 27 kg/m^2 for elderly caregivers and between 18.5 and 24.99 kg/m^2 for adult caregivers considered normal, and lower or higher levels considered underweight and overweight respectively), healthy diet (yes, no), self-rated health (very good/good, fair, poor/very poor), self-rated care of own health (very good/good, fair, poor/very poor) and overall satisfaction with life (very, somewhat, not very).

- Perceived overload: evaluation conducted through the Zarit Burden Inventory (ZBI), validated for the Brazilian context[18]. This questionnaire comprises 22 Likert response questions. The score on each response varied from 0-Never to 4-Always, and the final score of the instrument was given by the sum of the answers, totaling a value between 0 and 88. The higher the score the greater the perceived overburden of the caregiver. The classification used was low overburden <21, moderate overburden 21-40 and moderate to severe overburden ≥41[18].

- Depressive symptoms: measured by the Geriatric Depression Scale (GDS) 15 question version, developed for the screening of depressive symptoms. The scale is validated for the Brazilian context and the cut-off point used was >5 for indications of symptoms[19].

Information on care context

- Care characteristics: kinship/proximity to the cared-for elderly person (spouse, father/mother, others), time of care (continuous and categorized in five year groups), hours per day (continuous) and days of the week dedicated to care (continuous), participation in courses/training for caregivers (yes, no), if caregiver receives help and type of help received (affective/emotional, material/financial, others).

Variables of elderly person receiving care

- Sociodemographic information: age (continuous) and gender (male, female).

- Cognitive screening: performed through the Mini Mental State Exam (MMSE, score 0 to 30 points), validated for use in Brazil with a suggested classification according to schooling (<17 points for illiterate, <22 points for 1 to 4 years of schooling, <24 points for 5 to 8 years of schooling and <26 points for 9 years or more of schooling)[20].

- Activities of daily living: a combination of instruments validated for use in Brazil. In order to evaluate BADL, the Katz Index was used to evaluate dependence in six activities - bathing, dressing, toileting, transfer, sphincter control, feeding - with a score of 0-6 being considered as dependent. For IADL, the Lawton and Brody Scale was applied, which involves questions related to telephone use, travel, shopping, preparing meals, housework, drug use and money management, and ranges from 7 to 21 points. The classification used was 8-20 for partial dependence and 7 for total dependence[22].

Initially, descriptive statistical analysis was performed. The Kolmogorov-Smirnov test was used and it was verified that the data did not show adherence to normality.

The multi-analyses sought to verify associations between the variables of the health profile of the caregivers, treated as dependent variables, and information regarding the care context, treated as independent variables. The demographic and social characteristics of the caregivers, such as age, gender and schooling were also tested against their health profile. The chi-square test with odds ratio (OR) and confidence intervals at 95% (CI95%) were used to analyze the associations between the dependent and independent categories. Additionally, correlation analyzes were performed using the Spearman Correlation Coefficient (r_s) among the continuously constructed variables, adopting alpha correction as a function of the number of correlations. The associations and correlations considered statistically significant (p-value ≤ 0.05) are presented in the tables.

All the participants provided written consent for their participation in the study (Declaration of Helsinki and Resolution 466/12). The study was approved by the ethics committee in regional research (n. 517.182).

RESULTS

The caregivers were mostly women (n=76), elderly (n=83), with a mean age of 65.8 years and between one and four years of formal schooling (70.7%), as shown in Table 1.

Other sociodemographic information showed that the caregivers were mostly married (n=89, 89.9%), did not perform paid work (n=76, 76.8%), were retired (n=50, 50.5%), described themselves as white (n=70, 70.3%) and Catholic (n=66, 66.7%). The average monthly family income was R$2671.90 (±2187.50), 71.4% (n=70) received two or more minimum wages (R$724.00 for the year 2014), did not have private health insurance (n=80, 80.8%), lived with other people (2.9±1.4 people in the same house), and owned their own homes (n=80, 80.8%).

The health information reported by caregivers showed a low prevalence of health impairments. The screening instruments showed a slight perceived overburden in the ZBI and 16.2% had depressive symptoms according to the GDS (Table 2).

The most frequent health complaints among caregivers were pain, systemic arterial hypertension, spinal problems, insomnia, and vision problems. Other complaints of morbidities such as anemia, impaired hearing, cancer, constipation, hypothyroidism, urinary/fecal incontinence, obesity, osteoporosis and pulmonary problems were reported at a frequency of less than 10% and are not described in Table 2.

Almost 80% of caregivers used at least one medication continuously and polypharmacy (use of ≥5 medications continuously) was present in 54.5% (n=54) of caregivers. Most reported healthy eating habits, which included the daily intake of fruits and vegetables (n=89, 89.9%).

Table 1. Descriptive analysis and analysis of distribution of caregivers in the rural community according to age, gender and schooling (n=99). São Carlos, São Paulo, 2014.

Variables/Categories	n(%) or mean (±sd)
Age (years)	65.8 (±10.4)
Age range	
<60	16 (16.2)
60-69	53 (53.5)
70-79	20 (20.2)
≥80	10 (10.1)
Gender	
Female	76 (76.8)
Male	23 (23.2)
Schooling (years)	4.9 (±4.2)
Schooling level	
<1	6 (6.1)
1 to 4	70 (70.7)
5 to 8	5 (5.1)
≥9	18 (18.2)

sd=standard deviation.

Table 2. Descriptive analysis and analysis of distribution of caregivers in the rural community according to health variables (n=99). São Carlos, São Paulo, 2014.

Variables/Categories	n(%) or mean (±sd)
Zarit Burden Inventory (points)	18.4 (±14.9)
Level of overburden	
None/mild	67 (67.7)
Moderate	24 (24.2)
Moderate/Severe	8 (8.1)
Geriatric Depression Scale-15 (points)	3.3 (±2.8)
Analysis of depressive symptoms	
No indication	83 (83.8)
Indicated	16 (16.2)
Related Morbidities (number)	4.7 (±2.8)
Types	
Anxiety	26 (26.3)
Arthritis	29 (29.3)
Pain	57 (58.2)
Diabetes *Mellitus*	23 (23.2)
Dyslipidemias	10 (10.2)
Systemic Arterial Hypertension	49 (49.4)
Insomnia	41 (41.4)
Cardiac problems	12 (12.1)
Back problems	43 (43.4)
Gastrointestinal problems	17 (17.2)

to be continued

Continued from Table 2

Variables/Categories	n(%) or mean (±sd)
Vision problems	39 (39.4)
Falls*	34 (34.3)
Dizziness/Vertigo	25 (25.3)
Varicose Veins	28 (28.3)
Medications being used (number)	2.4 (±2.3)
Frequency	
Yes	77 (77.8)
No	22 (22.2)
Subjective evaluation of health	
Very good/Good	68 (68.7)
Fair	28 (28.3)
Very poor/Poor	3 (3.0)
Evaluation of care of own health	
Very good/Good	56 (56.6)
Fair	34 (34.3)
Very poor/Poor	9 (9.1)
Overall satisfaction with life	
Very satisfied	77 (77.8)
Somewhat satisfied	21 (21.2)
Not very satisfied	1 (1.0)
Body Mass Index	
Underweight	13 (13.1)
Normal weight	35 (35.4)
Overweight	51 (51.5)

*in last 12 months. Sd=standard deviation.

Table 3 displays information regarding the context of care. The caregivers had provided care to the elderly for more than five years (54.8%), every day of the week, for five hours a day or more (n=64, 67.6%). The profile of the elderly care recipient was male, with no evidence of cognitive impairment (53.5%) who were mainly dependent in IADL (91.9% were partially dependent and 8.1% were totally dependent).

An important result was the reporting by the caregiver of help from health institutions and services in 53.5% (n = 53) of cases, mainly through the supply of free medicines. Support was reported from other areas, such as religious groups (n= 11, 11.1%) and social services (n=8, 8.2%).

Table 4 shows the strongest associations between the health profile of the caregivers and the context of care. Receiving affective/emotional help was inversely related to the highest level of caregiver overburden. Caregivers of elderly women were less likely to report vascular diseases and a poor self-rating of health. Caregivers who provided care for more than five years and cared for elderly persons with evidence of cognitive changes were more likely to complain of vascular diseases and other morbidities. In Table 5, correlation analysis showed that caregiver's schooling was directly associated with BMI. After alpha correction, the analyzes showed weak associations between the number of medications used by the caregiver and the amount of days per week spent providing care (direct relationship) and between the age of the caregiver and ZBI score (inverse relationship).

Table 3. Descriptive analysis and analysis of distribution of elderly persons receiving care and context of care and of the rural community (n=99). São Carlos, São Paulo, 2014.

Variables/Categories	n (%) or mean (±sd)
Age (years)	72.0 (±8.2)
Gender	
Male	74 (74.7)
Female	25 (25.3)
Mini Mental State Exam (points)	20.3(±7.1)
Analysis of cognitive disorder	
Indication of disorder	46 (46.5)
No indication of disorder	53 (53.5)
Basic activities of daily living (points)	5.3(±1.4)
Dependency in:	
Bathing	13 (13.1)
Dressing	14 (14.1)
Going to the bathroom	9 (9.1)
Transferring	8 (8.1)
Sphincter control	17 (17.2)
Feeding	6 (6.1)
Instrumental activities of daily living (points)	14.6 (±3.8)
Dependent in:	
Using the telephone	43 (43.4)
Travelling	52 (52.5)
Shopping	69 (69.7)
Preparing meals	72 (72.7)
Domestic chores	68 (68.7)
Taking medication	30 (30.3)
Managing money	57 (57.6)
Family relationship	
Spouse	81 (81.8)
Parents	10 (10.1)
Others	8 (8.1)
Length of time of providing care (months)*	126.4 (±157.7)
Length of time providing care (years/groups)	
<5	42 (45.2)
5 to 10	27 (29.0)
<10	24 (25.8)
Care/day (hours)	8.2 (±5.1)
Care/week (days)	6.8 (±0.6)
Care related spending/month (*reais*)	219.3 (±673.9)
Training/course in caring	
Yes	5 (5.1)
No	94 (94.9)
Receives affective/emotional assistance**	
Yes	49 (50.0)
No	49 (50.0)
Receives material/financial assistance	
Yes	18 (18.2)
No	81 (81.8)

sd=standard deviation; * did not respond=6; **did not respond=1

Table 4. Multi-analysis of association between information of care and health variables of caregiver (n=99). São Carlos, São Paulo, 2014.

Health variables	Information of context of care			
	Receives emotional support	Cares for female elderly person	Time of care ≥5 years	Care for elderly person with cognitive disorder
Severe overburden	OR=0.37; CI95% 0.15-0.90*	-	-	-
Evaluation of health Fair/ Poor/Very Poor	-	OR=0.33; CI95% 0.10-1.0*	-	-
Report of arthritis	-	-	OR=2.50; CI95% 1.0-6.56*	-
Report of vascular illnesses (varicose veins)	-	OR=0.16; CI95% 0.03-0.73*	-	OR=2.70; CI95% 1.11-6.85*
Report of non-specified morbidities	-	-	-	OR=6.94; CI95% 1.43-33.63*

*Chi-square test; OR=odds ratio; CI95%=95% confidence interval.

Table 5. Multi-analyses of correlation between information of caregiver and continuous variable of health of caregiver (n=99). São Carlos, São Paulo, 2014.

Health variables	Information of context of care		
	Age of caregiver (years)	Care in days/week	Schooling of caregiver (years)
Overburden of caregiver (ZBI)	r_s=-0.20; p=0.04[2]	-	-
Number of medications	-	r_s=0.21; p=0.03[2]	-
Body Mass Index	-	-	r_s=0.22; p=0.02

r_s=Spearman Correlation Coefficient; [2]Alpha correction (Bonferroni Correction: alpha <0.025); ZBI=Zarit Burden Inventory.

DISCUSSION

The profile of the elderly caregiver identified resembles the results of other studies. Caregivers have been found to be family members, female, usually the daughter or wife of the elderly person receiving care, and aged between 50 and 60 years, according to Brazilian[23,24] and international studies[14,25,26]. The majority of caregivers have an unfinished elementary education[4,23–25], are unemployed or dedicate themselves solely to domestic activities[24].

Regarding the profile of elderly people living in rural areas, specific studies have found that the majority are female and married, the prevalent age group is 60 to 69 years[6], and only 10% of elderly persons are aged 80 years or more[6]. The percentage of adult women living in rural areas who are widowed is higher than the percentage of adult male widowers. The same is observed in older elderly persons in comparison with their younger counterparts. Most declared themselves white and of Catholic religion[27].

The level of schooling is low and the illiteracy rate is high, with men more educated than women. The majority had a low income, spent a large part of their money on food and medicines and lived with relatives in the same house[27].

A large part of the sample did not have a private health plan. Data from the PNAD show that in 2003, the main financer of the system of care of people aged 60 years or more in rural areas was the Sistema Único de Saúde (the Unified Health System) (SUS) (70.6%) followed by own financing (14.0%) and private health plans (8.3%)[6]. The data found in

this study for the profile of the elderly corroborate the findings in literature.

With regard to health conditions, the literature is divergent. Caregivers described fatigue, stress and overburden when evaluating their health status,[4,24,25.] In a sample of caregivers in Chile, moderate levels of overload were found related not only to the act of caring, but also to the shortages in the support network and physical incapacities[28]. Although distanced from formal support services, the elderly and caregivers residing in rural areas may perceive their health better than the elderly and caregivers of urban areas[29]. However, the present study could not verify this relationship due to the absence of a group of caregivers from urban communities.

This can be confirmed from PNAD data. From the evaluation of the health needs profile of the elderly population living in rural areas in 2003, a prevalence of 16.6% of people self-rated their health status as poor or very poor. The negative self-perception of health increased significantly with age and was lower in relation to the urban elderly[6]. Similarly, in another study comparing the rural elderly with the elderly in urban areas, the authors verified that the latter had fewer morbidities and also had a higher quality of life score in the physical and social domains, and in the facets autonomy, past, present and future activities and intimacy[29].

In Rio Grande do Sul, Brazil, it was demonstrated that the majority of the rural elderly self-assessed their health as regular, and an association was found with age. The elderly between the ages of 80 and 84 described their health as worse, while 85-89 year olds reported their health as excellent[30]. Area of residence may be related to improved health perception[12,13]. In the present study, many of the caregivers reported being satisfied with their health, life and the care they took of themselves.

In terms of morbidities, in another study in a rural context in southern Brazil, the results showed that joint diseases (rheumatism, arthrosis, arthritis), spinal problems, insomnia, arterial hypertension, cataracts, nerves and heart are the most frequent[27]. In rural elderly people in Minas Gerais, Brazil, hypertension, spinal and vision problems were the most prevalent conditions[29]. Health impairment and complaints can be influenced by factors related to the aging of the caregivers themselves. It can be observed that the elderly who provide care and those who do not have a similar health profile, both in the rural context.

A survey in the rural area of Minas Gerais, Brazil, with 2898 elderly people, and a review study that described the factors associated with health may explain this finding. The results showed that the factors associated with symptoms of depression, for example, were female and age. Multivariate analyzes revealed that the female gender, being 80 years of age or older, not having a partner, having no schooling, having a greater number of functional limitations and a greater number of morbidities were factors related to a depressed mood[31,32].

In terms of characteristics of care, Brazilian literature reveals information similar to the findings of the present study. Caregivers provided care for more than 10 hours a day [23,33,34]. Just over half of all caregivers provided care full time, with about 40% not receiving support from other people and having no previous training in the activity[4]. Around 70% were married[24].

A literature review has shown that the caregiver's work is aimed at the activities in which the elderly person describes limitations. Helping with eating, skin integrity, hygiene, bowel eliminations, therapy, locomotion and movement, preparation of meals, care of clothes, cleaning of the house and carrying out of tasks outside the home were the most frequent[24]. In the present study, no relationship was found between the activities carried out by the caregiver and their profile of health complaints. Activities carried out throughout life, especially among caregiver spouses, may not be sufficient to cause health impairment. However, a new development in the life of the couple, such as a change in cognition, is a factor that can cause burdens on the health of those who provide care.

The greater number of people who live with elderly persons in the rural area may result in greater affective support, as evidenced by a study in the state of São Paulo, Brazil[35]. This study also pointed out that reduced social support was more frequent for women, who were illiterate, widowed or single, and in the elderly with an income of between one and two minimum wages[35]. Personal relationships in a home environment in the context of care should be explored in greater depth in future research, as

caregiver overburden may be influenced by the greater or lesser help from third parties for the care recipient.

Cognitive disorders among the elderly persons were associated with reports of varicose veins in caregivers. No studies were found to explain this relationship. One study showed that the occurrence of cognitive impairment prevails among elderly persons aged 80 and older, without an occupation or schooling, who were widowed, had vision problems, cardiac problems and hypertension, and six or more functional disabilities[31]. It is important to highlight that elderly caregivers are also exposed to these risk factors for the cognitive performance of the elderly. The salient factors can be determinant for the cognition and the functionality of the caregiver, and consequently the quality of the care provided.

In the majority of the elderly, independence in the basic activities of daily living was maintained; however, the absence of schooling, the advancement of age and the greater number of morbidities may be associated with functional incapacity for the performance of instrumental activities of daily living. One study found that the basic activities with the highest frequency of disabilities are bathing and dressing, and telephone use and household chores among more complex activities[27]. The authors also showed that approximately 35% of the elderly were independent and 55% were partially dependent in ADL. In analysis by gender, women presented higher percentages of mild, moderate and severe dependence (63.2%, 10.5% and 5.3% respectively) than men (40.0%, 6.7% and 0%, respectively), who were more independent[27].

This study provided information on the profile of caregivers and elderly care recipients, as well as on the health complaints of caregivers and the care they took of themselves, and sought to identify care context information related to caregiver health. The absence of a comparative group of caregivers from urban areas is a limitation that can be overcome in future studies. In addition, follow-up analysis of the participants could allow predictive and cause-and-effect analyzes.

CONCLUSIONS

The caregivers of the elderly in the rural areas of this study were predominantly women, elderly, married, with one to four years of schooling, declared themselves as white, retired and Catholic.

The most frequent health complaints were pain, systemic arterial hypertension, insomnia, spinal problems and vision problems. Overburden was marginally associated with the advanced age of the caregiver, and strongly associated with a lack of affective or emotional help. Elderly caregivers of female elderly persons exhibited positive self-rated health and reported a lower occurrence of varicose veins. Arthritis was more prevalent in those who had provided care for more than five years, and this complaint and unspecified morbidities were strongly associated with caring for an elderly person with cognitive impairment.

The present study presents information from caregivers who provide care to the elderly in the community, without specifying the pathology that affects the dependent elderly person. Understanding the reality of care in rural areas and identifying care factors related to the health of caregivers can contribute to better care management for elderly persons and their caregivers. The combination of subjective and objective health assessment instruments may be significant in the context of primary health care in Brazil.

Other studies may be carried out to provide a deeper understanding of co-variables related to the aging of the caregiver and the context of care. In addition to the biopsychosocial context, the quality of the aging of the caregiver can be dictated by many characteristics of the care itself, such as receiving support from third parties, long periods of care and the profile of the elderly person being cared for. These characteristics may explain the influence on the health and well-being of the caregiver and their quality of life. Finally, it should be considered that most caregivers are also elderly and there is a need for attention to this scenario which is growing in scale and significance.

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Attitudes of elderly persons and professionals towards intergenerational exchanges

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Abstract

Objective: to describe and compare the responses of elderly persons and professionals involved in permanent education programs in the state of São Paulo, Brazil, using the Intergenerational Exchanges Attitude Scale (IEAS), considering the variables living with children, for the elderly persons, and work with intergenerational groups or only with the elderly, for the professionals. *Method:* The convenience sample consisted of 148 elderly persons and 52 professionals. The participants responded to the IEAS and a questionnaire to delineate their profile in terms of age, gender and educational level. Comparative analysis, using the Mann-Whitney test, weighted each factor of the IEAS and the averages by items and by factors. *Results:* Compared to the professionals, the elderly had more negative perceptions of the attitudes of children towards the elderly (p<0.001) and more positive perceptions of the attitudes of the elderly towards children (p<0.001). Elderly persons who did not live with children had more negative perceptions of the interaction between children and the elderly than those who lived with children (p=0.003). Professionals working with intergenerational groups had more positive perceptions of the interaction between children and the elderly than professionals who worked only with older age groups (p=0.015). *Conclusion:* Intergenerational activities can be an important mediator of attitudes regarding the interaction between children and the elderly, as well as a form of training and professional renewal for those who work or intend to work in intergenerational activities.

Keywords: Attitude. Intergenerational Relations. Children. Elderly.

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INTRODUCTION

Attitudes are learned or altered through different contexts (social, educational, cultural) and can have a major impact on social interactions[1-4]. Knowledge and interactions between different generations are essential to promote positive attitudes[5,6].

Intergenerationality strengthens communication, relationships and the permanent exchange of ideas between individuals of different age groups, encouraging the formation and consolidation of social bonds that allow the subjects of such relationships to enrich their knowledge and acquire life experiences[7].

The development of actions that integrate the elderly, adults, youth, adolescents and children is necessary for the deconstruction of stereotypes and the minimization of age-related prejudices. Intergenerational programs are social vehicles that, through continuing activities, allow for exchanges of experiences, the building of meaningful ties and reciprocity among the participants, and bringing different generations together by creating moments of coexistence. When there is respect for the diversities and knowledges of individuals, as well as the mutual recognition of the needs of each generation, solidarity in the intergenerational relationship is established[7-11].

In order for these programs to be viable, appropriate methods must be developed that facilitate meetings and result in joint actions so that the interests of both elderly persons and the younger generation are stimulated. Intergenerational strategies adapted to these needs aimed at different generations are fundamental to achieve intergenerational dialogue and solidarity, promoting meaningful contact between the different generations[9,10].

Intergenerational programs have beneficial effects for participants. Younger generations tend to have reduced dropout rates and improved academic and social skills. Elderly persons present improvements in mental and physical health and the reduction of solitude and isolation. For both generations there is improvement of self-esteem and greater understanding of others[10,12].

Several studies have described the benefits generated by participation in intergenerational activities. A study of children and the elderly who participated in activities in small and large groups showed that the elderly enjoyed keeping up to date and felt that they had contributed positively to the growth and development of the children. Several elderly persons said they felt mentally stimulated and many expressed satisfaction with the emotional support, acceptance and friendship. The benefits for children were related to attention, socialization and improved perception of basic human needs[12]. After several monthly meetings in which the elderly told stories and talked to primary school students about customs and traditions, a study identified the cultural enrichment and internalization of the elderly figure as a source of experience and wisdom for children. The elderly experienced improvements in self-image and self-esteem and satisfaction with life[13].

Todaro[14] describes the need for planned actions, setting objectives, choosing materials and activities and evaluating the proposed strategy. In intergenerational programs, the mediators (teachers and monitors) are considered members of the middle generation, who contribute to the process of interaction between the younger and older generations and serve as models. They maintain and cultivate relationships with children, young people and the elderly, transmitting values, encouraging participation and establishing roles among those involved. It is important that the mediators are aware of the different possibilities and the different effects on the learning process and the implications of intergenerational conflict that may be present. Given the importance of the mediator, training in the activity to be practiced, regarding the profile of the participants, and on the very relationship that the generations establish is required, so that they have a more comprehensive view, neither adultizing the children nor infantilizing the elderly and providing a productive and pleasurable intergenerational encounter[7,15,16].

Since information and interaction between members of different groups can foster positive attitudes and reduce negative attitudes, the promotion of technical, recreational and pedagogical training and the accompaniment of specialized human resources are necessary to serve both the elderly public and other age groups[1,3,5,11,17].

Understanding the multidimensionality of attitudes stemming from intergenerational exchanges is crucial to the establishment of intergenerational

cooperation. Thus, the present article aims to describe and analyze the responses of the elderly and teaching professionals to the Intergenerational Exchanges Attitude Scale (IEAS), considering the variables living with children, among the elderly, and working with intergenerational groups or only with the elderly, among the teaching professionals.

METHOD

The research participants were taken from educational programs located in the state of São Paulo, Brazil. One program was a reference in teaching and research in a public higher education institution in the state capital. Another two were from institutions from municipal regions near the state capital. The three programs were chosen based on their reputations and the qualified work they have carried out and the extensive network of non-formal education offered to the elderly public.

A non-probabilistic convenience sample was employed. All the students and teaching professionals were invited to participate in the research, through verbal invitation and the making available of a text describing the research project prepared by the researchers and their program coordinators. All those who responded positively to the invitation were included in the sample.

The inclusion criteria for participation in the study included presence at the institution on the day of data collection and interest in participating in the study. Incomplete or unfinished protocols were considered to be exclusion criteria. The present study did not consider cognitive limitations, the diagnosis of depression or sensory deficiencies. Participants self-completed the research protocol, which contained a questionnaire and a scale. The questionnaire was used to identify the profile of the participants in terms of age, gender and level of schooling. The Brazilian version of the Intergenerational Exchanges Attitude Scale (IEAS) created by Stremmel et al.[18], based on Likert type items, was used. The IEAS underwent a process of semantic and cultural validation ranging from greatest concordance (5) to greatest discordance (1)[19]. The validation process of the IEAS was performed previously and, in light of the convergent and construct validity, the 23 items were allocated into three factorial domains, shown in Chart 1 below.

Chart 1. Factorial domains and items of Intergenerational Exchanges Attitude Scale, Campinas, São Paulo, 2014.

Perceptions of attitudes of children towards older adults	Perceptions of attitudes of older adults towards to children	Perceptions of the interaction between children and older adults
Children are too selfish to be around older adults. (3*)	Older adults are responsive to the needs of young children. (1*)	Older adults and children help each other. (11*)
Children cheat older adults at game. (9*)	Older adults share wisdom with children. (2*)	Older adults and children have warm relationships. (12*)
Older adults have difficulty earning a child's respect. (10*)	Older adults are gentle and kind to children. (4*)	Older adults enjoy activities with children. (15*)
Children feel insecure around older adults. (13*)	Older adults are too protective of children. (5*)	Children and older adults naturally feel affection toward one another. (16*)
Children think older adults are boring. (14*)	Children stimulate older adults' interest. (6*)	Children and older adults make good companions. (17*)
Older adults get sick around children. (19*)	Children ask too many questions to be around older adults. (7*)	Children and older adults have fun together (18*)
Children think older adults are ugly. (20*)	Older adults are too lenient with children when they misbehave. (8*)	
Children are too active for older adults. (21*)		
Older adults are too frail to be around young children. (22*)		
Children think older adults are dumb.. (22*)		

* The numbers in parentheses indicate their order of apperance in the instrument;

The scale was applied differently for each group. Individual interviews were conducted with the professionals who developed the teaching activities. For the elderly persons, the research protocol was provided, and reading assistance was provided for those who presented difficulties during completion of the form. The interviewers were previously trained. Information about the objectives, the task involved, the minimum psychological and physical risks, as well as the guarantee of confidentiality and the right to abandon the project at any time was provided before the application of the instrument.

The participants signed a Free and Informed Consent Form (FICF), authorized by the Research Ethics Committee FCM/UNICAMP (CCAAE: 30881414.9.0000.5404).

The Mann-Whitney test was used for data analysis. Comparative analysis was used to weight each factorial domain of the IEAS. In the elderly group the means were weighted by items and by factors according to whether the individual lived with or did not live with children. In the group of professionals, the weighting of the means by items and by factors was based on whether the individual worked with an elderly group or worked with intergenerational groups. To analyze internal consistency, Cronbach's alpha coefficient was used, with alpha values greater than 0.70 indicating the high consistency and reliability of the scale. The significance level adopted for the statistical tests was 5% or $p<0.05$.

RESULTS

The answers of the professionals and the elderly were considered together in data analysis. In terms of the exploratory factorial analysis of the IEAS items, the Kaiser MSA measurement was above 0.60, indicating the consistency of the total sample.

Table 1 presents the profile of professionals and the elderly in absolute frequency and in approximate percentages.

Table 1. Profile of participants in the process of construct and convergent validity of the Intergenerational Exchanges Attitude Scale. Campinas, São Paulo, 2014.

Variables/Groups	Professionals (n=52). N (%)	Elderly Persons (n=148). N (%)
Gender		
Female	34 (65.4)	132 (89)
Male	16 (34.6)	16 (11)
Age (years)		
18-39	32 (61.5)	0
40-59	18 (34.7)	0
60-69	2 (3.8)	85 (57.4)
70-79	0	52 (35.1)
80+	0	11 (7.5)
Schooling (years)		
1-4	0	38 (25.7)
5-8	0	36 (24.3)
9-11	0	33 (22.3)
12+	52 (100)	41 (27.7)
Receives continuing training		
Yes	37 (71.2)	-
No	15 (28.8)	-
Intergenerational work / Lives with children		
Yes	33 (68.8)	107 (72.3)
No	15 (31.2)	41 (27.7)

According to Table 1, the sample was predominantly made up of female professionals, aged between 18 and 39 years, with a complete higher education, and who received continuing training and work or worked with intergenerational activities involving children and elderly persons.

The elderly participants were mostly female, aged between 60 and 69 years, had more than 12 years of schooling and lived with children.

Regarding attitudes towards the intergenerational exchanges between elderly persons and professionals, there was a statistically significant difference between the groups for the score of the perceptions of children's attitudes towards elderly persons factor, which was lower in the elderly persons group, and for the score of the perceptions of the attitudes of elderly persons towards children factor, which was higher in the group of elderly persons, according to Table 2.

Table 2 shows that, in comparison with the professionals, the elderly persons had more negative perceptions about children's attitudes towards the elderly (p<0.001). On the other hand, they had more positive perceptions about the attitudes of the elderly towards children (p<0.001).

Table 3 shows the statistically significant differences for the comparison of the factors between the group of elderly persons that lived with children and those that did not.

There was a statistically significant difference between the elderly persons who lived with and those who did not live with children for the perceptions of the interaction between children and elderly persons factor score, which was more negative among elderly persons who did not live with children (p=0.003).

Table 4 shows the comparisons of the factors among professionals who worked with intergenerational groups and those who worked only with groups of elderly persons.

Table 2. Comparison of Intergenerational Exchange Attitude Scale factors among elderly persons and professionals. Campinas, São Paulo, 2014.

Variables/Groups	Professionals (n=52)	Elderly Persons (n=148)	*p*-valor*
Perceptions of attitudes of children towards older adults	3.75 (0.50)	3.25 (0.54)	<0.001
Perceptions of attitudes of older adults towards children	3.37 (0.44)	3.86 (0.51)	<0.001
Perceptions of the interaction between childrens and older adults	3.75 (0.52)	3.90 (0.59)	=0.063

* *P*-value related to Mann-Whitney test for the comparison of the values between the groups of elderly persons and professionals.

Table 3. Comparison of Intergenerational Exchange Attitude Scale factors between elderly persons who live or do not live with children. Campinas, São Paulo, 2014.

Variables/Groups of elderly persons	Lives with children		*p*-value*
	Yes (n=107)	No (n=41)	
Perceptions of attitudes of children towards older adults	3.28 (0.57)	3.17 (0.42)	0.213
Perceptions of attitudes of older adults towards to children	3.90 (0.52)	3.73 (0.47)	0.066
Perceptions of the interaction between childrens and older adults	3.98 (0.60)	3.70 (0.52)	0.003

* *P*-value relating to Mann-Whitney test for the comparison of the values between the two groups of elderly persons.

Table 4. Comparison of factors of Intergenerational Exchange Attitude Scale among professionals who worked with intergenerational groups and those who worked only with elderly persons. Campinas, São Paulo, 2014.

Variables/Groups of professionals	Intergenerational Work		*p*-value*
	Yes (n=35)	No (n=17)	
Perceptions of attitudes of children towards older adults	3.80 (0.55)	3.69 (0.36)	0.301
Perceptions of attitudes of older adults towards children	3.38 (0.45)	3.35 (0.45)	0.920
Perceptions of the interaction between children and older adults	3.86 (0.52)	3.49 (0.51)	0.015

* *P*-value relating to Mann-Whitney test for the comparison of the values between the two groups of professionals.

There is a statistically significant difference between professionals working with intergenerational groups and those who worked only with elderly persons for the perceptions of the interaction between children and elderly persons factor. Professionals working with intergenerational groups had more positive perceptions about the interaction between children and elderly persons (p = 0.015).

DISCUSSION

The present study investigated attitudes towards intergenerational exchanges in a sample of teaching professionals and elderly persons enrolled in continuing education programs. Significant relationships between attitudes towards the intergenerational exchanges of elderly persons and professionals were identified. The elderly persons presented different attitudes in relation to intergenerational exchanges based on the variables living or not living with children. The same data were identified among professionals who worked with and those who did not work with intergenerational activities.

The results of this study, compared with the profiles of other experiments involving continuing education programs reported in literature, are similar. Most of the professionals were females, aged between 18 and 39 years and all had a higher level education. A study by Jarrott et al.[16], which assessed attitudes towards intergenerational exchanges in day-care administrators for elderly persons and of infant schools that carried out activities of this type, found the age of the interviewees ranged from 19 to 52 years, with 95% between 19 and 29 years of age. All were female.

Women represented the majority of the elderly participants of the sample. The more frequent presence of women in programs of permanent education has also been described in other Brazilian studies of this nature, as well as in research outside Brazil [20-22].

Brazilian literature shows that women have a more active participation in society and, therefore, visit places for a range of purposes, such as education, sports and leisure. The role of women and their greater social engagement, influenced by cultural issues, life expectancy, improvements in living conditions, and a greater concern for health, has resulted in the phenomenon known as the feminization of old age, or the growth of the female population over 60 years of age in society[23].

Data regarding the educational level of the elderly persons are also similar to those documented in Brazilian literature and literature from other companies on educational programs geared to this age group[20,21]. Most elderly persons who attend permanent education programs have, on average, ten years of schooling.

Regarding the attitude of elderly persons, a study of this public by Lu et al.[24] aimed to investigate the attitude of elderly persons towards old age and to analyze the associations of such attitudes with well-being, participation and social support. The result showed that elderly persons with higher levels of schooling and who lived in urban areas had more positive attitudes towards old age. In general, a high level of education may be related to positive to neutral attitudes towards old age, evidencing a heterogeneous perception of this phase of life[11,25,26].

Regarding attitudes towards intergenerational exchanges, in comparison with the professionals, elderly persons expressed more positive perceptions about the attitudes of the elderly towards children. Of the few existing studies, there is evidence of a tendency of elderly persons to have more positive attitudes towards children[8].

The elderly persons displayed a more negative perception about children's attitudes toward elderly persons than the professionals, and believed that children have more negative attitudes towards the elderly[14].

In contrast, the study by Todaro[14] analyzed the attitudes of children, controlling for gender, age and intensity of coexistence with the elderly persons, as well as testing the effectiveness of a children's reading program containing elderly characters. Children between the ages of seven and ten participated in an educational intervention, featuring pre-test, treatment and post-test, consisting of five sessions with an average duration of 50 minutes each. Comparing the scores of items based on the domains of the Todaro Scale for the Assessment of the Attitudes of Children Towards Aging, the children's attitudes towards elderly persons were generally more positive, especially for the domains of social and personal relationships (relating to the social image of the elderly persons). The least positive scores of children in relation to elderly persons were for agency and cognition. Boys and older children had more negative attitudes, but also improved the most between the pre-test and the post-test. Children who did not live with their grandparents had more negative attitudes about the persona domain, and it was found that a greater number of activities performed with grandparents led to more positive attitudes among children in the cognition domain. This study highlights the importance of intergenerational relationships in changing and promoting more positive attitudes towards old age.

It is therefore is emphasized that such attitudes are socially learned, either explicitly or unconsciously, and can be modified throughout life from observation, coexistence and experiences[6,11,14].

In the present study, perceptions about the interaction between children and elderly persons were more negative in elderly persons who did not live with children compared to those who lived with children. It was evidenced that the lack of contact and interaction with another generational group may reflect the presence of stereotypes and prejudices. In addition to approximation with different generations, one must also consider the quality of the relationship established for the promotion of more positive attitudes about others[1,14].

A study carried out involving children and elderly persons in intergenerational reminiscing activities, where the elderly persons told autobiographical stories, shared personal memories and recollections of the past in order to transmit popular traditions and life experiences to younger generations, found through tests before and after the intervention that there were positive effects on the perceptions and attitudes of children and elderly persons regarding the other age group[27].

Professionals working with intergenerational groups presented more positive perceptions about the interaction between children and elderly persons than professionals who did not carry out activities involving different generations. In the Jarrott et al.[16] study, the results for the IEAS 'relations and interactions' factor were good, indicating more positive attitudes about intergenerationality between children and elderly persons.

Education about aging can clarify misunderstandings involving images, social facts, and psychological and physical aspects. The effects and benefits of education programs about aging are guided by clarifying questions about this issue and, therefore, aim to minimize prejudices and negative attitudes related to age[6,11,14,24,28,29].

Promoting technical, recreational and pedagogical training and the accompaniment of specialized human resources not only for the elderly, but for all ages, is important, since information and interaction between members of different groups provide positive attitudes[1,3,5,14,17,30].

One limiting factor of the present study is that it represents the only application of the IEAS in a Brazilian context. It is therefore important to carry out intervention and segmental studies in order

to verify possible changes in attitudes regarding exchanges between children and elderly persons, when they interact with one another. and when this subject is being approached.

CONCLUSION

The present study aimed to describe and compare the behavior of elderly persons and professionals using the Intergenerational Exchanges Attitude Scale (IEAS), considering the variables coexistence with children for elderly persons, and working with intergenerational groups or only with elderly persons, for professionals.

The elderly persons presented more negative perceptions of the attitudes of children towards the elderly than the professionals. In contrast, the elderly persons expressed a more positive perception of the attitudes of the elderly towards children. In addition, attitudes regarding the interaction between children and elderly persons were more negative among elderly persons who did not live with children than in elderly persons who lived with a younger generation. It was found that professionals working with intergenerational groups presented more positive attitudes regarding the interaction between children and elderly persons than those who did not develop intergenerational activities. In order to reduce negative attitudes towards intergenerational exchanges, the development of intergenerational activities, as well as the training and refreshing of the technical and theoretical knowledge of professionals who act and/or intend to act in actions that promote intergenerationality is required.

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Approach to the most prevalent oral disorders among the elderly: an integrative review focusing on primary health care

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Abstract

Objective: an integrative review of the treatment of oral candidiasis, root caries and xerostomia among the elderly population, focusing on Primary Health Care, was carried out. *Method:* scientific articles were collected from the MEDLINE/PUBMED database using the keywords "Geriatric dentistry" and "Oral health", crossed with corresponding descriptors, together with specific terms for the pathologies studied, and with "the clinical trial" filter activated. The abstracts of the articles were read by three researchers. *Result*: oral candidiasis: six randomized clinical trials and one quasi-experimental design study, on the treatment of prosthetic stomatitis by medication and/or the disinfection of dentures by different techniques, were identified; root caries: three randomized clinical trials were included, which tested the use of mouthwash with chlorhexidine solution and oral hygiene instruction associated or otherwise with other drugs; and xerostomia: two articles were analyzed using various medications, and the functional massage of the salivary glands and associated muscles. *Conclusion*: The results demonstrate a variety of treatment options for the studied clinical situations, although these should be adapted to the characteristics of the services and the population, as standard treatment in Primary Health Care has not been established. Strategies based on soft technologies, such as health education, seem to provide good results. The present study provides additional knowledge for health professionals in search of more resolutive and qualified dental care for the elderly in primary health care.

Keywords: Candidiasis, Oral. Root Caries. Xerostomia. Primary Health Care. Elderly. Oral Health.

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INTRODUCTION

Oral health care in Brazil has historically prioritized the health of schoolchildren, leaving population groups such as the elderly on the margins of public policies in this area[1]. This group of patients has become a serious public health problem, and the increased longevity and the high disease burden of the elderly population in Brazil have brought several problems related to the dental care of these patients to the fore.

The dental care of the elderly becomes more complex given the demographic transition of population aging in Brazil over the last 50 years, a phenomenon which has occurred in parallel with the epidemiological transition[2]. As mortality from infectious diseases decreases, the life expectancy of the population increases, as people are exposed for a longer period to risk factors and the prevalence of chronic-degenerative diseases increases[3]. This causes the health-disease profile of the population to change, requiring the reorganization and restructuring of health systems to meet this different type of demand[4].

This fact can be observed in an epidemiological survey which showed that the elderly population had a decayed, missing and filled teeth index (DMFT) of approximately 27, which is extremely high, with a predominance of the "missing" component and a major need for prosthetic rehabilitation. The proportion of individuals aged 65 to 74 years who did not need some type of dental prosthesis was only 7.3%. This situation is a reflection of the old invasive odontological practice, which did not emphasize conservative treatments and the prevention of injuries[5].

Although public policies have been reorganized and reoriented through emphasis on the role of Primary Health Care (PHC) and the shift of the coordination of care to this level, the inherent complexity of health care among the elderly population poses challenges to the work of PHC health teams.

PHC is the first level of care provided by the health system and aims to resolve the most frequently occurring problems among the population[6]. In Brazil, the number of dentists in basic care has increased considerably, also improving the use of oral health services[7].

Despite the advances achieved in terms of increasing the public dental service, there are many difficulties in the organization of oral health care for the elderly. According to Oliveira et al.[8], due to the model of oral health care instituted in Brazil in recent decades, which features a predominance of exodontia in detriment of conservative procedures, the rate of edentulism in the elderly population has reached extremely high levels, as has as the presence of xerostomia[9] and root caries[10,11].

Xerostomia can be considered as the subjective complaint of dry mouth, and is clinically diagnosed through the sialometry test. Hyposalivation is considered salivary flow rates below 0.1 mL/min at rest or 0.7 mL/min under stimulation[12]. This condition can bring considerable oral discomfort and difficulty in chewing, swallowing, speaking and the wearing of dentures, as well as a burning sensation or even local pain, in addition to an increased chance of caries, candidiasis or other opportunistic infections[13]. The main cause of xerostomia in the elderly is the use of certain drugs, such as tricyclic antidepressants, sedatives, antihistamines and antihypertensive medication among others[12]. In addition to this factor, the functioning of the salivary glands can decrease with advancing age[13].

In this context, Wolff et al.[14] report that the increased risk for the onset of the sensation of pain in the oral mucosa, candidiasis and dental caries is associated with salivary flow reduction.

In dentistry, the most significant fungus is a yeast belonging to the Candida genus. Under normal conditions, it is a commensal organism and is present in about half of the population, causing no apparent damage nor inducing inflammation in adjacent tissues. However, under certain host conditions, the fungus multiplies, penetrates tissues, causes inflammation and becomes a pathogen. Among the species of the Candida genus found in humans, Candida *albicans* is responsible for the majority of infections. Factors related to the change from commensal organisms to pathogens may be predisposing, such as alterations in the buccal environment (poor hygiene and xerostomia)[15].

Turning to dental caries, Rösing and Jardim[16] consider these to be an increasing epidemiological problem due to the dental maintenance throughout the life of individuals. The authors emphasize the importance of the careful observance of this problem by dentistry professionals and the adoption of effective preventive and restorative approaches to this clinical situation from adulthood onwards[17].

From this perspective, the need for professional training and the stimulation of the practice of evidence-based dentistry is fundamental. It is imperative that PHC oral health teams are able to correctly diagnose and treat the most common oral problems in the growing elderly population, considering the uniqueness of the physical and mental condition and the complexity of the dental treatment of these individuals[4]. The present study therefore aimed to present an integrative review of the treatment of oral candidiasis, root caries and xerostomia, with a focus on PHC.

METHOD

A literature search was conducted of articles dealing with the treatment of oral candidiasis, root caries and xerostomia among the elderly population, irrespective of comorbidities. The MEDLINE/PUBMED, BIREME, LILACS and SciELO databases were used to achieve this. No articles were found in the BIREME, LILACS and SciELO databases that dealt with the subjects chosen based on geriodontics and with a focus on PHC.

The descriptors "Geriatric dentistry" and "Oral health" were chosen for the search and were crossed with the descriptors of the three pathologies, including all the respective "entry terms" in this crossing. In the search for candidiasis only, the crossing with "Oral health" was removed, due to the low number of articles that were found. Articles published in the period from 01/2004 to 10/2016 were included. The "Clinical trial" filter was activated in all searches. Articles were not excluded based on the language of the publication.

For the search in the MEDLINE/PUBMED databases, in relation to candidiasis the terms "Geriatric dentistry" [Mesh] OR "Dentistry, Geriatric" OR "Dental Care for Aged" OR "Dentistry for Aged" OR "Aged, Dentistry for" OR "Dental Care for Elderly" AND ("Candidiasis, Oral" [Mesh] OR "Candidiases, Oral" OR "Oral Candidiases" OR "Oral Candidiasis" OR "Thrush" OR "Moniliasis, Oral" OR "Moniliases, Oral" OR "Oral Moniliases" OR "Oral Moniliasis") were used.

In the same database, for the search on root caries, the terms "Geriatric dentistry" [Mesh] OR "Dentistry, Geriatric" OR "Dental Care for Aged" OR "Dentistry for Aged" OR "Aged, Dentistry for" OR "Dental Care for Elderly" AND ("Oral Health" [Mesh] OR "Health, Oral" AND ("Root Caries" [Mesh] OR "Caries, Root" OR "Caries, Cervical" OR "Cary, Cervical" OR "Cervical Cary" OR "Cervical Caries")) were used.

For the search on xerostomia, we used the terms "Geriatric dentistry" [Mesh] OR "Dentistry, Geriatric" OR "Dental Care for Aged" OR "Dentistry for Aged" OR "Aged, Dentistry for" OR "Dental Care for Elderly" AND ("Oral Health" [Mesh] OR "Health, Oral" AND ("Xerostomia" [Mesh] OR "Xerostomias" OR "Hyposalivation" OR "Hyposalivations" OR "Asialia" OR "Asialias" OR "Mouth Dryness" OR "Dryness, Mouth")).

Summaries of all the articles found were read by three independent researchers who excluded those which did not deal with subjects related to geriodontics, or were not within the scope of PHC activities or had obvious methodological problems in terms of the items on Cochrane's checklist (reference) described by Carvalho et al.[18]. The selected articles were characterized according to design, place of research, year of publication and the results found.

RESULTS

Oral Candidiasis

The search for candidiasis resulted in 22 articles. The abstracts were analyzed by three examiners, who excluded 10 articles, leaving 12. After reading the articles in full, four were excluded due to methodological problems or the age group of the sample. Eight articles remained for analysis.

The papers on candidiasis comprised seven randomized clinical trials and one quasi-experimental study. The study samples ranged from 27 to 215

patients. The randomized clinical trials included different treatment proposals for denture-related stomatitis. In four studies, different drug treatments were tested, while in two only types of disinfection of dentures were tested as a treatment for candidiasis. In one study, drug therapy and a form of denture disinfection were tested. Another study evaluated the effect of daily probiotic use on the prevalence of Candida *Albicans*. Both the study by Neppelenbroek et al.[19] and the study by Webb et al.[20] addressed only denture disinfection techniques as a form of candidiasis treatment, and both had positive results (Chart 1).

Chart 1. Description of articles on oral candidiasis. Porto Alegre, Rio Grande do Sul, 2016

Authors/Year/Country	Sample and Methodology	Results
Webb BC et al., 2005[20] (Australia)	60 patients with candida-associated denture stomatitis; Two test groups and one control group. Randomized clinical trial; Efficacy of two treatment methods.	The control group showed insignificant changes in the candida and aerobic bacteria counts on dentures. Both hypochlorite and microwave irradiation proved to be effective in combating candida-associated denture stomatitis.
Koray M et al., 2005[48] (Turkey)	61 patients; Three groups (fluconazole, hexetidine and fluconazole + hexetidine). Quasi-experiment; Efficacy of oral fluconazole and hexetidine	The three groups showed a significant reduction compared to pre-test. There were no significant differences between groups.
Catalán A et al., 2008[34] (Chile)	27 patients with stomatitis; nine per group (two tests and one control). Randomized clinical trial; Antifungal effect of melaleuca alternifolia	In vitro: melaleuca - total inhibition of candida. In vivo: two test groups - no statistical difference; test groups compared to control group - both reduced the signs of inflammation.
Neppelenbroek KH et al. 2008[19] (Brazil)	60 patients; three test groups (Mw - micro-waves, Mz-miconazole and MwMz) and a control group. Randomized clinical trial; Effectiveness of disinfection of complete upper dentures through microwave irradiation.	Mw and MwMz had much better results than control and Mz. There was no significant difference between the Mw and MwMz groups
Meurman JH et al., 2009[50] (Finland)	194 patients, two groups (control group with placebo and test group with AmF-SnF2 solution). Randomized clinical trial; Antifungal effect of amine flouride-stannous fluoride combination (AmF-SnF2) in solution compared to placebo	The number of patients with high candida counts was lower in the test group than in the control group. Total bacterial count was lower in both groups. The use of the AmF-SnF2 solution did not significantly change the mean candida score but the median was reduced in this group, while there was an increase in the control group.
Khozeimeh F et al., 2010[49] (Iran)	30 patients from a geriatric sanatorium, two groups (topical ketoconazole group and ketoconazole tablet group). Randomized clinical trial, efficacy between topical ketoconazole 2% in orabase and ketoconazole tablet.	The treatments exhibited similar efficacy.
Mima EG et al., 2012[35] (Brazil)	40 edentulous patients with dentures; Two groups: Nystatin Group and PDT Group. Randomized clinical trial; Compares the action of photodynamic therapy (PDT) and topical antifungal treatment against denture stomatitis, in terms of fungus count. Identification of species of candida.	Nystatin success: 54%. PDT success: 45%. Both reduced fungal culture in 30 days (with no statistical difference between groups). There were recurrence rates of 75% (Nyst) and 78% (PDT) among successful cases.
Kraft -Bodi E et al. 2015[36] (Switzerland)	215 elderly residents in nursing homes, two analysis groups (group using two types of probiotics and a placebo group). Randomized Double Blind Two-Arm Clinical Trial; effect of probiotic use on the prevalence and counts of oral candida.	Significant reduction in the prevalence of Candida *Albicans* in both dental biofilm and saliva ($p<0.05$). There was no difference between gingival bleeding and dental biofilm levels.

Root caries

The search for articles on root caries (Chart 2) resulted in 14 articles: eight were excluded after reading the abstract and one was excluded after a complete reading, leaving five articles for analysis. The resulting articles are randomized clinical trials with samples of 266 to 1101 participants.

Chart 2. Description of articles about root caries. Porto Alegre, Rio Grande do Sul, 2016

Authors/Year/Country	Sample and methodology	Results
Wyatt CC et al., 2007[21] (Canada)	1,101 elderly persons; Two groups: control group (placebo) - 551 elderly persons; CHX (chlorhexidine) test group - 550 elderly persons. Randomized double-blind clinical trial; tests the impact of regularly rinsing with 0.12% chlorhexidine solution on tooth loss.	Results showed that regular use of chlorhexidine mouthwash did not have a substantial effect on the preservation of dental structures among the elderly.
Tan HP et al., 2010[22] (China)	306 elderly persons from 21 institutions; four groups: Individual hygiene instruction (IHI); IHI + application of chlorhexidine 1% varnish every three months; IHI + 5% sodium fluoride varnish application every three months; IHI + annual application of 38% silver fluoride diamine solution. Randomized clinical trial; to compare the efficacy of four methods of preventing new root caries.	Groups two, three and four had reduced carious surfaces in comparison to the IHI only group (reduction of relative risk of caries). There was no significant difference between groups. Reductions of 57%, 64%, and 71% respectively. Side effects or discomfort were not reported.
Zhang W et al., 2013[23] (China)	266 elderly persons; three groups: Group One: OHI annually; - Group Two: OHI and application of SFD annually; Group Three: OHI and SFD annually and another oral health education program (OHEP) every six months. Randomized clinical trial; To evaluate the effectiveness of silver fluoride diamine (SFD) and education on the prevention and paralysis of root caries lesions.	Group three had fewer new carious surfaces than group one. Group two and three had a greater number of paralyzed caries than group one.
Cruz Gonzalez AC, Marín Zuluaga DJ, 2015[24] (Colombia)	75 elderly people living in geriatric institutions; Two groups (ART and conventional technique) evaluated after six months. Randomized Clinical Trial; to compare the clinical performance of the ART technique in relation to the conventional technique on root surfaces	The ART group presented an 81.3% survival rate after 6 months while the conventional technique obtained a rate of 92.9%. Although the ART group had a higher rate of failure and less success in terms of treatment, the authors suggest that ART is a recommended technique for the treatment of root caries in the institutionalized elderly.
da Mata C.et al., 2015[25] (Ireland)	99 elderly persons, two groups (ART and conventional technique). Randomized Controlled Clinical Trial with two-year follow-up.	The cumulative survival rate of the restorations was 85.4% for ART and 90.9% for the conventional technique. Statistical analysis did not find a significant difference between groups.

Wyatt et al.[21] tested the impact of regularly chewing a solution of chlorhexidine 0.12% among 550 elderly persons. All dental and crown surfaces were monitored for five years. Regular use of mouthwash was not effective in preventing new root caries.

Two studies had positive results for the prevention of root caries. Tan et al.[22] tested four methods of preventing new root caries in 306 elderly people with at least five teeth in their mouths. The three agents tested (the application of chlorhexidine 1% varnish

every three months, 5% sodium fluoride varnish every three months and the silver fluoride diamine (SFD) solution 38% annually – all combined with oral hygiene instruction) were found to be effective at preventing root caries.

Zhang et al.[23] evaluated the effect of SFD and education on the prevention and paralysis of root caries in 266 elderly people with at least five teeth with exposed roots in the mouth. In addition, the study evaluated the synergistic effect of the Oral Health Education Program (OHEP) and SFD. The patients were accompanied for 24 months. The results showed that the biannual application of SFD and OHEP is more effective at preventing and paralyzing caries than only oral hygiene instruction, with a synergic effect between the two.

Cruz-Gonzalez and Zuluaga[24] evaluated the effect of using the atraumatic restorative technique (ART) in comparison with the conventional technique in terms of the survival rate of the restorations. The authors suggest that ART is the technique of choice for the treatment of root caries in institutionalized elderly persons due to its high success rate and restoration survival rate (81%) after six months. In this same context, Mata et al.[25] described a survival rate of 85.4% in restorations performed with the ART technique after two years of follow-up in a randomized clinical trial performed with institutionalized elderly persons.

Xerostomia

Twenty-one articles about xerostomia resulted from the search, 16 of which were excluded after reading the abstract. After a complete reading of the articles, two were excluded, leaving three for analysis (Chart 3).

Chart 3 – Description of articles about xerostomia. Porto Alegre, Rio Grande do Sul, 2016

Authors/Year/Country	Sample and methodology	Results
Gil-Montoya JÁ et al. 2008[26] (Spain)	20 institutionalized elderly; Two phases: Phase One: test group - Biotene mouthwash and Oral Balance gel and control group - two placebo products. Stage Two: after a break of 20 days, the products were changed. Pilot study. Randomized double blind clinical trial; to evaluate the clinical efficacy of a mouthwash and gel containing the antimicrobial proteins lactoperoxidase, lysozyme and lactoferrin in elderly patients with dry mouth.	Some symptoms improved with the test group and others with the placebo.
Hakuta C et al., 2009[27] (Japan)	141 elderly persons; Two groups: test group - underwent program and control group which did not undergo program. Randomized clinical trial; evaluate oral functionality promotion program for the elderly in Japan with facial and tongue exercises and massage of the salivary glands.	In the test group: the tongue coating scores decreased; the amount of food debris in the oral cavity was reduced and dryness on the tongue was improved; the increase rate of salivary flow was greater; the period of time of the tongue being maintained in the forward position increased and the number of times for moving the tip of the tongue increased; pronunciation of words was clearer.
Ohara Y et al., 2015[28] (Japan)	47 elderly patients with xerostomia; Two groups (the group that received the oral health education program and the control group). Randomized Clinical Trial; the intervention group consisted of oral hygiene instructions, muscular exercises and massage of the salivary glands; the control group received general information about oral health.	21 patients from the intervention group and 17 patients from the control group completed the study. The salivary accumulation tests were significantly better in the intervention group than the control group.

Gil-Montoya et al.[26] conducted a pilot study with 20 participants, which evaluated the clinical efficacy of a mouthwash and gel containing antimicrobial proteins, lactoperoxidase, lysozyme and lactoferrin in elderly patients with hyposalivation accompanied by xerostomia. Some symptoms improved with the test solution and others with the placebo, with no definitive result.

Hakuta et al.[27] evaluated an oral functionality promotion program for the elderly in Japan, which consisted of facial and tongue exercises and massage of the salivary glands. The intervention group exhibited an improvement in the salivary flow rate, in addition to other functional gains. Recently, Ohara et al.[28] performed a similar study using OHEP with 47 elderly patients with xerostomia. The authors demonstrated that educational strategies (oral hygiene instruction, salivary gland massage and muscular exercises for the tongue and face) are effective for the control of xerostomia. However, the test group did not exhibit a different result from the control group after three months of observation.

DISCUSSION

Candidiasis is the most common fungal infection of the mouth in humans and has varying degrees of severity[13]. The use of dentures is a modifying factor of the oral environment that is strongly related to infection[29]. Dentures alter the oral condition by reducing pH, salivary flow and the contact of the tongue with tissues, as well as factors such as poor hygiene and the permanent use of the prosthesis during the night[29]. In addition, the acrylic surface serves as a reservoir for potentially pathogenic microorganisms, aggravating infection and allowing reinfection after treatment[30].

The management of denture-related stomatitis is complex due to its multifactorial etiology[13]. Several drugs alleviate the symptoms and clinical signs of the infection, but are not sufficient to eradicate the fungus from the dentures, causing high recurrence rates due to reinfection[31]. In addition, systemic agents, such as ketoconazole, fluconazole and itraconazole may produce varied adverse effects and drug interactions[32].

Although many studies have found a high rate of resistance to this drug, nystatin is still the first-choice treatment for candidiasis, and has been adopted by the Ministry of Health[33]. The studies by Catalan et al.[34] and Mima et al.[35] compared alternative therapies with Nystatin, and found equally positive results. The first tested the antifungal effect of the topical use of *Melaleuca alternifolia* and the second tested photodynamic therapy for the disinfection of dentures. Although the results were similar to nystatin, more research is needed on these subjects, as the studies have small samples. In addition, photodynamic therapy is expensive for consideration as treatment at a populational level. On the other hand, the proposed use of probiotics described by Kraft-Bodi et al.[36] could represent an interesting therapeutic strategy in this population, in view of its effect on the reduction of strains of Candida *Albicans*.

Two studies included in this review show that disinfection of dentures without systemic or topical treatment was sufficient to treat candidiasis and recurrence. This represents a much more conservative line of treatment, with little intervention and drug use, compatible with the public health reality of Brazil.

The study by Neppelenbroek et al.[19] tests microwave irradiation disinfection, which seems a highly promising method, but there is a need for more studies on the subject. Microwaves, when misused, can irreversibly damage dentures due to the increase in temperature[37], and can be very harmful to the user. In addition, different power and time protocols for handling the microwave apparatus must be tested to maximize results and minimize risks.

The study by Webb et al.[20] seems to be the most important among the studies found in relation to cost-benefit. It showed that immersion in a solution of water and sodium hypochlorite has the same disinfection power as the microwave technique, and is a much safer and cheaper approach.

In public health, priority should be given to the use of less invasive alternatives in the treatment of denture-related stomatitis, such as the recommendation of denture removal for sleeping, denture hygiene instructions and immersion of the dentures overnight in a solution of water and

sodium hypochlorite. Medications should be used if there is no improvement following previous recommendations.

Most of the existing studies regarding caries address the disease in a younger population[38], but more studies on root caries are now emerging, especially regarding the elderly population. Root caries occur due to the presence of plaque and food debris on the root surface of the teeth and are more prevalent among the dentate elderly, as the roots of the teeth tend to be exposed due to the sequelae of periodontal disease or the loss of insertion caused by age[39]. The World Health Organization recommends that countries urgently adopt strategies to improve the oral health of the elderly population, as dental treatment is the fourth most expensive type of treatment in industrialized countries, and successful prevention strategies are not implemented many nations will be unable to meet the cost of the necessary treatments for the population[40].

In a large scale epidemiological survey of Brazilian oral health, a low level of root caries was found in the population aged 65 to 74 years, although the small number of remaining teeth in the population in this age group should be considered. Large differences among the regions of the country were verified, with the root caries index in the north and center-west regions equal to twice the other regions of the country[41]. However, studies from other countries show a much higher prevalence, varying from 10.1% to 40.6%, with an average incidence among surveyed nations of 23.7%[42].

Both the article by Tan et al.[22] and Zhang et al.[23] show very important and perfectly compatible results with the reality of the PHC , with low-cost, low-invasive and highly-resolutive techniques.

The article by Tan et al.[22] showed three types of treatment, compared to the control group, which featured only oral hygiene instruction. The methods tested proved to be quite effective in preventing new root caries and were simple to apply, allowing trained health professionals, other than dentistry professionals, to use them.

The study by Zhang et al.[23] also uses SFD, but the differential of this study is the result of synergistic action with an OHEP, which occurred every six months in 30-minute meetings. The main objectives of the OHEP were to reduce habits of snacking outside meal times, learn correct methods of brushing and the use of additional teeth-cleaning tools.

Few studies have tested sodium fluoride varnish and SFD in the treatment of root caries, but these two agents demonstrate great efficacy in caries prevention in children and adolescents[43]. The major disadvantage of using SFD is that the product blackens the surface of the teeth, which, even among the elderly population, must be considered in a culture that values aesthetics such as ours.

A systematic review evaluated the effectiveness of chlorhexidine varnish in the prevention of root caries, and found that the agent is effective and has a greater impact on patients who do not receive prophylaxis and hygiene guidance systematically and among the institutionalized elderly[44]. In terms of oral health education, several evaluations have shown that the combination of the use of cariostatic agents with a program is probably an effective technique to combat root caries in the elderly population[42].

On the other hand, the treatment of xerostomia has been essentially palliative, with saliva substitutes, non-pharmacological topical stimulation with candies or chewing gum without sugar, lubrication of mucosal tissues (such as with olive oil), or even nocturnal humidifiers. There are proposals for the systemic stimulation of the salivary glands with sialogogues (silicone devices that stimulate salivation by chewing). In addition, the use of fluorides and antimicrobials in the prevention of caries and periodontal disease in these patients is common.[45].

The study by Hakuta et al.[27] obtained excellent results with an oral functionality promotion program for the elderly. This consisted of six sessions of exercises of the facial muscles, tongue and salivary gland massage, with two sessions per month for three months. Although the reduction of xerostomia was not the sole objective of this program, it achieved good results in this respect. The type of strategy addressed in this study complies with the logic of health promotion, being a low cost and reproducible approach for the reality of PHC in Brazil.

There are few studies on improving the mobility of the tongue and lips, among other aspects of oral functionality. It is important to note that health does not only mean the number of teeth present and the level of oral hygiene. Functional activities such as tongue and lip skills and salivary flow are also important elements. Impairment of these functions reduces masticatory efficacy, increases the risk of nutritional deficiencies, and decreases the pleasure of eating and communicating. These factors all influence the quality of life of the elderly and can lead to social isolation[27].

The growing number of dentists working in the Estratégia Saúde da Família (the Family Health Strategy), the increase in the number of elderly people in the population and the greater use of the public dental service emphasize that the adaptation of PHC to the needs of this population is required. Historically, dentistry is a science based on empirical knowledge,[46,47] but current trends and the increasing number of research studies are contributing to the development of evidence-based dentistry.

It is important to highlight the limitations of the present study, starting with the literature review itself. The small number of articles resulting from the searches shows a lack of randomized clinical trials on the subjects addressed, especially from Brazil. The fact that most of the studies were excluded from the research after reading the abstracts shows that the studies on the subject do not follow a methodological standard and that the database used may need updating in terms of its descriptors, since several subjects appeared as search results. Consideration should also be given to publication bias, in which articles with positive results tend to be more published than articles with negative results. In this way, the results may be slightly overestimated.

CONCLUSION

The results demonstrate a variety of treatment options for the clinical situations highlighted, revealing that the characteristics of the services and population served should be evaluated, as a standard treatment for use in Primary Health Care has not been established. Strategies focused on mild, low-tech technologies such as health education seem to provide good results. The present study contributes to the knowledge of health professionals to provide increasingly resolutive and qualified dental care for the elderly in primary health care. It is suggested that more studies are carried out with a focus on primary care so that effective and adequate care protocols can be created for this population.

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Inflammatory markers, sarcopenia and its diagnostic criteria among the elderly: a systematic review

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Abstract

Objective: To identify the relationship between inflammatory markers and sarcopenia, and the diagnostic criteria of the condition among the elderly. *Methods:* A systematic review was performed based on the consultation of the PubMed and LILACS databases. Eligible original articles were those involving individuals aged 60 years or more, which investigated sarcopenia [low muscle mass (MM) associated with poor muscle strength and/or reduced physical performance, according to the *European Working Group on Sarcopenia in Older People consensus* (EWGSOP)] or its diagnostic criteria, published in English or Portuguese, between 2010-2015. *Results:* Four articles were included in the review, the principle results of which were: the growth differentiation factor (GDF-15) exhibited a negative correlation with MM, handgrip strength and gait speed; the insulin-like growth factor-1 (IGF-1) correlated positively with MM; follistatin exhibited a weak correlation with physical performance; activin A and myostatin did not correlate with the diagnostic criteria; the highest tercile of extracellular heat shock protein 72 (eHsp72) was associated with lower median levels of MM, handgrip strength and gait speed; elderly persons with low MM had higher serum ferritin concentrations; women with low MM exhibited lower serum concentration levels of C-reactive protein (CRP). *Conclusion:* the six investigated inflammatory markers (GDF-15, IGF-1, follistatin, eHsp72, ferritin and CRP) were associated with the diagnostic criteria for sarcopenia, but not with sarcopenia itself. As research in this area is still developing, additional studies are required to broaden knowledge and eventually establish the role of these markers in the diagnosis and management of sarcopenia.

Keywords: Biomarkers. Elderly. Sarcopenia.

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INTRODUCTION

The aging process is triggered by physiological changes which occur distinctly among individuals and their organic systems. One of these changes is the change in body composition, where there is an increase in fat mass and visceral fat and an involuntary reduction of muscle mass[1]. According to the European Consensus on the definition and diagnosis of sarcopenia of the *European Working Group on Sarcopenia in Older People* (EWGSOP)[2], sarcopenia is a geriatric syndrome characterized by low muscle mass associated with low muscle strength and/or poor physical performance. This syndrome is associated with adverse outcomes such as functional disability (dependence)[2,3], low quality of life[3] and the risk of death[2].

The existence of these criteria makes it possible to diagnose three distinct stages of sarcopenia: pre-sarcopenia, when there is low muscle mass; sarcopenia, when there is low muscle mass associated with low muscle strength and/or low physical performance; and severe sarcopenia, when there is inadequacy in the three diagnostic criteria[2,4].

There are several mechanisms involved in the genesis and evolution of sarcopenia, including neuroendocrine factors (such as insulin-like growth factor 1 (IGF-1), insulin resistance), age-related factors (sexual hormones, apoptosis, mitochondrial dysfunction), inadequate nutrition/malabsorption, disuse (immobility, physical inactivity, zero severity) and neurodegenerative diseases (loss of motor neurons)[2,3]. Inflammation is another factor involved[1,3]. Studies have indicated the deleterious effects of inflammatory markers on muscle quantity, quality and functionality[5,6].

The inflammatory process results from changes in the anabolic and catabolic mediators. The decline in serum concentrations of anabolic hormones such as testosterone, growth hormone (GH), insulin and IGF-1 causes muscle catabolism. The reduction in GH and IGF-1 decreases the recruitment of satellite cells into the muscle tissue and protein synthesis. Consequently, there is increased production of inflammatory mediators such as pro-inflammatory cytokines, and inflammatory markers produced by hepatocytes that accelerate the process of muscle catabolism. In contrast, with the increased production of these inflammatory mediators, there is a reduction in anti-inflammatory mediators[4,7-9].

Despite knowledge of the role of inflammation in sarcopenia, studies on this topic and the relationship between inflammatory markers and the diagnostic criteria for sarcopenia among the elderly population are still incipient. Such research can contribute to a better understanding of the pathophysiology, diagnosis and management of sarcopenia.

Thus, the present article aims to identify, through a systematic review, the relationship between inflammatory markers and sarcopenia and its diagnostic criteria in the elderly.

METHODS

This systematic review was carried out in accordance with the recommendations proposed by the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA)[10], and it was registered in the *International Prospective Register of Systematic Reviews* (PROSPERO) under number CRD42015017926.

The eligibility criteria were original articles published in the period 2010-2015 in English or Portuguese, which addressed the relationship between inflammatory markers and sarcopenia and its diagnostic criteria in elderly persons with an age group of 60 years or older. Articles that did not evaluate the presence of sarcopenia (low muscle mass associated with low muscle strength and/or low physical performance) or its diagnostic criteria (muscle mass, strength and/or physical performance) as recommended by the European Consensus on the definition and diagnosis of sarcopenia of the EWGSOP[2] were excluded. Articles published from January to April 2010 were excluded because they were prior to the aforementioned Consensus[2]. Experimental studies with animals, *in vitro* studies, recommendations, guidelines, reviews, protocols, letters, editorials and case reports were also excluded.

The search strategies and sources were directed at articles included in the PubMed and Lilacs electronic databases, from January to February of 2016, with the last search carried out on 02/13/2016. For this process, the descriptors of the Medical Subject Headings (Mesh) and their correlates in Portuguese

of the Descriptors in Health Sciences (DeCS) were used: *sarcopenia*; *aged*; *older* and *elderly*; *biomarker* and *biomarkers* and *biologic marker* and *biologic markers*. The descriptors *inflammatory*; *inflammatory marker* and *inflammatory marker*s; *inflammatory biomarker* and *inflammatory biomarkers* and *inflammatory cytokines*, which were not included in the Mesh and the DeCS but were widely cited in articles, were also used. In order to widen the search the key words *biomarkers*: *serum marker* and *serum markers* described in the Mesh were inserted. The above descriptors and key words were used independently or combined with the aid of the conjunctions: AND and OR and the truncated term *sarcopeni**. The search sequence was: [(inflammatory OR biomarker OR biomarkers OR biologic marker OR biologic markers OR inflammatory marker OR inflammatory markers OR inflammatory biomarker OR inflammatory biomarkers OR serum marker OR serum markers OR inflammatory cytokines) AND (sarcopenia OR sarcopenias OR sarcopeni*) AND (aged OR older OR elderly)]. The filters used in the searches were: studies in humans published in the last six years.

The initial selection of articles was carried out by two independent reviewers who evaluated the suitability of the articles from the information provided in the title and abstract. Subsequently, the same reviewers evaluated the complete texts of the articles and made the final selection, according to the established criteria, on an independent basis. For registration, a standardized form was used, through which the authors independently extracted the following data: author(s); year of publication; study design; population (gender, place of recruitment, age/age range, sample size, country of study); objective; methods for measuring diagnostic criteria for sarcopenia; inflammatory markers evaluated; synthesis of main results regarding sarcopenia; conclusion of the study; studies with sarcopenia and/or studies involving the diagnostic criteria of sarcopenia. In cases of divergences in the selection of article(s), the third author also read the text and opted for the inclusion or exclusion of the same(s).

The quality and risks of bias of the articles included in the review were analyzed through the *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE)[11] which evaluates the quality of observational studies through 22 criteria. The STROBE was translated into Portuguese and validated by Malta et al.[12]. For the scoring of the articles the methodology of Mendes et al.[13], where each of 22 criteria receives a score of 0 to 1, was used. After evaluating all the criteria, each article received a score of 0 to 22 from each reviewer and the final grade was obtained from the mean. The score was transformed into a percentage, with articles with a percentage superior to 50% considered of good quality.

RESULTS

Figure 1 shows the article selection flowchart in detail. As can be seen, 154 articles were initially identified, of which only four, all in English, were included in the systematic review.

Table 1 presents the absolute and relative scores of the quality of the four articles identified from the criteria established by STROBE for observational studies. All the articles achieved a percentage superior to 50%, being considered of good quality and thus were included in the present review.

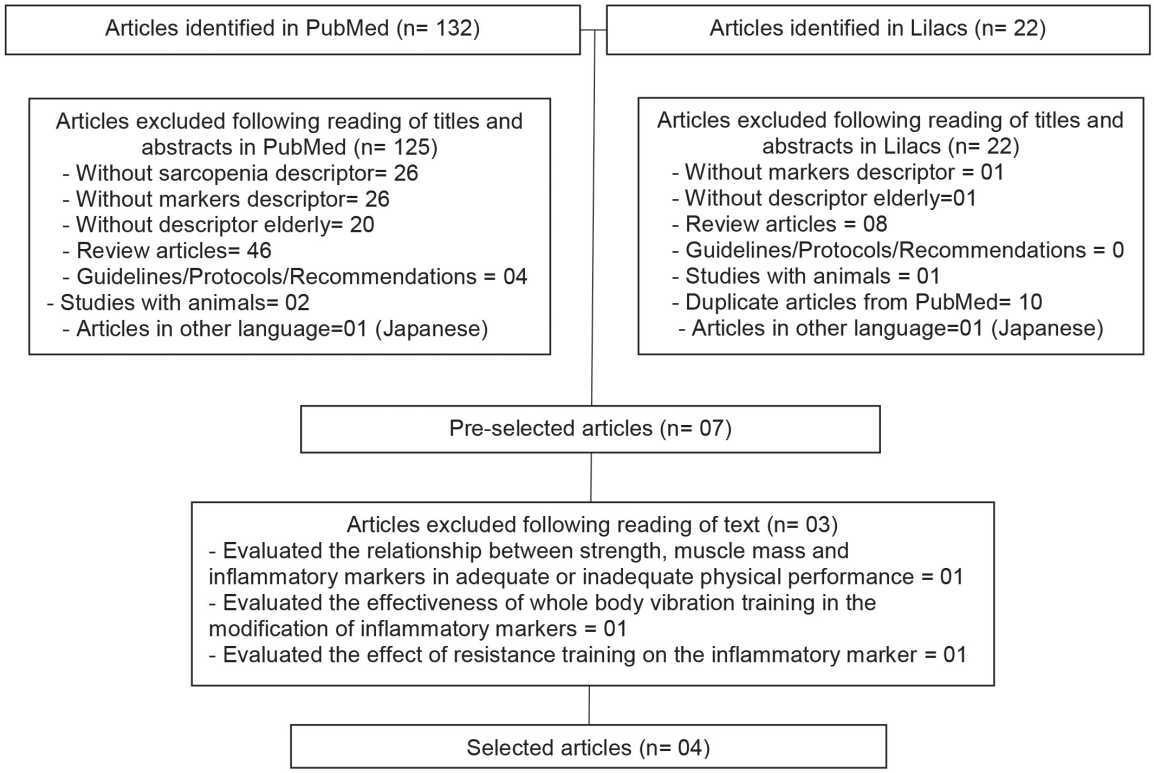

Figure 1. Flowchart of study selection. Santa Maria, Rio Grande do Sul, 2016.

Table 1: Score and quality percentage of included in accordance with STROBE. Santa Maria, Rio Grande do Sul, 2016.

Author(s)/year of publication	Quality of articles Score (%)
Hofmann et al., 2015[14]	18.5 (84.09)
Ogawa et al., 2012[15]	18.4 (83.63)
Chung et al., 2013[16]	19.1 (86.81)
Santos et al., 2014[17]	18.8 (85.45)

Regarding the outline of the included articles, all were observational studies, with one prospective[14] and three cross-sectional[15-17].

All the articles included described the relationship between inflammatory markers and the diagnostic criteria for sarcopenia. Hofmann et al.[14] and Ogawa et al.[15] evaluated this relationship with the three diagnostic criteria (muscle mass, muscular strength and physical performance) while Chung et al.[16] and Santos et al.[17] used the criterion of muscle mass. Only Hofmann et al.[14] evaluated this relationship with sarcopenia diagnosed according to the EWGSOP.

To evaluate muscle mass (MM), Hofmann et al.[14] and Ogawa et al.[15] used bioelectrical impedance analysis (BIA) as an instrument for assessing body composition, while Chung et al.[16] and Santos et al.[17] used Dual Energy X-ray (DEXA).

Muscle strength was assessed in two studies by the evaluation of hand grip strength (HGS) using dynamometry[14,15]. In addition to HGS, Hofmann et al.[14] verified muscle strength from isokinetic knee extension force using the Knee at 60º Isokinetic Peak Torque Test (PTE).

Physical performance was assessed by Hofmann et al.[14], using the Gait Speed Test (GS), the Six-Minute Walk Test and the Chair Stand Test. Ogawa et al.[15] used the GS test.

Eight inflammatory markers associated with sarcopenia and/or its diagnostic criteria were analyzed: growth differentiation factor (GDF-15); Insulin-like growth factor-1 (IGF-1); Follistatin; Activin A; and Myostatin, which make up the transforming growth factor beta (TGF-β) superfamily, in the study by Hofmann et al. Extracellular heat shock protein 72 (eHsp72) was analyzed by Ogawa et al[15]; Ferritin was evaluated in the study by Chung et al.[16] and C-reactive protein (CRP) was investigated by Santos et al.[17]. Ogawa et al.[15] also analyzed interleukin-6 (IL-6) combined with eHsp72 and its association with HGS.

In the study by Hofmann et al.[14], higher serum concentrations of GDF-15 and lower IGF-1 were found among elderly women regardless of whether they were classified as sarcopenic or non-sarcopenic. A significant correlation between GDF-15 and all the diagnostic criteria of sarcopenia, MM, muscle strength (HGS) and physical performance (Six-Minute Walk Test and GS) was also verified. IGF-1 and follistatin presented, respectively, a correlation only with the MM criteria and physical performance, evaluated by the Chair Stand Test. Activin A and myosin did not correlate with any of the diagnostic criteria for sarcopenia. No single or combined marker, meanwhile, reflected sarcopenia.

The study by Ogawa et al.[15] found that serum levels of eHsp72 were associated with all the diagnostic criteria for sarcopenia (low MM assessed by BIA, low muscle strength assessed by HGS, low physical performance assessed by GS), regardless of gender, age and incidence of pathologies, and a higher risk for low HGS when there were combined medium and high serum concentrations of IL-6 and eHsp72 adjusted for gender and age.

In the study by Chung et al.[16], elderly persons with low appendicular skeletal muscle mass (ASSM) had higher serum ferritin concentrations, although there was only a statistically significant difference among men. Santos et al.[17] found a correlation between CRP and fat free appendicular mass (FFAM) and higher serum concentrations of CRP in the elderly with low FFAM.

The characteristics of the articles, as well as the synthesis of the main results, are described in Chart 1.

Chart 1. Characterization of studies included in systematic review. Santa Maria, Rio Grande do Sul, 2016.

Autor(s)/ Year of publication/Study design	Population (gender, place of recruitment, age/age group, sample size, country) and objective	Methods for measuring diagnostic criteria for sarcopenia	Inflammatory markers evaluated	Synthesis of the main results regarding sarcopenia and conclusion of the study
Study with sarcopenia				
Hofmann et al.[14] Year: 2015 Design: Prospective study	Population: Young women living in the community - N= 17, Age= 22-28 years Elderly residents of long term care facilities - N= 81, Age= 65-92 years - Country= Austria Objective: Investigate whether serum concentrations of transforming growth factor beta (TGF-β) superfamily members such as GDF-15, myostatin, activin A or its follistatin antagonist, as well as IGF-1 differed between young and elderly women in different stages of dynapenia or with sarcopenia.	Muscle mass: - SMI was calculated through the MM/H^2 equation (kg/m^2) Method of measuring MM= BIA Cut-off point SMI= ≤6,75 kg/m^2 Muscle strength: - HGS= Evaluated by dynamometry Cut-off point HGS= considering best result. - PTE= evaluated knee extensor strength. Cut-off point PTE= ≤61.5 Nm Physical performance: - GS over ten-meter course=the time traveled at maximum speed over course of six meters was timed. Cut-off point= ≤1 m/s - Six Minute Walk Test= the maximum distance possible was travelled in six minutes. Cut-off point= distance in meters travelled in six minutes. - Chair stand test= sit and stand up from a chair as many times as possible in 30 seconds, Cut-off point= adequate when there was more than 50% control of the test. Women with low MM (SMI ≤6,75 kg/ m^2), combined with low muscle strength (PTE≤61.5 Nm) and/or low physical performance (GS) were considered sarcopenic.	- GDF-15 - IGF-1 - Follistatin - Activin A - Myostatin	GDF-15: the elderly had higher serum concentrations of GDF-15 ($p<0.001$) than the young women, regardless of the presence or absence of sarcopenia. GDF-15 exhibited a moderate negative correlation with MM (r= -0.320, $p<0.01$), a weak negative correlation with HGS (r= -0.290, $p<0.01$) and the 6-minute Walk Test 0.261, $p<0.05$) and a moderate positive correlation with *GS* (r=0.333, $p<0.01$) and age (r=0,388, $p<0.01$). IGF-1: The elderly had lower serum IGF-1 concentrations ($p<0.001$) than the young women, regardless of the presence or absence of sarcopenia. IGF-1 exhibited a moderate positive correlation with MM (r=0.365, $p<0.01$) and a moderate negative correlation with age (r= -0.359, $p<0.01$). In multiple linear regression analysis with the combination of markers, age and fat mass, IGF-1 was the only moderately predictive inflammatory marker for MM (+2.9%) Follistatin: follistatin presented a weak positive correlation with physical performance evaluated by the Chair Lift Test (r=0.220; $p<0.05$) among the elderly. No correlation was observed with age, MM, and physical performance. Activin A: there was no difference in serum concentration between elderly and young women, nor in terms of sarcopenia. No significant correlation was found with age and the diagnostic criteria for sarcopenia. Myostatin: There was no difference in serum concentration between elderly and young women, nor in terms of sarcopenia. No significant correlation was found with age and the diagnostic criteria for sarcopenia. Conclusion: the isolated or combined presence of inflammatory markers does not reflect sarcopenia in elderly women.

to be continued

Continued from Chart 1

Autor(s)/ Year of publication/Study design	Population (gender, place of recruitment, age/age group, sample size, country) and objective	Methods for measuring diagnostic criteria for sarcopenia	Inflammatory markers evaluated	Synthesis of the main results regarding sarcopenia and conclusion of the study
Studies involving the diagnostic criteria of sarcopenia				
Ogawa et al.[15] Year: 2012 Design: Cross-sectional study	Population: Elderly persons living in the community - N= 652 - N women= 382, N men= 270, Age= 65-96 years - Country= Japan Objective: evaluate serum concentrations of eHsp72 protein in elderly subjects and investigate their potential interaction with sarcopenia components (muscle strength, physical performance, and skeletal muscle mass).	Muscle mass: - Measurement method= BIA. Muscle strength: - Measurement method=dynamometry to identify HGS. Physical performance: - Measurement method=GS carried out on a flat course of 11 meters (the speed and number of steps were evaluated at the midpoint of 5 meters of the course).	- eHsp72	eHsp72: individuals with higher serum concentrations of eHsp72 (higher tercile) had significantly lower mean MM, HGS and GS levels than individuals with lower serum levels of eHsp72 ($p<0.01$). In the analysis of multiple logistic regression, adjusted for age, gender and incidence of pathologies, it was observed that the highest tercile of eHsp72 maintained a significant association with the lower terciles of MM (OR 2.72; CI 95%=1.21-6.16; $p<0.01$), HGS (OR 2.60; CI 95%=1.17-5.81; $p<0.01$) and low GS (OR 1.82; CI 95%=1.03-3.20; $p<0.01$). And there was a greater risk for low HGS when there were combined mean and high serum concentrations of IL-6 and eHsp72 adjusted for age and gender (OR 3.31; CI 95%=1.48-7.41). Conclusion: the presence of higher serum concentrations of eHsp72 was associated with changes in the diagnostic criteria for sarcopenia, which is a potential marker of sarcopenia.
Chung et al.[16] Year: 2013 Design: Cross-sectional study	Population: elderly persons in the community - N women= 1693, N men=1250, Age=60 years or older - Country= Korea Objective: to analyze the relationship of body composition with several factors for cardiometabolic risk in an elderly population participating in the Korea National Health and Nutrition Survey (KNHANES)	Muscle mass: - ASMM calculated through ASMM/W (kg) equation Method of measuring ASMM= DEXA Cut-off point= sarcopenia when % ASMM was 32.5% for men and 25.7% for women	- Ferritin	Ferritin: elderly persons with low ASMM had higher serum ferritin concentrations than the elderly with adequate ASMM, but with a statistically significant difference only among men ($p<0.001$). Conclusion: in relation to body composition, elderly persons with sarcopenic obesity presented greater resistance to insulin and the presence of more cardiometabolic risk factors than with obese or sarcopenic elderly persons.

to be continued

Continued from Chart 1

Autor(s)/ Year of publication/Study design	Population (gender, place of recruitment, age/age group, sample size, country) and objective	Methods for measuring diagnostic criteria for sarcopenia	Inflammatory markers evaluated	Synthesis of the main results regarding sarcopenia and conclusion of the study
Santos et al.[17] Year: 2014 Design: Cross-sectional study	Population: Post-menopausal women living in the community - N= 149, Age= mean of 67.17(±6.12) years - Country= Brasil Objective: To examine the association of sarcopenia and sarcopenic obesity with cardiometabolic risk factors in postmenopausal women.	Muscle mass: - FFAM= calculated by FFAM/H(m)^2 equation Measurement method of FFAM= DEXA Cut-off point: sarcopenia when low FFAM (<5.45 kg/m^2)	- CRP	CRP: Elderly patients with low FFAM had lower serum CRP concentrations when compared to the elderly with normal FFAM (p <0.05). There was also a positive and weak correlation between low FFAM and CRP (r=0.27, *p*<0.01). Conclusion: The criteria used to define sarcopenia were not associated with cardiometabolic risk.

BIA=bioelectrical impedance; DEXA=dual energy X-ray; EHsp72=extracellular heat shock protein; HGS=hand grip strength; GDF-15=growth differentiation factor; CI=Confidence Interval; IGF-1=insulin-like growth factor-1; SMI=skeletal mass index; FFAM/H(m)^2=fat free appendicular mass divided by height in meters squared; MM=muscle mass; MM/H (kg/m)^2=muscle mass divided by height squared in meters; Kg/m^2=kg per square meter; M/s=meters per second; FFAM=fat free appendicular mass; ASMM=appendicular skeletal muscle mass; ASSM/W (kg)=appendicular skeletal muscle mass divided by weight in kilograms; N=sample number; Nm=Newtons-meter; OR=Odds Ratio (chances); CRP=C-reactive protein; PTE=Knee at 60º Isokinetic Peak Torque Test; TGF-β=transforming growth factor beta; GS=gait speed.

DISCUSSION

The present article presents a systematic review of the relationship of inflammatory markers with sarcopenia and/or its components. Only four original articles that tackle this issue were identified, emphasizing the incipient nature of the theme. In this review, it was observed that only the study by Hofmann et al.[14] analyzed the association of inflammatory markers with sarcopenia (diagnosed according to the EWGSOP)[2]. The researchers included five markers in their analyzes: GDF-15[14], IGF-1[14], follistatin[14], activin A[14], and myostatin[14]. None of these markers were associated with sarcopenia. Ogawa et al.[15], Chung et al.[16], Santos et al.[17] and Hofmann et al.[14] investigated the association of inflammatory markers with the diagnostic criteria for sarcopenia, and identified eight inflammatory markers (eHsp72[15], ferritin[16], CRP[17], GDF-15[14], IGF-1[14], follistatin[14], activin A[14] and myostatin[14]). Of these, it was verified that six markers (eHsp72[15], ferritin[16], CRP[17], GDF-15[14], IGF-1[14] and follistatin[14]) exhibited an association with the diagnostic criteria for sarcopenia.

Regarding the quality of the articles, according to the STROBE criteria, the observational studies included presented percentages over 80%, which reflect their high quality, as the STROBE instrument assists in verifying the methodological transparency of a study[11].

The cytokine TGF-β and the components of its superfamily (activin A, myostatin, GDF-15 and follistatin), IGF-1 protein and the chemokine eHsp72, act in the immunologic system[18], in stress[19], in lymphoproliferative disorders [20] and especially in the inflammatory process[19,21,22]. They are considered markers of the inflammatory process of chronic non-communicable diseases such as heart disease[20], rheumatoid arthritis[18,22], systemic sclerosis[18] and osteoarthrosis[18].-

GDF-15 is poorly produced by the tissues, but its excessive production causes deleterious effects directly on muscle, which results in the reduction of muscle mass[23]. Bloch et al.[19] observed the association between higher serum concentrations of GDF-15 and the reduction of muscle mass in a study of elderly patients in intensive care. These results reinforce those obtained by Hofmann et al.[14] who found a negative correlation between GDF-15 and muscle mass, HGS and gait speed (p<0.01).

IGF-1 acts as a positive regulator of muscular growth[23]. However, the aging process triggers the decline of IGF-1[6]. Hofmann et al.[14] verified that elderly women, regardless of whether they were classified as sarcopenic or non-sarcopenic had lower serum IGF-1 concentrations (p<0.01) than young women. Follistatin, an antagonist of activin A and myostatin, as well as IGF-1, also acts as a positive regulator of muscle growth[23]. Activin A and myostatin, meanwhile, when excreted excessively, cause muscular atrophy and impairment, respectively, in muscle regeneration[23]. Hofmann et al.[24] when carrying out resistance training with 41 elderly women evaluated at the beginning and at the third and the sixth month of training, observed that higher serum follistatin concentrations were associated with longer training times (p=0.008), but found no changes in the serum concentrations of activin A and myostatin. These results are similar to those found by Hofmann et al.[14].

At high concentrations EHsp72 reflects the level of cellular stress that contributes to a decrease in muscle mass[21]. Ogawa et al.[15] observed the association between increased eHsp72 and low muscle mass. Similarly, Perreault et al.[21], in a study with 26 elderly subjects undergoing 16 weeks of physical training, found that the reduction of serum concentrations of eHsp72 increased the amount of muscle mass (p=0.03), due to the decrease of the inflammatory process.

The association between the higher serum concentrations of the inflammatory markers GDF-15 and eHsp72 and low HGS, investigated by Hofmann et al.[14] and Ogawa et al.[15], respectively, corroborate with the results of Baylis et al.[25], which found an association between greater Inflammatory load and low HGS (p=0.001). Ogawa et al.[15] reported a higher risk for low HGS among elderly persons (OR 3.31, CI 95% = 1.48-7.41) with combined medium and high serum concentrations of eHsp72 and IL-6. IL-6 is considered one of the most important inflammatory mediators in the aging process and is positively

correlated with a reduction of lean mass[26], functional decline[26] and mortality[26]. A study by Puzianowska-Kuźnicka et al.[27] with 3,496 elderly persons, found that serum IL-6 concentrations increase with age and are associated with poorer physical performance and greater cognitive deficit (p<0.001).

Ferritin, considered an acute phase protein, is involved in the systemic inflammatory process[28] and oxidative stress[29]. Similar to Chung et al.[16], who observed higher serum ferritin concentrations among sarcopenic elderly persons, Kim et al.[30], when evaluating the association between serum ferritin and sarcopenia in 952 men and 1380 elderly women (60 years and older), also identified the presence of higher serum ferritin concentrations among sarcopenic women (p<0.001).

Higher serum concentrations of CRP are associated with disability and mortality, an increased risk of low muscle strength, and are correlated with lower muscle mass in older individuals[31-33]. Legrand et al.[34], in a study with 567 elderly persons, found that high CRP values were associated with a low score in the Short Physical Performance Battery (SPPB) that evaluates physical performance.

It should be noted that elderly individuals with preserved muscle mass may present alterations in inflammatory markers. This is because *inflammaging* (the chronic and low-grade systemic inflammation common in aging) is due to changes in the immune system, inflammatory mediators, changes in body composition (increase in adipose tissue), and acute and chronic diseases that independently increase the inflammatory markers[35].

Finally, the use of different methods and cut-off points to diagnose and measure the diagnostic criteria for sarcopenia can be considered limiting factors of this systematic review, which may overestimate or underestimate the prevalence of the same. Another limiting factor was the populational heterogeneity of the studies, with populations composed of men and women in different countries, which made it impossible to ascertain the inflammatory profile of a specific population.

CONCLUSION

Four articles were included in this systematic review. Only one evaluated sarcopenia diagnosed in accordance with the EWGSOP Consensus.

None of the five inflammatory markers studied (GDF-15, IGF-1, follistatin, activin A and myostatin) were found to be associated with sarcopenia.

Of the eight inflammatory markers studied (GDF-15, IGF-1, follistatin, activin A, myostatin, eHsp72, ferritin and CRP), only two (activin A and myostatin) were not associated with the diagnostic criteria for sarcopenia.

In this context, the scarcity of studies on the relationship between inflammatory markers and sarcopenia and its diagnostic criteria points out the need for further research on the subject, in order to contribute to a deeper understanding of the pathophysiological mechanisms of sarcopenia, as well as the establishment of inflammatory markers in the diagnosis, intervention and accompanying of this condition.

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