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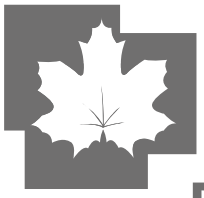

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REVIEW ARTICLES

Older adults and Post-Covid-19 Care

In December 2019, the world was caught unawares by the discovery of a new virus in the city of Wuhan in China, previously referred to as SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus 2) and the disease secondary to this new pathogen designated Covid-19 (Coronavirus Disease 2019). The emergence of Covid-19 became a major public health problem worldwide owing to its highly transmissible nature and lethality. Since the outbreak, nations have remained in a state of alert in an attempt to combat the virus and control the spread of the disease[1,2].

The virus started spreading exponentially and, on 11th of March 2020, the World Health Organization (WHO) declared the Covid-19 epidemic as having pandemic status[3].

The consequences of Covid-19 are not limited to human infections and deaths, but include associated social repercussions, such as racial and xenophobic attacks and negative economic impacts[4].

Although the virus does not target specific victims – Covid-19 has proven a disease with no predilection for age, race, socioeconomic status or nationality – incidence among adults is high and the lethality rate is greatest in individuals aged over 60 years[5].

Older adults are a high-risk population for serious acute respiratory syndromes, calling for close vigilance regarding the health of this group[6]. The literature reports different degrees of physical, respiratory and psychological dysfunction in Covid-19 patients, especially among older individuals[7,8].

Given that Covid-19 is a recent disease, scant knowledge is available on its behavior, particularly with respect to its long-term complications and outcomes, posing a challenge for researchers. The possibility of complications or impairments in survivors of the disease must be considered, particularly among postacute patients that received intensive care[9].

A study was conducted in Italy prior to the development of a vaccine involving patients who had recovered from acute Covid-19 after a hospital stay. Results showed that, irrespective of participant age, at least one symptom persisted after the hospital stay in 87.4% of cases, predominantly fatigue and dyspneia[10]. Similarly, the results of a study conducted in Israel showed that 79.8% of patients presenting complications post-Covid-19 were aged over 60 years.[11] The studies note that numerous investigations have focused on the acute period of infection, but studies monitoring patients over time are required to identify long-term effects in disease survivors.

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Although great strides in vaccinating the older population have been made, including application of a third booster shot, the longer term impact of the disease on the health of older people remains unclear.

In this context, there is a need to (re)recognize the long-term behavior of Covid-19, especially in the older population, a more vulnerable group.

The Covid-19 pandemic has, especially in Brazil, brought inequalities to the fore and exposed the high level of discrimination in the country, predominantly against women, the disabled and Afro-Brazilians[12]. Thus, there is a pressing need to produce scientific knowledge on the consequences of Covid-19 so that health actions can be implemented in an effective, efficacious and resolutive fashion that cater to health needs, especially those of the older population.

International experiences have shown that Covid-19 strategies aimed solely at hospital care are insufficient for the integrated care of patients. This situation highlights the need to strengthen Primary Care, given this is the key point of entry to the health system of most patients and where care is delivered on a continual basis. Examining the attributes of Primary Care reveals the potential of the care provided at this level for following and monitoring the health of Covid-19 survivors[13].

Therefore, recognizing the health status of older Covid-19 patients is pivotal in determining the true magnitude of the disease´s impact on people´s health over time, enabling care to be planned and delivered in an integrated and resolutive fashion.

Arthur de Almeida Medeiros

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Clinical Frailty Scale in older adults admitted at Emergency Department: is baseline frailty a good predictor of Ninety-Day Mortality?

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Abstract

Objective: To evaluate the ability of the Clinical Frailty Scale (CFS) to predict 90-day mortality and other poor outcomes in older adults admitted at a Hospital Emergency Department (ED). *Method:* This is a prospective cohort study including older adults admitted at ED of a Public Hospital who spent at least one night in it. The degree of baseline frailty was assessed through the CFS, and its score was the predictor studied, through the Receiver Operator Characteristics (ROC) curve analysis. We analyzed 90-day mortality as a primary outcome. The following outcomes were considered as secondary ones: mortality, functional decline, readmittance to ED, readmission and need for home care. *Results:* 206 participants were included. Of the 127 frail older adults, 40 (31.5%) died before the 90th day compared to 5 (6.3%) in the non-frail group (p<0.001). After adjustment for demographic and clinical variables, frailty remained in the model as an independent predictor of 90-day mortality. The accuracy obtained by the ROC curve (AUROC) for predicting 90-day mortality was 0.81. For 180-day mortality, 0.80, for the need for home care, 0.77 for readmission, 0.65. For the other outcomes studied, the accuracy was not significant. *Conclusion:* Baseline frailty measured by the CFS is a good predictor of 90 and 180-day mortality and needing for home care in older adults admitted to ED. Its application in this setting might help clinical decision-making.

Keywords: Frailty. Aging. Risk factors. Mortality. Emergency Department.

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INTRODUCTION

Several risk factors have been identified as predictors of mortality[1] and functional decline in older adults admitted to Emergency Department (ED), especially advanced age and chronic diseases[2]. However, these factors alone are not sufficient predictors of unfavorable outcomes in older adults due to the heterogeneity of this population[3,4].

Frailty is a complex and multidimensional clinical syndrome characterized by reduced reserves and resistance to stress[5], influenced by genetic, environmental, dietary factors and the presence of chronic diseases. Frail older adults, markedly in their last year of life, are frequent users of pre-hospital care services[6], ED, hospital and intensive care units[7]. In these patients, the incidence of unfavorable outcomes is higher in the first three months after hospital discharge[8]. The baseline degree of frailty of older adults admitted to ED is an individual predictor of mortality and other unfavorable outcomes[9]. Frailty stratification makes it possible to recognize patients for whom more invasive treatments, possibly disproportionate to baseline health, can be avoided[10].

There is no consensus on the best operational definition of frailty or the most appropriate scale to identify frail older adults treated in ED[10–12]. In this scenario, the scales must be easy and fast to apply and have good predictive capacity[12,13]. Some frailty scales use unfeasible measures for application in overcrowded ED, where patients are bedridden, and professionals are pressured by the need for agility during care[10]. Furthermore, robust older adults, when seriously ill and in situations of acute decompensation of chronic diseases, may appear more frail than their baseline health status prior to admission[12].

Functional decline is the main frailty marker[14] and can be assessed by instruments that stratify the degree of frailty according to performance in activities of daily living (ADLs). The *Clinical Frailty Scale* (CFS)[14] considers the functional capacity to identify and stratify frailty. It has been validated in some countries for predicting mortality within 30 and 90 days of admission to the ED[15] and has shown good predictive capacity for unfavorable outcomes in patients in clinical and surgical emergencies admitted to the ED and intensive care[9,10,15–19].

The *National Institute for Health and Care Excellence* (NICE) recommends the application of CFS to all elderly people admitted on an emergency basis. A greater degree of frailty measured by the CFS in older adults admitted to the ED was associated with an increase in the in-hospital mortality rate, ranging from 2% in robust older adults to 24% in older adults with a high degree of frailty[20]. Studies involving frail older adults with COVID-19 found similar results. However, the mortality rates found were higher[21,22]. In Brazil, CFS has been studied for risk stratification in patients with COVID-19[23]. However, it has not been evaluated for predicting unfavorable outcomes in older adults admitted to ED for clinical or surgical reasons in general.

The primary objective of this study was to assess the ability of baseline frailty, as measured by CFS, to predict 90-day mortality in older adult patients admitted to a public Brazilian ED. Secondarily, we assessed the ability of the CFS to predict, during the follow-up period, other unfavorable outcomes such as mortality within 180 days of admission, readmission to the ED, readmission, functional decline and need for home care (HC) after hospital discharge. Additionally, we analyzed 90-day survival according to CFS categories.

METHODS

We developed a prospective cohort study involving older adult patients admitted to the ED of the Hospital das Clínicas of the Federal University of Minas Gerais (HC-UFMG) during two inclusion periods: from December 2019 to May 2020 and from November 2020 to January 2021 The interruption of collection was necessary in response to the hospital's restructuring to meet the demands caused by the COVID-19 pandemic.

All patients aged 60 years or older admitted to the ED for clinical or surgical emergencies and who stayed for at least one night in that unit were eligible to participate in the study. Older adults who met the inclusion criteria were invited to participate.

All participants were selected for convenience by the researcher, previously trained in the application, interpretation and understanding of the CFS. After receiving explanations about the research, all participants or their guardians (in the case of patients with cognitive impairment) who agreed to participate, signed the Informed Consent Form (ICF) and underwent the same study protocol.

Patients who were discharged from the ED or transferred to other units (operating center, inpatient or intensive care units) before being invited to the study, patients unable to communicate (patients in the active process of dying or patients with advanced dementia, unaccompanied or without a caregiver capable of consenting and providing reliable information) were excluded, as well as patients who refused to sign the consent form. In accordance with the sanitary protocols adopted by the HC-UFMG in the pandemic, patients admitted to the respiratory isolation unit were not included, in order to reduce the transmission of the new coronavirus.

Sociodemographic (age, gender, education, race/color) and clinical-functional data (comorbidities, medication use, functionality, mobility and hospitalization history) were collected from patient reports. In the case of the participant's cognitive disability, defined by the clinical evaluation and/or data from the medical record, the information was obtained from the caregivers and confirmed in the electronic medical record. The history of admission to other hospitals was asked to the participants or guardians.

Baseline frailty was defined as the degree of frailty two weeks before admission or prior to the acute illness that led to hospitalization[12]. CFS ≥5 was considered as the cutoff point for defining frailty[14]. We used the textual version of the CFS translated into Brazilian Portuguese[24] to stratify the state of baseline frailty. The older adults were classified ranging from very active (level 1) to terminally ill (level 9).

The clinical variables collected were defined from items that make up the *Criteria for Screening and Triaging to Appropriate Alternative care* (CriSTAL)[25], a scoring system developed with the objective of predicting short-term mortality in elderly admitted to the ED and which has been validated in some countries. In Brazil, its use has been studied at HC-UFMG. According to criteria adopted in CriSTAL, we consider metastatic disease and/or that refractory to treatment as advanced neoplasm; chronic kidney disease (CKD), stage 4 or 5 CKD (glomerular filtration rate < 30mL/min/1.73m2 by CKD-EPI); chronic heart failure *New York Heart Association* (NYHA) functional class III or IV; chronic obstructive pulmonary disease (COPD) *Global Initiative For Chronic Obstructive Disease* (GOLD) 3 or 4; acute cerebrovascular accident (CVA) or transient ischemic attack (TIA), history of acute myocardial infarction; moderate to severe liver disease: chronic viral hepatitis, chronic hepatitis from another cause, alcoholic liver disease with or without cirrhosis, chronic liver failure, liver fibrosis, any cirrhosis, with or without portal hypertension and/or varicose veins, liver transplant, hepatosplenic schistosomiasis). Multimorbidity was defined as the presence of two or more chronic diseases[26], which were classified according to the International Classification of Diseases (ICD-10).

Post-discharge follow-up was carried out by telephone contact with participants or their guardians between 3 and 4 months after admission to the ED. Our objective was to verify the 90-day mortality and secondary outcomes. A second telephone contact between 6 and 7 months was carried out to verify the secondary outcome of mortality up to 180 days after admission. There were delays in locating some patients, which required several attempts to contact them by phone. However, for the outcomes of mortality at 90 and 180 days, only deaths that occurred within the study period were computed.

We used a standardized follow-up questionnaire that included reclassification of current frailty level and use of health services after hospital discharge. For deceased patients, information was collected on the date, place and cause of death recorded in the death certificate.

The primary outcome was mortality within 90 days of admission to the ED. The secondary outcome was the occurrence of a measure consisting of at least one of the following: mortality within 180 days of admission, readmission to ED, readmission, need for HC after hospital discharge, and functional decline.

The sample size of 201 patients was calculated to ensure a statistical power of 80% in order to verify the hypothesis of an association between the binary independent variable baseline frailty (CFS≥5) and the 90-day mortality outcome, using binary logistic regression. The prevalence of frailty in hospitalized patients at baseline was 56.7%[19] and a significance level of 0.05. A death rate in 90 days of 9.5%[8] was estimated, ranging up to 24.5%, considering an accuracy of 15%, based on the variability of this estimate found in the literature[1,8,27,28].

For descriptive statistical analysis, after checking for normality with the Shapiro-Wilk test, continuous variables were expressed as measures of central tendency and dispersion. Categorical variables were expressed as frequency distribution and data were tabulated according to frailty status. Chi-square and Fisher's exact tests were applied to examine associations between explanatory variables and 90-day mortality. To verify the effect of frailty on 90-day mortality, a multivariate binary logistic regression model was performed. The model was adjusted for potentially confounding variables, included according to clinical relevance, evidence in the literature and p-value <0.20 in the univariate analysis. In the final model, all variables that presented p-value <0.05 were maintained. Age and gender were included despite statistical significance. The retention of these variables in the model was justified by the known association of females with greater frailty and males with worse outcomes[10]. The frailty classification for the model was dichotomous. Association measures were expressed as *odds ratio* (OR) and 95% confidence interval (CI).

The clinicometric properties of the CFS were evaluated through sensitivity, specificity and the area under the *Receiver Operating Characteristics* (AUROC) curve. An AUROC ≥0.80 was considered to have good predictive accuracy.

Kaplan-Meier survival curves were calculated using the Logrank, Breslow, and Tarone-Wire test to analyze whether the risk of dying within 90 days increased with the greatest degree of baseline frailty. For this analysis, patients were stratified into five groups according to CFS categories: 1-3, robust; 4, vulnerable or pre-frail; 5, mild frailty; 6 to 8, moderate, severe and very severe frailty and 9, terminally ill. This distribution was adopted considering the degree of functional dependence and ADLs used by the scale.

Data were computed on the online platform *Research Electronic Data Capture* (REDCap)[29]. The results were presented following the STROBE methodology[30].

The study was approved by the Research Ethics Committee of UFMG, under the protocol CAAE: 23649519.0.0000.5149 and is in compliance with Resolutions 466/2012 and 510/2016 of the National Health Council.

RESULTS

During the recruitment period, 577 individuals aged 60 years and over were admitted and stayed for at least one night at the ED, meeting the eligibility criteria. A total of 371 patients were excluded. The reasons for the exclusion were documented (Figure 1). At the end of the 6-month follow-up, all but one participant had secondary outcomes verified.

Median age was 71 years, interquartile interval (IQI) from 66 to 78 years, 87 patients (42.2%) were female. The prevalence of frailty in the sample was 61.7% (95% CI 54.6 to 68.3%) and the median CFS score was 5 (IQI 4-6). Most patients (96.7%) were admitted for clinical reasons. The association between frailty and the characteristics of patients and outcomes is shown in table 1. The results suggest that frailty was associated with: female gender, not living alone, advanced cancer, acute CVA or TIA, presence of dementia or *delirium* at admission and having been hospitalized in the last year, including in the ICU.

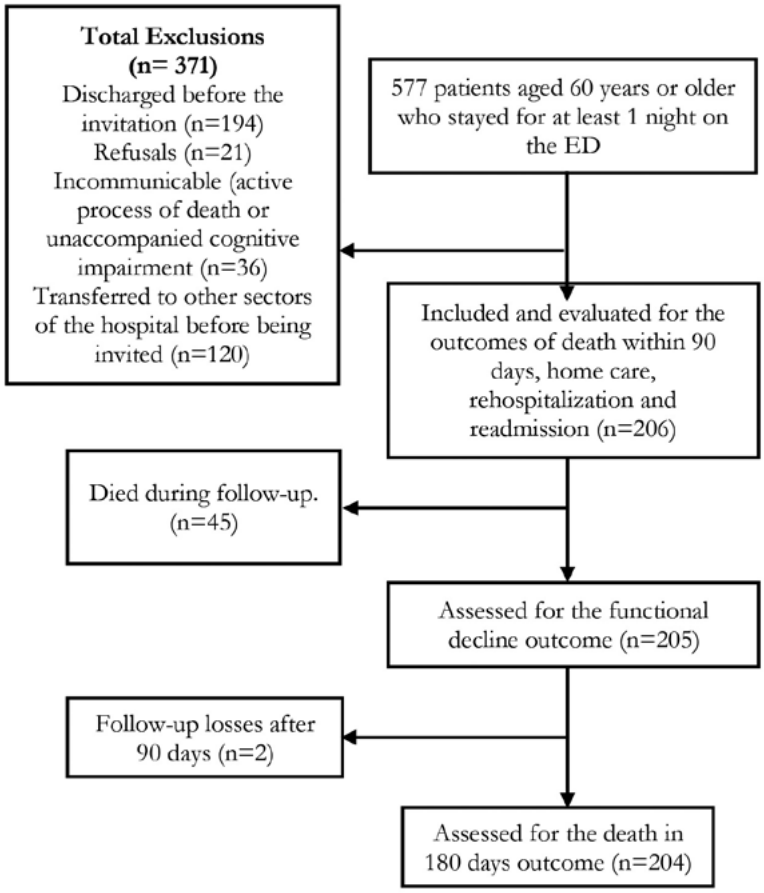

Figure 1. Study participant selection and follow-up flowchart. Belo Horizonte, MG, 2019-2021.

Table 1. Patient characteristics and outcomes according to frailty status (n= 206). Belo Horizonte, MG, 2019-2021.

Variables	CFS <5 (n = 79)	CFS ≥5 (n =127)	Total (n = 206)	*p* value
Sociodemographic characteristics				
Age, median (AIQ)	70 (64-76)	71 (66-79)	71 (66-78)	0.106
Sex, n (%)				
Female	24 (27.6)	63 (72.4)	87 (42.2)	0.007
Male	55 (46.2)	64 (53.8)	119 (57.8)	
Race/color, n (%)				
White	24 (33.3)	48 (66.7)	72 (35.0)	0.456
Brown	41 (42.3)	56 (57.7)	97 (47.1)	
Black	11 (34.4)	21 (65.6)	32 (15.5)	
Indigenous	3 (60.0)	2 (40.0)	5 (2.4)	
Education, n (%)				
Illiterate	8 (26.7)	22 (73.3)	30 (14.6)	0.199
<8 years	49 (37.4)	82 (62.6)	131 (63.6)	
Between 8 and 12 years	17 (45.9)	20 (54.1)	37 (17.9)	
>12 years	5 (62.5)	3 (37.5)	8 (3.9)	
Living alone, n (%)	18 (81.8)	4 (18.2)	22 (10.7)	<0.001

to be continued

Continuation of Table 1

Variables	CFS <5 (n = 79)	CFS ≥5 (n =127)	Total (n = 206)	*p* value
Clinical features				
Multimorbidity, n (%)	68 (35.6)	123 (64.4)	191 (92.7)	0.004
Advanced neoplasm (III/IV), n (%)	4 (9.5)	38 (90.5)	42 (20.4)	<0.001
DRC stage 4 or 5, n (%)	6 (30.0)	14 (70.0)	20 (9.7)	0.419
CHF (NYHA III / IV), n (%)	17 (44.7)	21 (55.3)	38 (18.4)	0.370
COPD GOLD 3 or 4, n (%)	2 (22.2)	7 (77.8)	9 (4.4)	0.487
Current CVA or TIA, n (%)	14 (66.6)	8 (33.4)	22 (10.7)	0.010
AMI history, n (%)	21 (46.7)	24 (53.3)	45 (21.8)	0.194
Liver disease, n (%)	3 (18.8)	13 (81.2)	16 (7.7)	0.093
Dementia, n (%)	0 (0.0)	24 (100.0)	24 (11.6)	<0.001
Delirium, n (%)	0 (0.0)	24 (100.0)	24 (11.6)	0.004
Hospitalization in the last 12 months, n (%)	44 (30.6)	100 (69.4)	144 (69.9)	<0.001
ICU in the last 12 months, n (%)	15 (25.0)	45 (75.0)	60 (29.1)	0.012
Outcomes				
90-day mortality (n=206), n (%)	5 (11.1)	40 (88.9)	45 (21.8)	<0.001
180-day mortality (n=204), n (%)	9 (14.8)	52 (85.2)	61 (29.9)	<0.001
Home care (n=206), n (%)	1 (4.5)	21 (95.5)	22 (10.7)	<0.001
Readmission (n=206), n (%)	13 (22.4)	45 (77.6)	58 (28.2)	0.003
Readmission in ED (n=206), n (%)	7 (21.9)	25 (78.1)	32 (15.5)	0.037
Functional decline (n=205), n (%)	28 (43.7)	36 (56.3)	64 (31.2)	0.301

CFS =*Clinical Frailty Scale;* CKD =chronic kidney disease; CHF = chronic heart failure;

FC NYHA =*New York Heart Association* functional class; COPD =chronic obstructive pulmonary disease; GOLD =*Global Initiative For Chronic Obstructive Disease*; CVA = stroke; TIA = transient ischemic attack; ICU = Intensive Care Unit; ED =Emergency Department.

During the total follow-up period (median 189 days, minimum 2 and maximum 226 days), 61 (29.6%) patients died. Of these, 45 deaths (21.8%) occurred within 90 days of admission to the ED. There was no record of death among participants classified as CFS 1 and 2. There was a dose-response effect between frailty and mortality, where the highest score in the CFS was associated with higher mortality (CFS 3, 6%; CFS 4, 7%; CFS 5, 13%; CFS 6, 20%; CFS 7, 44%; CFS 8, 71% e CFS 9, 70%) (Figure 2).

There was a strong positive association between baseline frailty and mortality within 90 days of admission to the ED (OR: 6.81; 95% CI 2.55-18.13; p<0.001). After adjustment for potentially confounding variables (age, sex, race/color, advanced cancer, liver disease, CVA or TIA, dementia, delirium, multimorbidity, hospitalization in the last 12 months, ICU in the last 12 months), frailty measured by CFS remained in the model as a strong independent predictor of mortality within 90 days of admission (OR: 3.84; 95% CI: 1.36 to 10.90, p=0.011). Advanced cancer, age and ICU in the last 12 months also remained in the final model. Male gender was maintained in the model due to clinical plausibility, despite statistical significance (Table 2). The performance of CFS to predict all outcomes of this study was presented as AUROC. The AUROC for mortality within 90 days of admission to the ED was 0.81 (95% CI 0.74-0.89; p<0.001), with a sensitivity of 88.9% and a specificity of 46% for the cutoff point CFS ≥5. After adjustment, the CFS maintained good predictive ability (AUROC: 0.79; 95% CI 0.71-0.86; p<0.001) (Table 2).

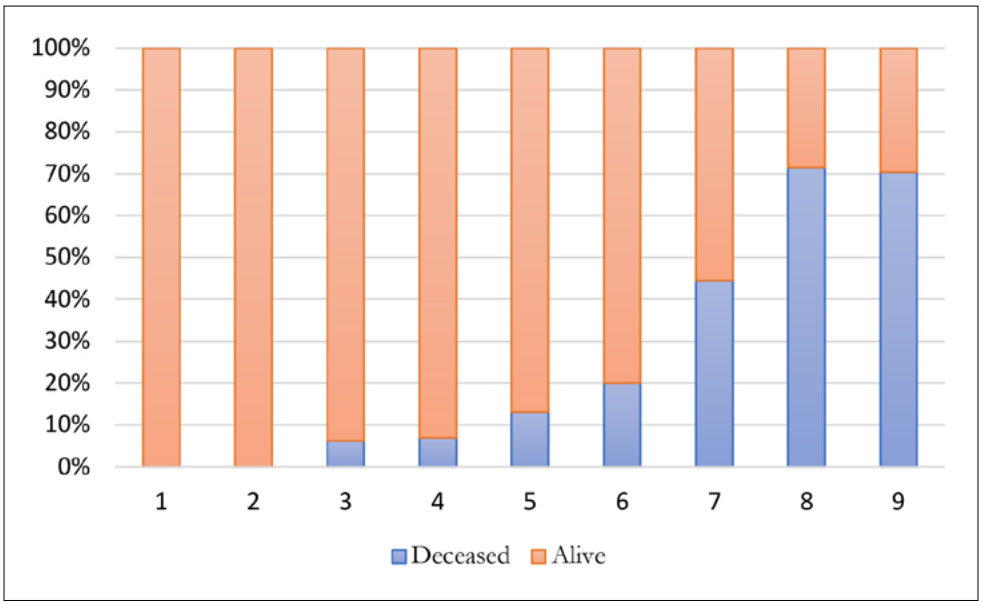

Figure 2. 90-day mortality according to CFS category (n=206). Belo Horizonte, MG, 2019-2021.

Table 2. Association between baseline frailty (CFS≥5) and death within 90 days of admission to the Emergency Department (ED). Final logistic regression model. Belo Horizonte, MG, 2019-2021.

Predictor	OR (95% CI)	*p*-value
Adjusted frailty	3.84 (1.36-10.90)	0.011
Advanced neoplasm	4.11 (1.79-9.47)	0.001
Age per year	1.06 (1.01-1.10)	0.019
ICU in the last 12 months	2.51 (1.15-5.48)	0.021
Male	1.36 (0.64-2.91)	0.425

CFS = *Clinical Frailty Scale;* AUROC = *area under Receiver Operating Characteristics curve;* ICU = Intensive Care Unit.

The analysis of the ROC curve for CFS in relation to 180-day mortality showed an AUROC of 0.80, with 95% CI from 0.73 to 0.87 (p<0.001). For HC requirements, AUROC of 0.77 (95% CI 0.69-0.86; *p*<0.001) and readmission, AUROC of 0.65 (95% CI 0.57-0.74; *p*= 0.001). We found no association between CFS score and ED readmission (AUROC: 0.56, 95% CI 0.46-0.66; *p*= 0.267) or functional decline (AUROC: 0.46, 95% CI 0.37 -0.54; *p*=0.325).

Figure 3 shows the Kaplan-Meier curves by CFS. By the *p* value referring to the Logrank test (<0.001) and also to the Breslow and Tarone-Wire tests, there is evidence that the survival curves differ in relation to the CFS groups. Patients classified as CFS 9 have a tendency to die more quickly than others, with approximately 50% probability of dying around the 37th day. The other categories follow the order of the groups themselves, only the robust group (1 to 3) coincides with the vulnerable group (4).

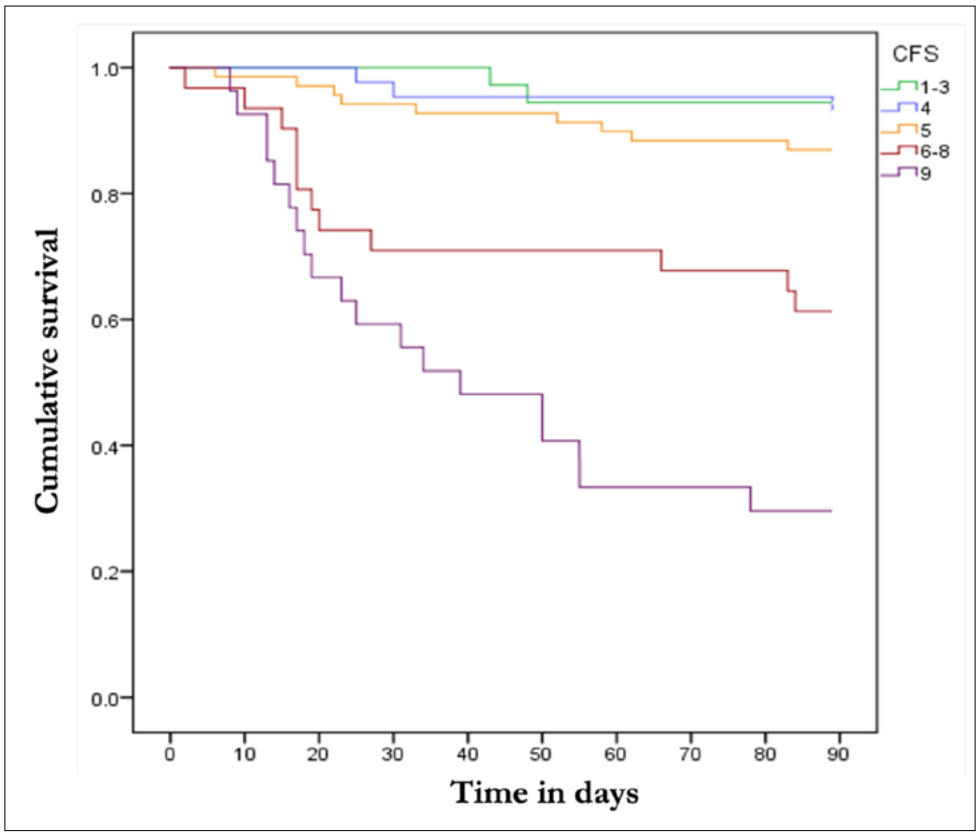

Figure 3. Kaplan-Meier survival curves over 90 days according to five CFS groups. Belo Horizonte, MG, 2019-2021.

DISCUSSION

This is the first Brazilian study that used the CFS to stratify frailty in older adult patients treated at the ED for clinical or surgical reasons, in order to assess their ability to predict unfavorable outcomes. The results of the present study showed that baseline frailty, as measured by the CFS, is a good predictor of mortality within 90 days of admission to the ED. The predictive capacity of the scale for the outcome of mortality at 90 and 180 days in our sample is comparable to that found by other studies that used the CFS[10,27] and was superior to other frailty scales[8,28]. The CFS is a valid and reliable scale[15,31], quick and easy to apply, which properly identifies and stratifies frailty. We also observed a dose-response effect between 90-day mortality and higher CFS scores, similar to what was previously demonstrated[15,32].

The prevalence of frailty in hospitalized older adults observed in our sample (61.7%) is within the wide range described in the literature (27 to 80%)[9]. This great variability is due, in part, to the frailty instrument used. When compared to studies that used the CFS to stratify older adults in the ED (between 25 and 57%)[15,16,18,19,27], the prevalence found in our sample was slightly higher. We also found a mortality rate higher than those previously described. One of the hypotheses that can be justified is related to the case mix of the ED at HC-UFMG, where care for patients with severe and advanced chronic diseases predominates and who are usually more fragile than patients treated in general hospital services, due to trauma, or cases of lesser complexity. Another possibility was the impact of the COVID-19 pandemic, which contributed substantially to higher mortality among older adults. Some of these patients became infected during the follow-up period and died from this cause.

We can hypothesize that the combination of CFS with clinical criteria of acute deterioration, such as early warning scores, will perform better risk stratification in older adult patients admitted

to the ED than the use of these assessments alone, as demonstrated previously[23,33].

In evaluating the predictive capacity of the CFS for other unfavorable outcomes, baseline frailty showed a moderate performance in predicting the need for home care after discharge. Half of the patients who required home care were classified as CFS 8 and 9. We emphasize that, in our municipality, we do not have *hospices*. However, palliative care can be provided to these patients by public home care services. We did not find studies in English or Portuguese that assessed the ability of frailty measured by the CFS to predict the need for home care in the short term.

We conducted this study in real situations, in an ED of a tertiary-level public university hospital in Brazil. In the Brazilian reality, as in other low- and middle-income countries, these units operate above their capacity, have long waiting times for hospitalization and high demand for hospital beds[34]. The results observed in this study point to the need to include the identification of frailty in the routine of evaluating older adults in the ED. In addition, in the context of public health resource management, recognizing the fragility state of the population helps to plan public policies, organize the demand for specialized services, optimize health programs and better allocate resources[35].

Prognosing is a complex task, but necessary and urgent in the current context. The assessment of the degree of baseline frailty, using simple and rapid scales, such as the CFS, can reduce prognostic uncertainty in scenarios of rapid changes in health status – such as in emergency units. Very frail older adults are readmitted to ED, notably in their last year of life, and are submitted to treatments that are not beneficial or inappropriate to their state of baseline frailty. These treatments can have a negative impact on the patient's quality of life and increase emotional and financial costs. Furthermore, they can lead to an unnecessary prolongation of the dying process, generating false expectations in patients and families, in addition to complicated grief.

CFS could be used in ED as a screening tool to identify patients who would benefit from a comprehensive geriatric and gerontological assessment and those who would not benefit from life-sustaining treatments. This would make it possible to start timely discussions with patients and families about the goals of care and post-discharge planning.

Our study has some limitations. Due to limited human resources for data collection, inclusion was only performed between 8 am and 5 pm on weekdays, which limited the sample size and led to a potential selection bias. Patients who were discharged from the ED on the same day of admission were not included. Presumably they may be less frail considering their short stay at the ED. However, it is not possible to generalize the results for these patients. The severity of patients admitted to HC-UFMG, an academic center for tertiary and quaternary care, especially for cancer and heart disease, limits the generalizability of our results to low-complexity services. Patients unable to communicate or those in the active process of dying were not included in the study, therefore, it is not possible to generalize the results to these groups of patients.

CONCLUSION

This prospective study showed that baseline frailty (relative to two weeks before admission to the Emergency Department), measured by the *Clinical Frailty Scale*, was able to identify older adults at higher risk of dying in the short term and needing home care services. The *Clinical Frailty Scale* is a valid, reliable and practical scale for predicting unfavorable outcomes in older adult patients treated in the Emergency Department. Its use to stratify the degree of frailty in older adults can help in decision making and reduce prognostic uncertainty. Other studies are needed to better clarify the role of frailty and the impact of acute conditions on mortality and other unfavorable short- and medium-term outcomes in older adult patients treated at ED in Brazil.

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Oral health condition and access to dental services in older people attended at a municipal hospital in the rural area of Benguela, Angola

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Abstract

Objective: To analyze the oral health status of elderly people in the municipality of Bocoio, Benguela province, Angola, Africa. *Methods:* Epidemiological, cross-sectional and analytical study carried out with 213 elderly people in 2019. Through interviews and clinical examinations, the sociodemographic profile; oral health perception; oral hygiene; use of dental services; consumption of tobacco, alcohol, and sugar; functional and social impairments due to oral problems; dental caries index (DMFT); root caries; periodontal condition; use and need for prosthesis; and presence of oral lesions were analyzed. *Results:* Most of the elderly were female (69.01%), aged 60 to 70 years (77.46%), did not work (92.96%), did not attend school (82.63%), and classified their oral health status as moderate (75.59%). It was found that 52.58% performed oral hygiene twice a day, using toothbrush and fluoridated dentifrice (92.49%); no participant used dental floss; 47.89% had their last dental appointment more than two years ago; 20.66% smoked daily; consumption of alcohol and sugary foods was low; 89.67% reported difficulty chewing; and 7.04% were fully edentulous. There was an association (p<0.01) between the greater number of missing teeth, and older age group and low level of education. The mean DMFT was 20.8±5.3 and no filled teeth were found; the mean of decayed roots was 2.43±2.10; most teeth had periodontal pocket (50.32%) and attachment loss (51.00%); 99.53% of the elderly needed a prosthesis; and 0.94% had oral lesions. *Conclusion:* The oral health condition of the elderly in Bocoio is precarious and marked by the lack of access to dental services.

Keywords: Oral Health. Aged. Rural Population. Health Services Accessibility.

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The authors declare that there is no conflict in the conception of this work.

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INTRODUCTION

According to the World Health Organization (WHO), the oral health of the older population in the WHO African Region has severe deficiencies[1]. WHO data indicate that 80% of the population in this region has low socioeconomic status and is afflicted by various oral diseases that affect their general health and well-being, causing pain, discomfort, limitations, social and functional deficiencies, damage to the quality of life and negative economic impact on the population[1]. The health status of the Angolan population is characterized by low life expectancy at birth, high rates of maternal infant mortality, high prevalence of communicable, chronic and degenerative diseases[2]. Data from the Ministry of Health of Angola suggest that a large part of the population does not have access to quality health services, considering the provision of care offered by the public and private sectors and by traditional medicine, which can compromise the healthy aging process[2]. To promote healthy aging, health systems need integrated strategies and actions that encompass the different stages of the individual's life cycle, aiming at health promotion, disease prevention and equitable access to primary health care, with maintenance and improvement of long-term functional capacity[3].

Rural areas tend to have a higher proportion of older residents, as young individuals look for better education and work opportunities in large urban centers[4]. Thus, this older population raises concerns for health systems, as they sometimes have less ability to access health services due to limitations in their physical health condition and may be uninformed about the care and attention necessary for oral health[5].

Older people's oral health is directly related to the social context in which they are inserted and, in this sense, oral diseases are an important public health problem in the African region, considering the great burden of oral diseases and the repressed demand for dental services[1]. This may be due to the fact that these services are located, essentially, in large urban centers, in private clinics or in central hospitals, with infrastructure and equipment that may be insufficient to serve the entire population[6,7]. Evidence suggests that older people living in rural areas are more likely to suffer from the absence of treatment for oral diseases, indicating a deficiency in dental services available in these areas and highlighting the existing inequality in the country, to the detriment of rural areas, where the insufficient number of dentists and training courses for professionals in the dental field is noted[5,8].

The municipality of Bocoio, located in a rural area of the province of Benguela, is mostly composed of peasants and the local economy is based on agriculture, forestry and livestock. In this population, epidemiological studies on oral health are scarce due to transportation difficulties and limited human and economic resources. Health services do not offer regular follow-up for older people with chronic-degenerative diseases and there is no encouragement to prevent health and self-care measures[4]. In this sense, it is hypothesized that the older population in this region has poor oral health and a deficiency in meeting the demand for dental services. It is highlighted that untreated oral diseases and their health problems can promote other health problems, negatively influencing quality of life and mental health, becoming a social and economic burden for the individual, society and the state[9,10]. Thus, the aim of this study was to analyze the oral health condition and access to dental services in older people attended at a rural municipal hospital in Bocoio, Benguela province, Angola, Africa.

METHOD

The present study was conducted in accordance with the STROBE protocol guidelines for conducting observational studies. This is an epidemiological, cross-sectional and analytical study carried out with older people in the municipality of Bocoio, in the province of Benguela, Angola, Africa, in 2019. The municipality of Bocoio has a territorial area of 5,612 km^2 and is located 521 km away from Luanda, capital of Angola, and, in 2019, it had an estimated population of 155,446 inhabitants, with an aging rate of 4.4%. The human development index (HDI) for the province of Benguela is 0.526.

The study was carried out in accordance with the ethical principles and standards of Resolution No. 466/2012 of the National Health Council and approved by the Ethics and Research Committee of the Instituto Superior Politécnico de Benguela (process: Cep/ISPB 01102019), ensuring confidentiality, anonymity and non-use of information to the detriment of individuals. The Informed Consent Form was obtained from all older people participants and those who needed dental treatment were treated at the Hospital Municipal do Bocoio.

Older people aged 60 years and over, of both sexes, who sought health services at the Hospital Municipal do Bocoio, from October to December 2019, and who agreed to participate in the study, were included in the study. Six older people were excluded from the study who were hospitalized, had any physical limitations that prevented clinical examinations, or who did not have the cognitive ability to answer the questionnaire. The cognitive ability of the older people was verified by consulting the patients' medical records. For the composition of the sample, through a convenience sampling, all the older people who sought health services at the Hospital Municipal do Bocoio in that period were invited, making a total of 213 older people. The hospital provides health services that include, in addition to general medicine, different specialties, including pediatrics, nutrition, psychology, physiotherapy, orthopedics, obstetrics, gynecology and dental services, and is not a reference center for dental treatment in the region of Bocoio.

The variables analyzed were the sociodemographic profile; oral health perception; oral hygiene practices; use of dental services; tobacco and alcohol consumption; consumption of sweets and sugary drinks; perception of functional and social impairments due to oral health problems; dental condition, assessed using the dental caries index (DMFT); root caries; periodontal condition; periodontal attachment loss; use and need for prosthesis; presence and location of oral lesions.

The DMFT was obtained through the total quantification of the number of decayed, lost and filled dental elements, divided by the total number of examined older people[12]. The evaluation of periodontal condition was performed using the modified community periodontal index, using a periodontal probe with a 0.5mm spherical tip, with a black marking between 3.5 and 5.5 mm, and rings at 8.5 and 11.5 mm from the spherical tip. All teeth present in the mouth are examined for the absence or presence of gingival bleeding and the absence or presence of periodontal pockets; the depth of the pocket is measured with that periodontal probe[11].

Clinical oral examinations were performed individually, in an isolated room at the Hospital Municipal do Bocoio, with an adequately ventilated environment and only natural light, using the WHO millimeter periodontal probe and flat oral mirror, in accordance with the guidelines of the Manual for Surveys in Oral Health of the World Health Organization[12]. Data were collected by a single researcher, previously trained and calibrated. The calibration process, lasting 32 hours, was carried out according to the following steps: process preparation; theoretical discussion of the variables used, codes and examination criteria; practical discussion; calibration itself; and calculation of the degree of intra-examiner agreement. Agreement was analyzed from the repetition of the clinical examination of 10% of the patients in a sample of 40 older people, not included in the final study sample, with a subsequent comparison between each pair of examinations. Patients were examined in random order, with an interval of 7 days between assessments, without the examiner being informed that the patient was being re-examined. By calculating the Kappa coefficient, the degree of intra-examiner agreement was 0.92[11].

Data on sociodemographic profile, perception of oral health, oral hygiene practices, use of dental services, consumption of tobacco and alcohol, consumption of sweets and sugary drinks, and perception of functional and social impairments due to oral health problems were collected through individual interviews, with the application of a semi-structured questionnaire.

Statistical analysis was performed using descriptive statistical techniques and data presented in tables and graphs. The association between the

number of dental elements present in the oral cavity and sociodemographic characteristics was analyzed using the G test. Data processing and analysis were performed using the EpiInfo software version 7.2.2, adopting a significance level of 5%.

RESULTS

As shown in Table 1, of the total of 213 older people examined, most were female, aged between 60 and 70 years, with a mean age of 68.5±7.1. There was a predominance of older people who did not work and who did not attend school. Most of the older people classified their oral health condition as moderate. Regarding oral hygiene practices, it was found that most performed oral hygiene twice or more times a day, using a toothbrush and fluoride toothpaste, however, the use of dental floss was not reported by any of the participants.

Most older people had had their last dental appointment more than two years ago (47.89%) and, among those who had already consulted a dentist, all reported pain or problem with their teeth, gums or mouth as a reason for the appointment (Table 2). It was found that approximately 20% of the older people smoked cigarettes, cigars, pipes every day, while the consumption of alcoholic beverages, during the last 30 days, was low.

The frequency of ingesting sweets and sugary drinks was low, with only 1.41% of the older people reporting daily consumption of this type of food.

As seen in Table 2, the analysis of the perception of functional and social impairments due to oral health conditions revealed that most older people have already had difficulty chewing food (89.67%), dry mouth feeling (48.36%) and interrupted sleep due to teeth problems (90.61%).

Table 1. Sociodemographic profile of the older people (N=213). Bocoio Municipality, Benguela Province, Angola, 2019.

Variables	n (%)
Sex	
Female	147 (69.01)
Male	66 (30.99)
Age group (years)	
60 to 70	165 (77.46)
71 to 80	42 (19.72)
> 80	6 (2.82)
Occupation	
Unemployed/retired	198 (92.96)
Employed	15 (7.04)
Education level (years studied without failure)	
Never attended school	176 (82.63)
1 to 5	31 (14.55)
6 to 12	5 (2.35)
>12	1 (0.47)

Table 2. Perception of oral health and functional and social impairments due to oral problems, oral hygiene practices, use of dental services, tobacco and alcohol consumption among older people (N=213). Bocoio Municipality, Benguela Province, Angola, 2019.

Variables	n (%)
Oral health perception	
Good	2 (0.94)
Moderate	161 (75.59)
Bad	8 (3.75)
Very bad	14 (6.57)
I do not know	28 (13.15)
Toothbrush use	
Yes	197 (92.49)
No	16 (7.51)
Use of fluoridated toothpaste	
Yes	197 (92.49)
No	16 (7.51)
Tooth brushing frequency	
Once a day	86 (40.38)
2 or more times a day	112 (52.58)
Never	15 (7.04)
Time since last dental appointment	
Less than 6 months	12 (5.63)
6 to 12 months	12 (5.63)
12 to 24 months	86 (40.38)
More than 24 months	102 (47.89)
Never been to the dentist	1 (0.47)
Reason for the last dental appointment	
Pain or problem in teeth. gums or mouth	212 (99.53)
Never been to the dentist	1 (0.47)
Frequency of cigarette/cigar/pipe consumption	
Every day	44 (20.66)
A few times a month	4 (1.88)
Never	165 (77.46)
Alcohol consumption during the last 30 days	
Up to 2 times	24 (11.27)
Between 2 and 4 times	5 (2.35)
Did not consume alcohol during the 30 days	184 (86.38)
Had difficulty chewing food	
Often	58 (27.23)
Sometimes	133 (62.44)
Never	22 (10.33)
Had difficulty speaking	
Often	19 (8.92)
Sometimes	37 (17.37)
Never	157 (73.71)

to be continued

Continuation of Table 2

Variables	n (%)
Felt embarrassed because of the appearance of their teeth	
Often	6 (2.82)
Sometimes	19 (8.92)
Never	188 (88.26)
Felt tense because of problems with their teeth	
Often	1 (0.47)
Sometimes	23 (10.80)
Never	189 (88.73)
Dry mouth feeling	
Often	21 (9.86)
Sometimes	82 (38.50)
Never	110 (51.64)
Avoided smiling because of their teeth	
Often	6 (2.82)
Sometimes	26 (12.21)
Never	181 (84.98)
Had interrupted sleep because of teeth	
Often	2 (0.94)
Sometimes	191 (89.67)
Never	20 (9.39)
Had difficulty performing daily activities because of teeth	
Sometimes	1 (0.47)
Never	212 (99.53)

It was observed that 51.64% of the older people had less than 20 dental elements present in the oral cavity, being 7.04% total edentulous. There was a statistically significant association (p<0.01) between the smaller number of dental elements present in the oral cavity and conditions of older age group and lower level of education, but not with gender or occupation (Table 3).

The average DMFT of the older people was 20.8±5.3. As seen in Figure 1, no older person without dental caries experience was found. The minimum value of the DMFT was 3, while 8.92% of the participants had DMFT equal to 32. The analysis of the dental condition showed that of the total of 6815 dental elements examined, 2,356 (34.57%) were healthy, 1,350 (19, 81%) decayed, 3,086 (45.28%) lost due to tooth decay, and 23 (0.33%) lost for other reasons. No filled dental elements were found in the study.

The mean number of decayed roots per older person was 2.43±2.10. The analysis of the root condition showed that from a total of 3706 exposed roots examined, 3187 (86.00%) were healthy, 518 (13.98%) decayed, and 1 (0.02%) was filled.

Regarding periodontal condition, it was observed that less than half of the dental elements were healthy and that most had periodontal pockets (50.32%) and periodontal attachment loss (51.00%). As shown in Table 4, almost all older people needed some type of prosthesis, with a predominance of the need for prostheses with more than one element, both in the maxillary and mandibular arches. Regarding the use of dentures, only one upper removable partial denture was found in the study.

Two oral lesions were identified, one ulcerative lesion located in the anterior region of the inferior alveolar ridge and the other an abscess located in the posterior region of the inferior alveolar ridge.

Table 3. Relation between sociodemographic variables and the number of dental elements present in the oral cavity of the older people (N=213). Bocoio Municipality, Benguela Province, Angola, 2019.

	Dental elements present in the oral cavity				
Variables	0 a 9	10 a 19	> 19	total	*p*-value
Sex	n (%)	n (%)	n (%)	n (%)	
Female	24 (72.73)	49 (63.16)	74 (71.84)	147 (69.01)	0.4496
Male	9 (27.27)	28 (36.84)	29 (28.16)	66 (30.99)	
Total	33 (100.00)	77 (100.00)	103 (100.00)	213 (100.00)	
Age group (years)					
60 to 70	4 (12.12)	60 (77.92)	101 (98.06)	165 (77.46)	< 0.0001
71 to 80	23 (69.70)	17 (22.08)	2 (1.94)	42 (19.72)	
> 80	6 (18.18)	0 (0)	0 (0)	6 (2.82)	
Total	33 (100.00)	77 (100.00)	103 (100.00)	213 (100.00)	
Occupation					
Unemployed/retired	33 (100.00)	69 (89.47)	96 (93.2)	198 (92.96)	0.0589
Employed	0 (0)	8 (10.53)	7 (6.8)	15 (7.04)	
Total	33 (100.00)	77 (100.00)	103 (100.00)	213 (100.00)	
Education level (years studied without failure)					
Never attended school	33 (100.00)	67 (87.01)	75 (78.95)	175 (82.16)	0.0086
1 to 5	0 (0)	7 (9.09)	25 (26.32)	32 (15.02)	
6 to 12	0 (0)	2 (2.60)	3 (3.16)	5 (2.35)	
>12	0 (0)	1 (1.30)	0 (0)	1 (0.47)	
Total	33 (100.00)	77 (100.00)	103 (100.00)	213 (100.00)	

Association between variables analyzed using the G Test

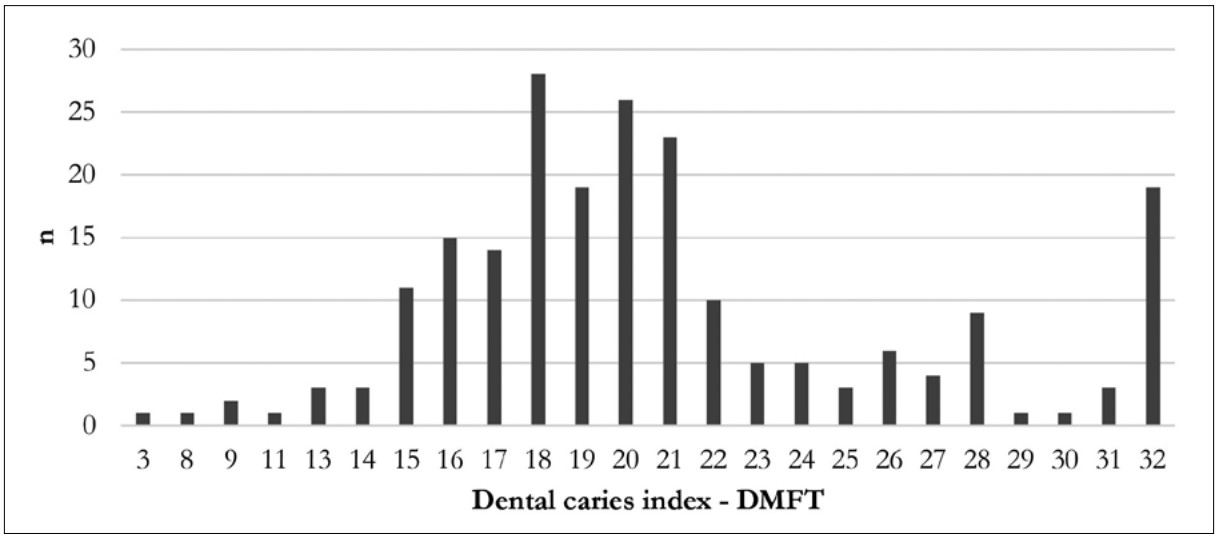

Figure 1. Absolute distribution of the older people in the municipality of Bocoio, according to the DMFT index. Benguela, Angola 2019.

Table 4. Periodontal condition and need for prosthesis in the older people in the municipality of Bocoio, Benguela, Angola, 2019.

Variables	n (%)
Periodontal condition*	
Healthy	1839 (49.62)
Gingival bleeding	1624 (43.82)
Periodontal pocket from 4 to 5mm	912 (24.61)
Periodontal pocket of 6mm or more	953 (25.72)
Total	3706 (100.00)
Periodontal attachment loss (mm)	
0 to 3	1816 (49.00)
4 to 5	915 (24.69)
6 to 8	869 (23.45)
9 to 11	98 (2.64)
12 or more	8 (0.22)
Total	3706 (100.00)
Need for superior prosthesis	
Doesn't need	7 (3.29)
Needs a fixed or removable partial denture of 1 element	3 (1.41)
Needs a fixed denture or removable partial denture of more than one element	102 (47.89)
Needs a combination of dentures and/or removable partial dentures of more than one element	73 (34.27)
Needs full denture	28 (13.15)
Total	213 (100.00)
Need for lower prosthesis	
Doesn't need	3 (1.41)
Needs a fixed or removable partial denture of 1 element	1 (0.47)
Needs a fixed denture or removable partial denture of more than one element	105 (49.30)
Needs a combination of dentures and/or removable partial dentures of more than one element	77 (36.15)
Needs full denture	27 (12.68)
Total	213 (100.00)

* A dental element may have more than one periodontal alteration

DISCUSSION

In the present study on the oral health condition of older people cared for at a rural municipal hospital in Bocoio, Angola, a worrying scenario of lack of access to dental services and a high burden of untreated oral diseases was identified. The findings of this study suggest that the large number of dental elements lost due to tooth decay, as well as the lack of curative and rehabilitative treatment for the disease, represent the main oral health problems in the studied population.

Oral health problems found in older people, on several occasions, do not only reflect the condition resulting from currently present diseases, as, in fact, they can express the result of the combination of complications from various pathological processes accumulated throughout the individual's life, which may be due to poor oral hygiene, lack of access to dental care services, and lack of health education actions and strategies that promote awareness of the importance of adopting measures to maintain oral health. In this context, it was found that the older people who sought health services at the Hospital

Municipal do Bocoio were predominantly female. This result is in line with findings from other studies that suggest that women pay more attention to their oral health condition, are more likely to seek dental treatment, and are more perceptive in relation to the damage caused by oral health problems, when compared to men[12,13].

It was also found that most of the older people did not work, which may be a reflection of the economic characteristics of the region, considering that it is a rural area, in which the majority of the population is fully dedicated to agricultural activities, so that the older people are retired or have never worked as employees in the public or private sectors[14]. Another important aspect is that most older people had never attended school. The low level of education can contribute to the onset of diseases, in addition to hindering the process of raising awareness of individuals in relation to the practice of health care throughout life[15]. People living in rural or remote regions may have a lower socioeconomic level, lower health literacy, not have health insurance coverage or financial resources to use with dental care[16]. In this sense, the findings of the present study showed that there was an association between the smaller number of dental elements present in the oral cavity and a low level of education, which is in accordance with evidence in the literature suggesting that the prevalence of oral diseases is inversely related to the level of education[17].

In this study, it was observed that practically no older people classified their oral health status as good or better, diverging from the results of other studies conducted in Brazil and Norway, which showed that most older people rated their oral health as good[18,19]. This can be explained by the high burden of oral diseases and lack of access to preventive, curative and rehabilitative dental services. The importance of valuing and maintaining oral health is highlighted, considering not only the functional aspects but also its influence on the older person's self-esteem, social relationships and quality of life[20].

The need for health education and oral health prevention actions and strategies is also present in the light of the findings related to oral hygiene practices, considering that the use of dental floss was not reported by any participant. In this context, advanced age can change the ability to perform oral hygiene, due to physical and motor deficiencies, lack of motivation, lack of interest or misinformation about the importance of self-care measures[21]. It is also possible to suggest that financial aspects influence oral hygiene practices, due to the lack of resources to purchase materials. It is noteworthy that, regardless of the presence of teeth, it is necessary to sanitize the oral cavity and dental prostheses, in addition to performing the self-examination to identify oral lesions, highlighting the role of the dentist as an advisor and encourager of the older person and caregivers for the hygiene practices and maintenance of the older person's oral health[21,22].

In the present study, it was found that the use of dental services by older people in the last 12 months was low, including approximately only 11% of the participants. This fact is in accordance with evidence found in a national epidemiological study on oral health conducted in Brazil, which demonstrated that adults living in rural areas used dental services less frequently than those living in urban areas[23]. Furthermore, dental appointments tend to gradually decrease with aging, resulting in a low demand among older people of more advanced age[24]. The findings of the present study reinforce the results of research that demonstrated that the human resources and infrastructure necessary for oral health services, in the West African region, are located mainly in large urban centers, close to the higher-income population, while the population in rural regions has few available resources[6,7]. This highlights the existing inequalities between rural and urban areas, considering the accessibility, distribution and use of oral health services.

Difficulty in chewing food was reported by the vast majority of the older people and can be explained by the large number of lost teeth and untreated carious lesions, which compromise the masticatory function and the feeding process. Thus, the improvement and increase in the longevity of the functional capacity of the older person is reinforced as an important health paradigm, highlighting the maintenance of independence and autonomy as goals to be achieved in the health care of the older person[25].

The prevalence of smoking among the older individuals studied proved to be worrying, with one in every five older individuals having the habit of smoking every day. It is a risk factor for highly serious non-communicable diseases, such as lung cancer and head and neck cancer, in addition to being related to greater colonization of the oral cavity by pathogenic microorganisms, highlighting that the harmful effects of the use of tobacco are cumulative and long-lasting[26]. Thus, the importance of developing health programs aimed at raising awareness among the population and smoking cessation is highlighted.

The findings of this study revealed that approximately half of the older people had more than twenty dental elements present in the oral cavity and that there was an association between the smaller number of teeth present and the older age group. This proportion is different from that found in a study carried out in Brazil, with non-institutionalized older people, which verified the presence of twenty teeth or more in only 7.69% of the individuals[27]. It is possible to suggest that this difference is related to cultural and socioeconomic differences between the populations studied, such as consumption of sweet foods and sugary drinks and access to dental services. Tooth loss is a serious public health problem, however, it is still erroneously accepted by society as something normal and naturally related to advancing age and not as a reflection of the deficiency of preventive oral health policies[27].

The average DMFT found in the present study was high, highlighting the large proportion of teeth lost due to tooth decay, similarly to what was observed in other studies conducted with non-institutionalized older people, living in urban areas in cities in the south and southeast of Brazil[27,28]. Evidence has shown that tooth extractions are more frequent in rural than urban areas, which may be related to restrictions on access to and use of quality specialized dental services, making tooth extraction an inevitable procedure when tooth decay is found in advanced stages with great tissue destruction[29,30]. Tooth loss is one of the most frequent oral problems in older people and is related to the progression of preventable diseases such as tooth decay and periodontal diseases and can affect the chewing efficiency, taste, speech and aesthetics of the older person, reducing their quality of life[20].

Regarding periodontal condition, it was observed that most of the dental elements examined had periodontal pockets and periodontal attachment loss. Similarly, a study conducted in a population of older people living in a rural area of India found that the prevalence of periodontal disease was high and that the periodontal condition deteriorated with aging[31]. It should be noted that periodontal diseases, by causing attachment loss and gingival recession, can cause root exposure, increasing the chance of developing root caries[32].

In this study, it was found that almost all older people needed some type of dental prosthesis, however, only one participant had the necessary prosthesis. In this context, it was found that the proportion of total edentulous patients was lower than that found in other studies, which may be related to the low consumption of sugary foods and beverages and the limited access to specialized dental services, perpetuating the permanence of dental elements with extensive carious lesions and advanced alveolar bone loss[33]. Also in this sense, it is possible to suggest that the high need for prostheses may also be related to deficiencies in access to human, material and infrastructure resources, such as prosthesis laboratories, located far from this rural region, such as Luanda, capital of Angola, located more than 500 km from the municipality of Bocoio. It should be noted that masticatory capacity, swallowing, speech and esthetics, which are affected by tooth loss and extraction, can be partially recovered through the use of adequate dentures, which contributes to improving the quality of life of older people. Furthermore, attention should be paid to health education measures and guidelines on the use, hygiene, maintenance and replacement of dental prostheses in order to reduce the risk of developing oral lesions[34].

In this research, older people from a rural municipality in Angola were examined, thus not allowing the extrapolation of the findings to a population of older people living in large urban

centers, which can be considered a limitation of the study. The convenience sampling technique can also be considered a limitation of the research.

There is a lack of research on oral health in the Angolan population and, consequently, a limited scientific production that does not allow for addressing all existing and emerging challenges in health care. It is noteworthy that, so far, there is no epidemiological study regarding the oral health conditions of the rural older population in Angola, so that this research can serve as a reference point for the planning of strategies and public policies on oral health aimed at this population.

CONCLUSION

The oral health condition of the older pople treated at a hospital in the rural municipality of Bocoio, Angola, Africa, is precarious and marked by a high proportion of missing teeth and a deficiency in the use of dentures. The lack of access to dental services, characterized by the great need for dentures and the absence of treatment for teeth affected by different oral diseases, highlight the need to implement strategies and public policies for the promotion, prevention and recovery of oral health.

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Factors associated with non-adherence to pharmacotherapy in older people in primary health care in Brazil: a systematic review

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Abstract

Objectives: To identify the factors associated with non-adherence to pharmacotherapy in elderly Brazilians assisted by Primary Health Care (PHC) through a systematic review of the literature. *Method*: This is a systematic literature review in English, Spanish, and Portuguese, performed in the SciELO electronic library and in the electronic databases MEDLINE - via PubMed, LILACS, Embase, and Web of Science from January 2010 to June 2020. Study selection was performed independently by two reviewers using the Rayyan selection application. *Results:* After applying the eligibility criteria, nine studies were included in the systematic review. The most frequent method used to measure the outcome was the Morisky-Green Scale (4-items). The results point that the main factors related to non-adherence to pharmacotherapy in PHC are difficulties in medication access, multimorbidities, polypharmacy, the use of potentially inappropriate medications for the elderly, the degree of trust in the medical professional, beliefs, negative self-perception of health and functional disability. *Conclusions*: In the context of PHC, non-adherence to pharmacotherapy by the elderly population presents itself as a very frequent problem, being triggered by multiple factors and with negative consequences for the control of health conditions, the rational use of medications, and healthy aging. It is also noteworthy that part of the associated factors are subject to intervention at this level of health care.

Keywords: Aging. Health of the elderly. Primary Health Care. Pharmaceutical Assistance. Adherence to pharmacological treatment.

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INTRODUCTION

The aging process brings numerous challenges such as motor, cognitive, and mental losses, increased vulnerability, social isolation, and the development of chronic non-communicable diseases (NCDs). Increased life expectancy in the world - and quite significantly in Brazil - did not necessarily imply an improvement in the quality of life of people in more advanced ages. Thus, based on the healthy aging paradigm, strategies to improve the lives of older people need to be thought out and implemented in different areas[1,2].

The older population notably presents characteristics inherent to aging that become social and health demands as this population becomes more and more prevalent. Thus, people started to deal with health conditions that last for years and require full monitoring, and which can often accumulate throughout life, which makes the older person frequently present more than one chronic NCD. With a greater number of health problems, older people often need complex and continuous pharmacotherapeutic regimens[3,4].

The literature points out that this scenario creates precedents for the irrational use of medications, especially when adherence to the pharmacological treatment - understood as the degree of correspondence between the recommendation of a healthcare professional and the patient's behavior in the use and management of medications - is not effective and triggers a series of damages to the health of the older person[5].

Thus, non-adherence to pharmacotherapy is a multifactorial public health problem representing a challenge to the progression of pharmaceutical care in the Unified Health System (SUS). Thus, non-adherence involves the process of accessing medicines, but also and mainly the use and correct handling of medicines promoted by proper guidance by health professionals[5,6].

Primary Health Care (PHC) plays a crucial role in carrying out healthcare actions at the individual and collective levels, in the ordering of care, and the search for comprehensiveness, considering the territorialization and epidemiological profile, being frequently accessed by the Brazilian older population [7]. However, pharmaceutical care in this scenario is still far from the ideal implementation, despite being growing and essential for the identification and resolution of pharmacotherapeutic problems such as non-adherence[8].

Taking into account the aforementioned issues and the many challenges of adherence to therapeutic regimens, knowing the factors that can interfere with adherence to pharmacotherapy is essential in an attempt to increase the quality of health care and improve public policies for older people[5]. Thus, the present study aims to identify and analyze the factors associated with non-adherence to pharmacotherapy of Brazilian older people in the context of PHC through a systematic review of the literature.

METHOD

This is a systematic review of the literature based on the recommendations for systematic reviews of the *Cochrane* Collaboration. The study's protocol was registered in the *International Prospective Register of Systematic Reviews* (PROSPERO) under the registration code CRD42020202476. The guiding question was: *What are the factors to influence older people not to adhere to the pharmacological treatment prescribed in the context of primary health care in Brazil?*

We considered the observational epidemiological design studies published from January 2010 to June 2020 in Portuguese, English, and Spanish including the older population (60 years and older, as recommended by the WHO for developing countries and criterion adopted by the Elderly Statute), the PHC health services, the assessment of non-adherence to pharmacological treatment and its associated factors, in the context of Brazil.

The last decade was chosen as the time frame based on the analysis of the results of the 2010 Demographic Census, which showed the growth of the Brazilian older population and brought the need for current assessments of the population aging process. The languages, on the other hand, were determined as they are the main choices for the publication of studies carried out in Brazil.

Studies on treatment adherence to specific medications without a description of the method used to measure said adherence and without a description of the type of study were excluded, as well as publications in the annals of scientific events, literature reviews, and case reports.

Studies were searched in the electronic library *Scientific Electronic Library Online* (SciELO) and in the databases *Medical Literature Analysis and Retrieval System Online (MEDLINE)* - via PubMed, Latin American & Caribbean Health Sciences Literature (LILACS), *Excerpta Medica Database* (*Embase*), and *Institute for Scientific Information Web of Knowledge (Web of Science)*. The restricted access databases *Embase* and *Web of Science* were accessed free of charge via the Federated Academic Community (CAFe) access by Capes Journal. Databases were chosen taking into account the number of records, their scope, and their importance in the field of health sciences.

The descriptors were adapted for each database and combined using Boolean operators (OR, AND, and NOT). The following descriptors were used for the search strategy in the databases according to their definition in the Health Descriptors (DeCS) in English, adopting the following search strategy used in all databases: ((aged) or (older person) or (aging) or (older) or (advanced in years)) and ((medication adherence) or (treatment adherence) or (adherence to medicinal treatment) or (adherence evaluation) or (medication non-adherence) or (pharmacological treatment adherence) or (drug therapy adherence)) and ((Primary Health Care) or (health services)) and ((Brazil) or (Brasil) or (Brazilian)).

The studies were independently selected by two reviewers from September to December 2020 using the selection application *Rayyan* developed by *the Qatar Computing Research Institute (QCRI)* as an auxiliary platform to archive, organize, and select the papers.

Initially, titles and abstracts were analyzed (screening phase) to verify if each study found referred to the theme and if it was following the eligibility criteria. The papers considered eligible in the screening phase were then analyzed in their entirety with the reading of the entire text by the two reviewers who made the pre-judgment regardless of the inclusion or exclusion of the study. The inclusion was carried out in pairs by the consensus of the two reviewers who assessed the consistency in the use of the eligibility criteria in each study. Disagreements in the full reading phase were resolved based on the analysis of a third reviewer.

The data extraction process started only after all papers have been included and reviewed according to the eligibility criteria. At this stage, the two study selection evaluators proceeded by filling out a form from the *Google Forms* software with all the variables of interest to the study: authors, year of publication, location, study title, journal name, type of study design, sociodemographic and behavioral characteristics of the sample, estimates of the prevalence of non-adherence, the instrument used to measure adherence, and factors associated with non-adherence to the pharmacotherapy described.

Then, all the information present in the forms was checked, with the data of the selected articles being systematized in an electronic *Excel* spreadsheet (database indexation phase). This rigorous and organized process avoided frequent returns to the original texts of the papers and facilitated the analyzes by bringing together all the data of interest for the systematic review in a single structure. A flow diagram was created for a visual representation of the identification process of the papers included in the systematic review.

The instrument for the critical assessment of prevalence studies proposed by Loney et al.[9] was used with adaptations to determine the methodological quality of the papers. It is an evaluation guided by eight criteria: 1) study design and appropriate probabilistic or census sampling methods; 2) adequate sampling source; 3) previously calculated sample size; 4) use of objective and adequate criteria using a validated instrument to measure the outcome; 5) outcome impartially measured by trained evaluators; 6) adequate response rate (>70.0%) and description of refusals; 7) presentation of confidence intervals and subgroup analyses when appropriate; and 8) study participants and subjects well described and similar to the research question. Each criterion could get a score of zero or one (met criterion). Thus, the total score can range from zero to eight, and the higher the

score, the better the quality. Studies were considered of high quality if they scored 7 or 8 points, moderate quality from 4 to 6 points, and low quality from 0 to 3 points. The critical quality assessment was not used as an exclusion criterion for papers. This assessment allowed us to verify the interference in the results and a possible endangerment in the level of evidence.

RESULTS

The electronic search in the databases retrieved a total of 1021 studies. Duplicates (n=80) were removed, resulting in 941 studies for evaluation. After analyzing the title and abstract of each study, 909 were removed as they did not fit the theme and/or objectives of the study. Thus, 32 studies were selected for full reading, and 23 of these were excluded for not meeting the eligibility criteria.

Therefore, nine studies were included in this systematic review. Most studies were published in national journals, two in English and seven in Portuguese, and they were carried out in four of the five regions of Brazil between 2010 and 2020. Figure 1 shows the steps taken in the study selection process.

Table 1 shows the characteristics of the studies included in this review, presenting the following items: author, year of publication, study design, study subjects, division of groups, variables analyzed, and results. Table 2 describes the assessment of methodological quality, and Table 3 presents the assessment methods, prevalence, and factors associated with non-adherence to pharmacotherapy.

Table 1. Characteristics and results of the studies included in the systematic review. Juiz de Fora, MG, 2021.

Author, year, place of study, and journal	Research design	Sociodemographic characterization, health, and behavioral profile
Aiolfi et al., 2015 Dourados (MS) Revista Brasileira de Geriatria e Gerontologia[10]	Cross-sectional study.	N = 124 Gender: male (32.3%) and female (67.7%) Age: 71 years and over (55.64%) Education: illiterate (38.70%) Family arrangement: accompanied (79.83%) Self-rated health: bad/very bad: (12,1%) *Per capit*a income: up to one minimum wage (73.3%) Medications per day: 4 or more (59.68%) Health diagnoses: 3 or more (58.87%) Cognitive deficit (61.29%)
Borba et al., 2018 Recife (PE) Science & Public Health[11]	Cross-sectional study	N = 150 Gender: male (26.7%) and female (73.3%) Age: 60 to 69 years (54.7%) Education: up to 8 years of study (58.7%) Family arrangement: spouse + family members (60%) Self-perceived health: regular (62%) and poor (12%) Monthly income of the older person: from one to two minimum wages (52.7%)
Obreli-Neto et. al., 2010 Salto Grande (SP)[12] Revista de Ciências Farmacêuticas Básica e Aplicada[12]	Cross-sectional study	N = 102 Gender: male (38.3%) and female (61.7%) Age: average 64.7 years old Education: incomplete elementary education (76.5%) Monthly Family Income: average of one minimum wage Color: black (68.6%) Dissatisfaction with UBS: 66,7% Average number of reported diseases: 2,4

to be continued

Continuation of Table 1

Author, year, place of study, and journal	Research design	Sociodemographic characterization, health, and behavioral profile
Saraiva et al., 2020 Crato (CE) Journal of Diabetes e Metabolic Disorders[13]	Cross-sectional study	N = 300 Gender: male (35.7%) and female (64.3%) Age: average 61 years old Education: up to 8 years of study (65%) Marital status: married (69.7%) Monthly Family Income: up to 1 minimum wage (65%) Regular practice of physical activity: 40.3% Number of chronic complications: 1 to 2 (52.7%)
Schmitt Júnior, Lindner, Santa Helena, 2013 Blumenau (SC) Revista de Associação Médica[14]	Cross-sectional study	N = 150 Gender: male (27.8%) and female (72.2%) Age: 60 to 69 years (62.9%) Education: 3 to 4 years of study (45.7%) Color: White (81.2%) Marital status: married/common-law marriage (47%) Number of medications: 5 or more (43%) Prescription of inappropriate medications for older people (16.6%)
Silva et al., 2014 Londrina (PR) Revista de Ciências Farmacêuticas Básica e Aplicada[15]	Cross-sectional study	N = 117 Gender: male (35.7%) and female (65%) Age: 60 to 69 years (45.3%) Education: up to 7 years of study (65%) Color: White (70.9%) Self-perceived health: bad or very bad (13.7%) Does not practice any physical activity (65%)
Stefano et al., 2017 Marília (SP) Revista Brasileira de Geriatria e Gerontologia[16]	Cross-sectional study	N = 150 Gender: male (35.7%) and female (62,3%) Age: 60 to 69 years (53.5%) Education: up to 4 years of study (57,9%) Marital status: married/common-law marriage (49,1%) Retired or pensioners (78.9%)
Tavares et al, 2013 Bagé (RS) Revista de Saúde Pública[17]	Cross-sectional study	N = 1242 Gender: male (35.7%) and female (62,3%) Age: 65 to 74 years (45.3%) Education: 55.7% (up to 7 years of study) Socioeconomic status: C (39.5%) Self-perceived health: regular/bad/very bad (40.6%) Cognitive Deficit (13.4%) Disability for Instrumental Activities of Daily Living (34.6%) Number of reported morbidities: 3 or more (30.4%)
Ungari, Amauri, 2010 Ribeirão Preto (SP) Brazilian Journal Pharmaceutical Sciences[18]	Cross-sectional study	N = 109 Gender: male (15.6%) and female (84.4%) Age: 60 years and over (55.1%) Education: up to 8 years of study (75.35) Marital status: married (56%) Color: White (81.7%) Does not practice any physical activity (50.5%)

Table 2. Critical assessment of the methodological quality of the studies included in the systematic review according to Loney. Juiz de Fora, MG, 2021.

Author and Year	Quality Score	Assessment
Aiolfi et al., 2015.[10]	7	High Quality
Borba et al., 2018.[11]	7	High Quality
Obreli-Neto et. al., 2010.[12]	7	High Quality
Saraiva et al., 2020.[13]	7	High Quality
Schmitt Júnior, Lindner, Santa Helena, 2013.[14]	8	High Quality
Silva et al., 2014.[15]	8	High Quality
Stefano et al., 2017.[16]	7	High Quality
Tavares et al, 2013.[17]	8	High Quality
Ungari, Fabbro, 2010.[18]	7	High Quality

Table 3. Assessment methods, prevalence, and factors associated with non-adherence to pharmacotherapy of older people. Juiz de Fora, MG, 2021.

Author and Year	Assessment Method	Prevalence	Factors associated with non-pharmacological pharmacotherapy	Association measures and statistical significance
Aiolfi et al., 2015.[10]	8-item Morisky Medication Adherence Scale (MMAS-8)	68.5% (Non-Adherence)	Absence of cognitive deficit Younger older people	PR= 1.28 (95% CI 1.02 - 1.61); *p*=0.003* PR= 1.62 (95% CI 1.27 - 2.01); *p*<0.001*
Borba et al., 2018.[11]	Positive response to questions related to the use of medications	66.7% (Partial Adherence) and 6% (Non Adherence)	Beliefs related to the use of medications: For partial adherence For non-adherence	Adjusted OR = 9.65 (95% CI 1.6 - 56.6)** Adjusted OR = 18.15 (95% CI 3.5 - 95.4)** OR adjusted by the variables: self-perception of health, understanding the explanations about diabetes, and professional responsible for guiding treatment.
Obreli-Neto et. al., 2010.[12]	8-item Morisky Medication Adherence Scale (MMAS-8)	37.3% (Low adherence)	Patients' dissatisfaction with healthcare services Medication Regimen Complexity Index Number of medications taken Number of diseases reported Number of residents per household	r=0.884; *p*<0.0001 ** r=-0,705; *p*<0,0001 ** r=-0,604; *p*<0,0001 ** r=-0,604; *p*<0,0001 ** r= 0,328; *p*<0,0001**

to be continued

Continuation of Table 3

Author and Year	Assessment Method	Prevalence	Factors associated with non-pharmacological pharmacotherapy	Association measures and statistical significance
Saraiva et al., 2020.[13]	Morisky-Green Scale (4 items) and Beliefs about Medicines Questionnaire (BMQ)	77.3% (Low adherence)	Marital Status (married)	RP= 1,27 (IC 95% 1,02 - 1.59) *p*=0,01 *
			Arterial hypertension	RP= 1,14 (IC 95% 0,99 - 1,32) *p*=0,03 *
			Does not practice physical activity regularly	RP= 1,16 (IC 95% 1,02 - 1.33) *p*=0,01 *
			Low belief in the need for medication	*p*=0,038**
Schmitt Júnior, Lindner, Santa Helena, 2013.[14]	Morisky-Green Scale (4 items)	35.4% (Non Adherence)	Previous interruption due to lack of medication	Adjusted OR = 2.9 (95% CI 1.3-6.9)*p*=0.01 **
			Prescription of inappropriate medications for older people	Adjusted OR = 2.9 (95% CI 1.1-7.9) *p*=0.03 **
				Adjusted OR for the variables: consumption class, how you feel about your treatment, and report of adverse reactions
Silva et al., 2014.[15]	Morisky-Green Scale (4 items)	45.3% (Non adherence)	Male gender	*p*<0.05 / ***
			Older age (octogenarians)	*p*<0.01 / ***
Stefano et al., 2017.[16]	Haynes and Morisky-Green Scale (4 items)	40.3% (Low adherence)	****	***
Tavares et al, 2013.[17]	Brief Medication Questionnaire (BMQ)	32.9% likely low adherence and 1/3 low adherence.	Age between 65 and 74 years old	Adjusted PR= 1.25 (95% CI 1.00–1.56); *p*=0.052 **
			Does not have health insurance	Adjusted PR= 1.01 (95% CI 1.00); *p*=0.028 **
			Need to buy (in whole or in part) the medications	Adjusted PR= 1.07 (95% CI 0.86 – 1.33)*p*<0.001 **
			Presence of three or more morbidities	Adjusted PR= 1.39 (95% CI 1.06 – 1.82)*p*=0.004 **
			Present functional disability for instrumental activities of daily living	Adjusted PR= 1.25 (95% CI 1.05–1.49); *p*=0.009 **
			Greatest number of medications used	Adjusted PR= 10.18 (95% CI 5.65 – 18.33); *p*<0.001 **
				PR adjusted by the set of variables presented

to be continued

Continuation of Table 3

Author and Year	Assessment Method	Prevalence	Factors associated with non-pharmacological pharmacotherapy	Association measures and statistical significance
Ungari, Fabbro, 2010.[18]	Morisky-Green Scale (4 items)	Less adherent: 20.2% (Criterion 1) and 56.9% (Criterion 2)	Lower degree of trust in the healthcare professional	PR= 1.06 (95% CI 0.26 - 4.31); *p*=0.03 *
			Greater number of antihypertensive medications used	PR= 1.78 (95% CI 0.80 – 3.92); *p*=0.071*

PR: Prevalence Ratio; OR: Odds Ratio; 95%CI: 95% Confidence Interval; *p:* probability of significance; *Calculated based on the paper's information; **Data presented in the original paper; ***Not possible to calculate the association measure; **** Only presented the descriptive analysis.

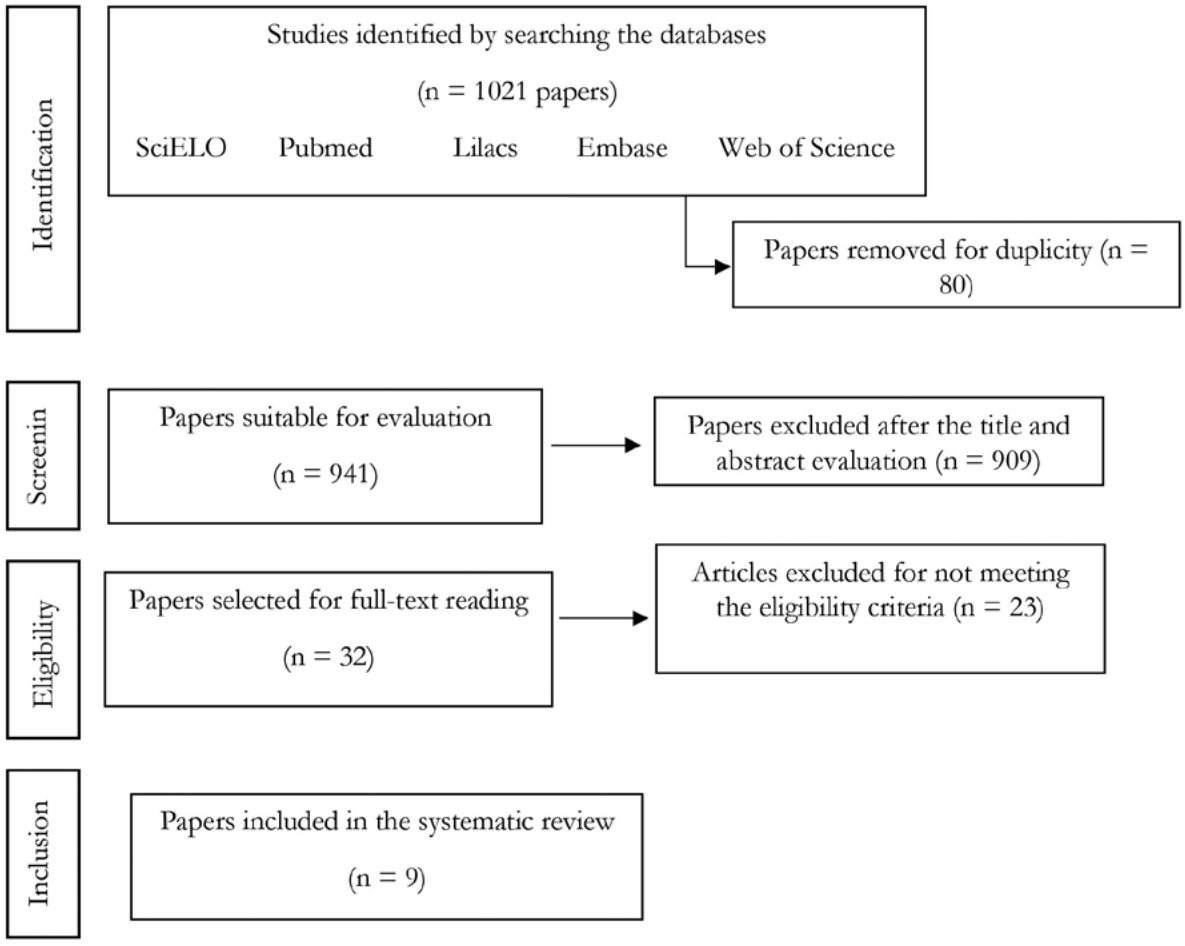

Figure 1. Flowchart of the search process, selection steps, and reasons for excluding the studies selected for systematic review. Juiz de Fora, MG, 2021.

DISCUSSION

The production of papers involving this theme of older people in PHC in Brazil is scarce. This revelation is presumably related to the challenges of PHC given the growing demand due to the population aging and the offer of practices under the logic of the biomedical model, which make it difficult to look at the multiple demands of the older person from the perspective of integrality[19,20].

The cross-sectional study was the only type of epidemiological research found, and not all authors[10,13,15,16,18] presented the association measures expected for studies with this design. In addition, the study[16] carried out in Marília (SP) was restricted to the descriptive analysis of the findings, which made it impossible to verify any association with the outcome, regardless of its nature.

Cognitive deficit and older age are pointed out by some researchers as risk factors for non-adherence to pharmacotherapy, which can be attributed to the increase in comorbidities that tend to accompany aging and also the difficulties related to the cognitive deficit, such as memory, attention, and concentration[17,21]. Opposing these findings, the study by Aiolfi et al.[10] observed the association between the absence of cognitive deficit and younger age as risk factors for non-adherence. According to the authors, this correlation is because younger older people have less support from family members and caregivers to help manage medication compared to those with some degree of cognitive deficit and older age. On the other hand, it is worth noting that a screening instrument for the cognitive decline was used, and not a specific test for the diagnosis of cognitive deficit. These findings reinforce the need for a care model in PHC involving the multidimensionality of care, which is anchored in physical, mental, functional, environmental, social, and other aspects[22].

In the study by Borba et al.[11], negative self-perceived health revealed an association with non-adherence to pharmacotherapy in the bivariate analysis. Although the independent variable was not associated with the outcome in the multivariate analysis, it is worth discussing this association since self-perception is a robust and powerful indicator in health care for measuring the quality of life and a predictor of morbidity and mortality recommended by the World Health Organization (WHO), being widely used in epidemiological studies related to population aging[23-26]. It is capable of synthesizing the interaction of multiple factors, such as the older person's physical, psychological, cognitive, and social well-being. Its application contributes to the development of prevention and health promotion actions within the scope of PHC, to the identification of priority needs, and the planning of public policies. This finding corroborates other studies relating it to the loss of autonomy and functional capacity, among which the ability to manage and take their medications[23-25].

Functional incapacity was identified as a factor associated with non-adherence to pharmacotherapy. A study carried out by Ikemagi et al.[26] with community older people points out the feedback relation between drug treatment and functional performance that can occur in some cases. It is important to mention that functional performance is an important component of functional capacity. Older age[15], the greater number of chronic diseases,[12,17] and not practicing any physical activities[13] are factors associated with non-adherence and are also related to functional disability, thus demonstrating the existing interconnection in the complex health production of the older person. This entire spectrum emphasizes the difficulties in handling medications and the need for support from healthcare professionals to constantly stimulate self-care and medication adherence, especially in situations of vulnerability[26-28].

Furthermore, the lower degree of trust in the medical professional is also a factor for non-adherence[18]. In a study with older people from a multidisciplinary health center, Oliveira et al.[27] identified that low knowledge about the therapy, low clarity about the health-disease process, and impaired communication in the patient-professional relationship predisposes to the risk of non-adherence. Also, this condition is exacerbated when there are changes in the older person's routine to create delays and forgetfulness in the administration of medication, and these factors are also related[27].

In this perspective, some beliefs are understood as ideas, convictions, and attitudes taken by individuals towards health and that influence their quality of life, including the lack of NCD control as a result of non-adherence on the part of those who do not believe in pharmacotherapy. This condition makes beliefs an extremely delicate associated factor that needs to be explored by health professionals[11,29].

The education of the older person is important for understanding the health-disease processes and for analyzing and understanding adherence. Although no association between the education level and non-adherence was found, it should be noted that in all studies a profile of low education was identified. It is important to consider that low education can lead to a poorer understanding of what is prescribed in consultations and appointments, as well as less initiative to adopt essential routine behaviors such as the use of medications[5,30].

The magnitude of social inequalities in health in Brazil is reflected in the profile and behavior of use and adherence to pharmacotherapy. Thus, adherence is worse mainly among people with worse income and education conditions. Data from the National Survey on Access, Use, and Promotion of the Rational Use of Medications (PNAUM), the first and most recent population-based survey, identified a 20.2% prevalence of non-adherence to pharmacotherapy for chronic diseases in Brazil, mainly heart diseases and metabolic diseases. This prevalence is unevenly distributed. In the Northeast region, non-adherence is 27.8% while in the South region of the country it is 17%. These regional disparities are directly related to worse access to medicines and lower use of healthcare services when compared to other regions[5,31].

Linked to this Brazilian social panel, several aspects related to medications can be identified as factors associated with non-adherence. Many older people with multi-morbidities often take many medications daily, which exposes them to polypharmacy - which is the concomitant use of five or more medications - and its consequences such as a higher incidence of adverse reactions, cumulative toxicity, iatrogenic events, potential drug interactions, and non-adherence to the pharmacotherapy[12,17,18,32,33]. A study carried out by Arruda et al.[34] with older people from an outpatient clinic in Vitória (ES) showed that 61.4% of non-adherents deal with polypharmacy. This scenario is complex and can be avoided by encouraging the rational use of medication at individual and collective levels and with a multidisciplinary follow-up[34].

Another factor associated with the older person's non-adherence to pharmacotherapy is the use of potentially inappropriate medications[14], those presenting more use problems than clinical benefits due to changes in pharmacokinetic and pharmacodynamic responses as a result of the aging process. When associated with a condition of polypharmacy, the use of these medications considerably increases the manifestation of adverse events that make the patient abandon or interrupt the treatment[35]. Furthermore, the selection and prescription of medications for older people are critical points to be assessed by the management of pharmaceutical care and by prescribers, aiming to ensure patient safety in PHC[36,37].

Going against the idea of a robust PHC that should have universal coverage in the Brazilian territory, the socioeconomic condition ends up being an important marker of the profile of its users who are mostly from a lower socioeconomic level. Thus, access to and purchase of medications are one of the most worrying factors associated with non-adherence in the daily lives of older people, as many depend exclusively on the medications provided by the healthcare service they attend to continue the treatments[38].

Difficulties in accessing and purchasing medications or their lack were identified as factors for non-adherence in most studies, which shows their relevance for compliant pharmacotherapy. Considering the assumptions and objectives to guide a robust and resolute PHC, the medications prescribed must be standardized by the pharmacy of the basic healthcare unit and identified by the active ingredient with complete dosage and use prescription. Divergent situations may culminate in non-adherence problems, whether due to lack of financial condition for purchase, low level of trust in the health professional, or even lack of information to purchase and follow the prescription[38-40].

The Morisky-Green Scale (4 items) was the most frequently used instrument[10,12-16,18]. It is a psychometric scale with four items to which respondents respond dichotomously (yes/no), and the user classified as adherent is the one whose all responses were negative. Currently, it is the most used instrument in Brazil, and its wide choice is due to its easy application and low cost[8].

Regarding the prevalence measurement of non-adherence to pharmacotherapy, several methods can be used, such as interviews, pill counting, dispensing control, therapeutic monitoring, semi-structured questionnaires, among others. The diversity of instruments used to assess the outcome is a challenge for the comparative analysis of the findings. However, it should be noted that the method of choice is often based on the availability of the healthcare service budget, the availability of health professionals, the methodological and operational attributes of a survey, or even the profile of the population to be evaluated[41].

With the significant progress of pharmaceutical care in recent years and the enactment of several policies related to the area and context of the pharmacist's work, the importance of pharmaceutical care, especially for the older population in PHC becomes clear. This relevance is based on the possibility of the pharmacist monitoring individuals regarding the use of medications and identifying problems related to them. Based on this survey, the pharmacist proposes interventions in the use of medications and proposes interventions after the identification of each problem related to it to optimize the effectiveness and safety of the therapeutic treatments[42,43].

One of the proposals of pharmaceutical care is to enable the pharmacist to follow up and monitor the patient's use of medications, thus allowing a continuous assessment of adherence to pharmacotherapy and the adoption of different strategies for safe and rational adherence[42,43]. It is important to emphasize that the older person assisted by pharmaceutical care has all the necessary support to encourage adherence, as is the case in the city of Curitiba (PR), where PHCs offer it to all users and shows good and positive results on their health[42-44].

Therefore, the provision of pharmaceutical care is a potential investment and improvement that converges with the principles of SUS and reflects on the constant encouragement of healthy aging with health education proposals to assist on the older person's autonomy. Non-adherence to pharmacotherapy reflects a failure to control diseases and negative consequences for health in the short and long term, generating possible unexpected and additional expenses for SUS, and reflecting new health needs, hospitalizations, and the use of new technologies and resources[43,44].

Despite the adoption of all the methodological rigor involved in a systematic review, some limitations deserve consideration: the use of only an electronic library and database that make papers available for free, the small number of studies found, the heterogeneity between the outcome measurement methods and the analysis of adopted data that made it impossible to carry out a meta-analysis. Also, there is a discrepancy in the methods of statistical analysis used, and some studies[15,16,18] do not advance towards a more complex and robust statistical analysis, such as multivariate regression analyses. However, at the same time that these elements are configured as limitations, they are also signs of the need to deepen the discussion.

The critical assessment of the methodological quality of the studies included according to Loney's proposal points to high quality for all studies included. However, it should be noted that although the sampling criteria have been well delineated, the existence of biases in the sample selection and biases in the reporting of methodological processes is potential, as in studies[15,17] in which only participants living in the urban area were selected and a study considering only units with the Family Health Strategy to comprise the sample. It should also be noted that some of the studies[10,11,18] focus on specific health conditions such as Systemic Arterial Hypertension[10,18] and Diabetes Mellitus[11].

Therefore, studies investigating aspects of the older person's health in healthcare services require investments and continuous investigations to spread the expanded concept of health and meet the health needs of this population in line with

the attributes of the PHC such as longitudinality, comprehensiveness, accessibility, and coordination of care. Understanding the factors associated with the older person's non-adherence to pharmacotherapy has the potential to contribute in the field of public health and pharmaceutical care to a continuous search for quality of care in PHC and the effective implementation of public health policies for the older person[22,45-47].

CONCLUSION

The results point to difficulties in accessing medications, multimorbidities, polypharmacy, the use of potentially inappropriate medications for older people, the degree of trust in the health professional, beliefs, negative self-perceived health, and functional disability as the main factors associated with non-adherence to pharmacotherapy.

Note that these factors are subject to interventions as long as intersectoral policies focusing on individuals during their whole life are adopted, as well as strategic actions implying a new model of health care centered on the person, on the development of bonds, on the co-responsibility of care, and on the subjects' autonomy. Said model inversion becomes central from the strengthening of the PHC.

The high prevalence of non-adherence to pharmacotherapy in the Brazilian older population in the context of PHC is a reality. This situation imposes the need for health interventions based on comprehensive care, health promotion in its broadest sense, encouraging the rational use of medication, and adherence to pharmacotherapy to contribute to the quality of life of the older person and to guarantee active and healthy aging.

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Predictive physical frailty markers of depressive symptoms in older people in primary health care

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Abstract

Objective: to identify which markers of physical frailty predict depressive symptoms (DS) in old people assisted in Primary Health Care. *Method:* this is a quantitative, descriptive, and correlational cross-sectional study was carried out at the Basic Health Unit in Curitiba, (PR), Brazil, with a sample of 389 old people. Data were collected from January to October 2019, using a sociodemographic and clinical questionnaire, depression scale (Center for Epidemiological Studies) and to evaluate the phenotype of Frailty. The statistical analyzes were performed using descriptive statistics, inferential statistics (Pearson's chi-square), with statistical significance level $p < 0.05$, and logistic regression, reporting the estimate, *p* value (Wald test), Prevalence Ratio with a 95% confidence interval. *Results:* of the 389 old people, 103 (26.5%) had DS; among these 63 (61.2%) were pre-frail, 19 (18.4%) frail and 21 (20.4%) non-frails. The markers fatigue/exhaustion ($p \leq 0.001$) reduced level of physical activity ($p \leq 0.001$), unintentional weight loss ($p=0.003$) and the condition of pre-frailty and frailty were associated with DS s ($p=\leq 0.001$). The final predictive model for DS included the markers of fatigue/exhaustion (PR 5.11; 95%CI; 3.81-6.87; $p<0.0001$) and reduced level of physical activity (PR 2.16, 95%CI %; 1.45-3.22; $p<0.0001$). *Conclusion:* the markers of fatigue/exhaustion phenotype and reduced physical activity are predictors of DS in the old people. This result highlights the importance and need to assess these markers, and the effectiveness of actions to combat sedentary lifestyle in the old people in primary health care.

Keywords: Frail elderly. Depression. Frailty. Primary Health Care.

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INTRODUCTION

Physical frailty in older people is considered a geriatric syndrome and has become a concern for public health, due to the increase in the population's life expectancy. This syndrome presents itself as a multidimensional condition, compromising different biological functions. It was also defined by experts as a "clinical condition characterized by an increase in vulnerability in the individual, when exposed to internal and external stressors", in addition to being one of the main contributors to functional decline and early mortality in older people[1].

The identification of frailty through physical phenotype includes the assessment of five markers: unintentional weight loss, self-reported fatigue/exhaustion, reduced level of physical activity, decreased gait speed and handgrip strength. The quantity of identified markers classifies older people as non-frail (none), pre-frail (one or two) or frail (three or more)[2].

Frailty has an expressive prevalence in older people in the community. A systematic review with meta-analysis analyzed a sample of 13,392 individuals (≥65 years) from 22 European countries and identified 18% of frail older people[3]. In South America, there is a study that included Brazil, Chile, Peru, Colombia, Ecuador, Argentina and Venezuela, which identified an average prevalence of 21.7% of frailty, with one in five older residents in the community being identified as frail[4].

Although the phenotype is physical, the multifactorial frailty allows us to observe the relationship with cognitive, psychological and social functioning aspects[5]. The relationship between frailty and psychosocial factors was investigated in a study with meta-analysis that included 8,023 individuals. Frail individuals were twice as likely to develop depression (OR: 2.64; 95% CI: 1.59-4.37), compared to non-frail, and those with depression were three times more likely to develop frailty (OR:3.72; 95% CI: 1.95-7.08), which demonstrates the bidirectional relationship between the conditions[6].

Similar to frailty, Depressive Symptoms (DS) are also common in the aging process. Furthermore, studies show related to frailty markers, as older people in this condition can reduce the level of physical activity, decrease strength and present fatigue/exhaustion[7]. Also, loss of interest, decline in functional capacity and social participation, with a tendency to isolation, are common[8].

The potential impact of DS and incident frailty in older people was investigated in a study carried out in Latin American countries (Cuba, Dominican Republic, Mexico, Venezuela, Puerto Rico and Peru) in a cohort of 12,844 older people. The results showed a reciprocal relationship between both conditions and an increased risk of 59% (HR=1.59; 95% CI: 1.40-1.80) older people with DS to develop frailty[9].

The prospective relationship between increased risk of frailty and DS and the reciprocal interaction between conditions were demonstrated by studies that identified, in addition to somatic symptoms, the association between the condition and some markers in relation to DS. Among them, fatigue/exhaustion, reduced gait speed, decreased physical activity, unintentional weight loss, comorbidities and cognitive and functional impairments are frequent[10]. As well as the markers, the frailty condition was also investigated in the cross-sectional and longitudinal analysis in a study carried out in China with 1,264 older people. There were associations between the pre-frail and frail condition, in addition to the handgrip strength marker with the occurrence of DS in older people[11].

Experts considered it necessary to evaluate the symptoms presented by the older people, especially in relation to fatigue/exhaustion and its causes, since this component proved to be the first symptom to manifest in older adults[1].

Clarifying the relationship between frailty and DS has important implications for understanding the factors that contribute to the etiology and prognosis of these variables. The emphasis on the markers of the physical frailty phenotype is relevant, since, in some studies, there is a predominance of them, however, there are few studies on how they behave in predicting DS and in the frailty condition of the older people.

Based on the above, the aim of the study was to identify which markers of physical frailty can predict DS in older people assisted in Primary Health Care.

METHOD

This is a cross-sectional, correlational study, carried out in a Basic Health Unit (UBS) that makes up the Primary Care network in the city of Curitiba (PR), Brazil, from January to October 2019. The UBS was elected among 110 other units in the municipality, as it has a population of 23,890 people with an active registry, 4,439 of which are older people, representing 18.58% of the enrolled population.

Participants were older people of both sexes, aged over 60 years, registered and residing in the coverage area of the UBS. The non-probabilistic sample, representative of the population of older people attended at the UBS, was defined by a sample calculation that indicated 354 older people, to whom 10% was added due to the possibility of losses, the final sample consisted of 389 older people. A confidence level of 95% (CI=95%) was considered, with a significance level of 5% (α=0.05).

The older people were invited to participate in the research individually, according to the demand for care at the UBS. The objectives and ethical aspects of the research were explained. After solving any doubts, the older people and caregivers signed the Informed Consent Form (ICF).

The following inclusion criteria were defined: being 60 years old or older, of both sexes; reside in a household registered with the UBS; presenting cognitive capacity identified by the Mini Mental State Examination[12] according to cutoff points proposed according to education[13] or being accompanied by a family caregiver at the time of data collection, when not presenting cognitive capacity to answer the questionnaires.

Older people residing in long-term institutions or physically incapable of performing the proposed tests, being in a wheelchair or presenting amputation of lower and/or upper limbs were excluded.

Three previously trained researchers applied the Mini Mental State Examination (MMSE), and later data collection was performed using a sociodemographic and clinical questionnaire, depression scale and Physical Frail assessment tests. As measures to minimize risks and protect the older participants, the handgrip strength and gait speed tests were applied by two researchers simultaneously, to promote greater safety and avoid an episode of the participant's fall during the performance of the gait speed test.

The sociodemographic and clinical characterization consisted of the covariates: age, sex, education, marital status, family income, existing and/or self-reported morbidities. The *Center for Epidemiological Studies* (CES-D) scale was used to screen for depressive symptoms. The Scale contains 20 items on mood, somatic symptoms, interactions with others and motor functioning. The answers are in Likert scale, and the score varies from 0 to 60 points. Older people with a score of 12 to 60 is indicative of the presence of DS[14].

To assess physical frailty, the five markers of the Fried[2] phenotype were considered, which classifies individuals with three or more criteria as frail; pre-frail, with one or two criteria; and those that do not have any of the following components are non-frail: reduced handgrip strength (HGS), reduced gait speed (GS), fatigue/exhaustion, unintentional weight loss, and reduced level of physical activity.

HGS was measured using a Jamar® hydraulic dynamometer, considering the average of the three measurements taken by the older people, those who comprised the lowest strength quintile were considered frailty markers[2]. For the assessment of GS, the older person was instructed to walk, in the usual way, counting the distance of 4.6 meters. After adjusting for sex and median height, those with the lowest quintile were considered fragile for this component[2].

Fatigue/exhaustion was identified by self-report, according to the older person's response to items 7 and 20 of the *Center for Epidemiological Scale - Depression* (CES-D)[14], (A) felt that they had to make an effort to cope with their everyday tasks; and (B) felt that they couldn't get on with their things. Unintentional weight loss was verified by the body mass index (BMI), calculated from anthropometric measurements and associated with the older person's self-report. Weight loss greater than or equal to 4.5 kg in the last twelve months was considered unintentionally (no diet or exercise)[2].

The reduction in the level of physical activity was assessed using the *Minnesota Leisure Activity Questionnaire*, validated for Brazilian older people[15], which includes questions regarding the frequency and duration of activities performed in the last year.

Data were organized and presented by descriptive statistics (absolute and relative frequency), inferential (Pearson's chi-square) with a statistical significance level of $p \leq 0.05$). Logistic regression models with different structures in the linear predictor were adjusted. At first, a model was carried out, individually, for each marker of physical frailty and the condition of physical frailty in relation to DS. Then, the effect of markers on DS was jointly evaluated, adjusting a single model with selection of variables (*backward*) using the Likelihood Ratio Test (LRT) at the 5% level. For the models, the estimate and p value (Wald test), the Prevalence Ratio (PR) with a 95% confidence interval were reported, as well as the measures of accuracy, sensitivity, specificity, and the Cox and Snell, and Nagelkerke of Mc Fadden Pseudo R^2 coefficients.

The study followed the recommendations contained in Resolution No. 466/2012 and Resolution No. 510/2016. Afterwards, it was referred to the Ethics Committee of the Health Sciences Sector of the Federal University of Paraná, which received a favorable opinion under number 2,918,847.

RESULTS

Of the 389 participants, a mean age of 70.45±6.87 years (60-94) was identified. There was a predominance of females (n=255; 65.6%), with low education (n=138; 35.5%), married (n=187; 48.1%), with a family income of 2-4 minimum wages (n=156; 40.1%). As for the frailty condition, 186 (47.8%) older people were pre-frail, 169 (43.4%) non-frail and 34 (8.8%) frail.

DS were observed in 103 (26.5%, 95%CI; 22.2%-31.2%) of older people. Among them, and there was a predominance of pre-frail (n=63; 61.2%), followed by non-frail (n=21; 20.4%) and frail (n=19; 18.4%) (Table 1).

Regarding the frailty markers, fatigue/exhaustion, reduced level of physical activity and unintentional weight loss were associated with DS, as shown in Table 1.

The frail condition was also associated with DS ($p<0.001$). The logistic regression model of the frailty condition in relation to DS indicated that the prevalence of DS in pre-frail older people was 2.6 times when compared to non-frail older people ($p<0.001$). In the frail condition, the prevalence of DS was 3.4 times that of non-frail older people. Compared to pre-frail, frail older people still had 1.85 times more DS (Table 2).

Table 3 shows the regression analysis with models independently adjusted for each frailty marker in relation to depressive symptoms. In the analysis of the five frailty components, three had statistically significant *p*-values: fatigue/exhaustion ($p<0.001$) unintentional weight loss ($p<0.003$) and reduced physical activity ($p<0.001$). Of these, the model with the fatigue/exhaustion covariate obtained better (and higher) coefficients of qualitiy of adjustments measures.

The final regression model, after selecting the variables, showed that an older person with fatigue/exhaustion had a 5.11 times higher prevalence of DS when compared to another older person who does not have this frailty marker. The model also includes the reduced level of physical activity marker, indicating that an older person in this condition had a 2.16 times higher prevalence of DS compared to those without a reduction in physical activity (Table 4).

When considering the covariates age, sex, education, marital status and family income and the frailty markers in the regression model, only fatigue/exhaustion and reduced level of physical activity remained in the model, showing that the results are independent of sociodemographic covariates.

Table 1. Absolute and relative frequency distribution and association between markers, frailty condition and SD of older people. Curitiba, Paraná, Brazil, 2020.

Frailty markers	Frailty Condition	Depressive symptoms (n= 389)		*p* Value
	n (%)	Yes n=103	No n =286	
Decreased Hand Grip Strength				0,076
Yes		28 (27.2%)	54 (18.9%)	
No		75 (72.8%)	232 (81.1%)	
Reduced Gait Speed				0.491
Yes		10 (9.7%)	35 (12.2%)	
No		93 (90.3%)	251 (87.8%)	
Fatigue/Exhaustion				<0.001*
Yes		52 (50.5%)	14 (4.9%)	
No		51 (49.5%)	272 (95.1%)	
Unintentional weight loss				0.003*
Yes		32 (31.1%)	49 (17.1%)	
No		71 (68.9%)	237 (82.9%)	
Reduced level of physical activity				<0.001*
Yes		37 (35.9%)	45 (15.7%)	
No		66 (64.1%)	241 (84.3%)	
Frailty Condition				<0.001*
non-frail	148 (51.7%)	21 (20.4%)	169 (43.4%)	
pre-frail	123 (43.0%)	63 (61.2%)	186 (47.8%)	
Frail	15 (5.2%)	19 (18.4%)	34 (8.7%)	

* Chi-square test, p≤ 0.05

Table 2. Regression model of the frailty condition in relation to the DS of older peple. Curitiba, Paraná, Brazil, 2020.

Frailty Condition	Estimate	PR	CI for PR (95%)	*p* Value	Adjustment quality measures		
					Coxsnell R^2 (%)	Nagelkerke R^2 (%)	McFadden R^2 (%)
Pre-frail/Non-frail	1.283	2.610	1.707-3.991	<0.001			
Frail/ Non-frail	2.189	3.373	2.407-4.706	<0.001	9.310	13.586	8.453
Frail/Pre-frail	0.905	1.853	1.186-2.896	0.017			

PR: Prevalence Ratio; CI: Confidence Interval, R^2 Coxsnell, R^2 Nagelkerke, Pseudo R^2 Mcfadden.

Table 3. Regression models for the older person's DS independently adjusted for each marker of physical frailty and qualitiy of adjustments measures. Curitiba, Paraná, Brazil, 2020.

Frailty marker	Estimate	PR	CI for PR (95%)	*p* Value	Adjustment quality measures		
					Coxsnell R^2 (%)	Nagelkerke R^2 (%)	McFadden R^2 (%)
Decrease in handgrip strength	0.472	1.397	0.975-2.001	0.078	0.773	1.128	0.671
Reduced Gait Speed	-0.259	0.822	0.463-1.458	0.492	0.125	0.183	0.108
Fatigue / Exhaustion	2.986	4.989	3.766-6.610	<0.001	22.611	32.996	22.174
Unintentional weight loss	0.779	1.713	1.222-2.403	0.003	2.138	3.120	1.869
Reduced level of physical activity	1.099	2.098	1.523-2.891	<0.001	4.327	6.315	3.827

PR: Prevalence Ratio; CI: Confidence Interval, R^2 Coxsnell, R^2 Nagelkerke, Pseudo R^2 Mcfadden. PR and CI(95%) were calculated from the linear predictor and are in the Prevalence Ratio (PR) scale.

Table 4. Predictive variables of the final predictive model of depressive symptoms. Curitiba, Paraná, Brazil, 2020.

Frailty marker	Estimate	aPR	CI for PR (95%)	*p* Value	Adjustment quality measures		
					Coxsnell R^2 (%)	Nagelkerke R^2 (%)	McFadden R^2 (%)
Fatigue/Exhaustion	2.983	5.116	3.811-6.869	<0.0001	24.986	36.462	24.870
Reduced Physical Activity Level	1.092	2.160	1.450-3.218	<0.0001			

aPR: Adjusted Prevalence Ratio; CI – Confidence Interval, R^2 Coxsnell, R^2 Nagelkerke, Pseudo R^2 Mcfadden; aPR and CI(95%) were calculated from the linear predictor and are in the Prevalence Ratio (PR) scale.

DISCUSSION

The present study investigated which markers of physical frailty can predict the occurrence of DS in older people. Predictive analyzes indicated a greater chance of older people who present fatigue/exhaustion and a low level of physical activity to develop DS. Furthermore, the frailty condition, obtained through these and other markers, explain that the higher the level of the frailty condition, the greater the chance of developing DS. There was a prevalence of the fatigue/exhaustion marker among older people with DS, followed by a reduction in the level of physical activity and unintentional weight loss.

The prevalence of DS among older people was higher than the national average, estimated in a systematic review with meta-analysis carried out with older people living in the community[16]. Lower estimates have been identified in national and international literature. In Pelotas (RS), researchers estimated the prevalence of DS at 15.2%[17], 14.2% in São Paulo (SP)[18], 9.8% in Australia and 5.0% in the USA[19]. The variability of DS percentages among older people in different Brazilian cities is due to the different methods used to classify DS, the instruments used and the characteristics of the samples[16].

There was a predominance of females in the sample of older people with depressive symptoms. This result was consistent with other studies that showed women at higher risk of developing DS compared to men[20,21].

Although the highest prevalence in females is not universal, women experience more the accentuated progression of DS over time[22]. This high frequency of DS among women suggests their greater social vulnerability in relation to men. This condition can be explained by physiological and hormonal differences, low level of education, low income and sociocultural issues[23].

The proportion of older people in the frail condition was analyzed in the general sample (n=389) and it was observed that the percentages of pre-frailty and frailty were high among older people with DS. Both conditions (frail and pre-frail) were associated with depressive symptoms.

The cross-sectional associations between pre-frailty, frailty and depressive symptoms verified in this study were also observed in Brazilian research with 2,042 community-dwelling older people that analyzed the relationships between the presence of depression and specific DS and conditions of pre-frailty and frailty. The results also indicated the association between DS and the frail condition (p<0.001)[24].

The mechanisms of associations between frailty and depressive disorders are still unclear and hampered by the overlapping symptoms. Frail older people can more easily develop DS due to impaired functionality, low physical activity and social activities. At the molecular level, frail older people may have increased levels of low-grade inflammation, such as increased cytokines of interleukin-6, C-reactive protein, or tumor necrosis factor-α, which may act as moderate risk factors for onset of DS [11,25].

The fatigue/exhaustion, reduced level of physical activity markers showed a strong association with DS. Changes in motor behavior, such as weakness associated with depression, can contribute to the low level of physical activity. A study carried out in Japan, with 3,191 older people in the community, showed that physical activity was associated with a reduced risk of DS regardless of the frequency and duration of the activity[26]. Physical activity performed individually or in groups involves feelings of pleasure, self-esteem, fun, facilitates the change of focus from pain and loneliness, relieves tension. Thus, older people should be encouraged to engage in physical activities in their daily lives.

It is considered that depressive symptoms and physical frailty have a negative impact on physical and psychosocial functioning, loss of independence and autonomy of the older person. The inclusion of practices that aim to minimize or avoid such health conditions becomes necessary at different levels of care, especially in Primary Health Care.

In the study, it was observed that the greater the frailty condition, the greater the chance that the older person would have DS. These results corroborate the cross-sectional study carried out in Singapore, with a sample of 721 community older people aged 60 years or over. The study identified a prevalence of frailty in 24.5% of older people and an independent association between the level of frailty and DS. It was found that with the increase in the level of frailty severity, the older peple reported substantially higher DS scores[25].

In the present study, frailty was identified as a predictor of DS in older people. Similar data were found in a systematic review study that identified the level of frailty as a longitudinal predictor of depressive symptoms. The study observed that one in ten older people had DS, and identified a high percentage of older people with DS and in the frail condition[27]. It is noted that the importance and need to observe that the presence of DS affects behavior and levels of physical activity in older people, with a consequent reduction in social participation, risk of depression and increased frailty.

The presence of the reduced physical activity level marker in the model gives the older person a 2.16 times higher prevalence of DS, compared to those without the respective marker. Evidence points to physical activity as a protective factor for DS [28,29]. The benefits of physical activity for health maintenance in older people have been consistent with positive results or associations in mood, self-esteem and a lower occurrence of DS.

As for the association between fatigue/exhaustion and DS, it was also identified in other studies in the literature, being considered an important indicator of decline related to aging and strongly associated with negative health events[18,30].

The predictive models analyzed confirm the importance of assessing fatigue/exhaustion and the low level of physical activity for preventing the development of DS in community-dwelling older people. The approach in clinical practice with a

focus on fatigue and exhaustion and the low level of physical activity are essential for screening older people at risk of DS both in the context of Primary Health Care, as well as in outpatient networks that serve users in this age group.

Fatigue/exhaustion by self-report should be a priority in clinical practice and in gerontological care, directing greater attention to this condition, given the adverse health outcomes of older people, such as physical inactivity, falls, hospitalization and poorer quality of life[31].

Due to the scarce energy reserve, exhaustion is common, which is sometimes admitted as a symptom of old age, however it can come from DS and the first signs of poor prognosis of frailty[1,32]. These are measurable and modifiable conditions if identified early, which contributes to the prevention and minimization of outcomes such as DS and frailty in the older people population.

The causality of the presence of DS in older people evaluated in this research is unknown, but the strong association with frailty markers that act in a disabling cascade, with an impact on the older person's autonomy and the potential development of DS suggests the importance of self-reported frailty assessment and causes of fatigue/exhaustion.

As limitations of the study, it is noteworthy that the data were obtained in a cross-sectional study. Thus, inferences about the causality of the relationship between predictor variables and DS should be made with caution, since this is a research with results from a local population in the region of Curitiba, Paraná. Another limitation refers to instruments with self-report questions to assess DS, which can lead to biases due to the need for the older person to report feelings and/or memories. The *Minnesota Leisure Time Activities* instrument to assess the level of physical activity contains activities that are not compatible with the reality of the Brazilian population, which can impact the measurement of energy expenditure in older people.

CONCLUSION

The condition and frailty markers fatigue/exhaustion and reduced level of physical activity were predictors of depressive symptoms (DS) in older people. Pre-frailty and frailty were higher in older people with DS in the studied sample.

Pre-frailty was shown to be a prevalent condition among older people in which symptoms of fatigue and lack of energy and interpersonal sensitivity are added to a decrease in positive affect. Once the frail and pre-frail older person is identified, it is important to consider the strong relationship between these conditions.

The fatigue/exhaustion and reduced level of physical activity frailty markers were shown to be predictors of DS in older people, the first being the one with the greatest predictive power.

DS can present impaired screening due to the subjectivity of reported symptoms. The screening of physical frailty, in turn, is carried out with a focus on the physical dimension of the older person, which facilitates the diagnosis and directs health care. In this context, the importance of implementing screening for physical frailty in primary health care is highlighted.

These results favor the Geriatric and Gerontological practice, since when evaluating the causes of common complaints related to fatigue and the reduction of activities of daily living, the professional identifies changes early, and enables assertive behaviors for frail and pre-frail older people with increased risk for developing depressive symptoms. Actions can be aimed at encouraging the practice of physical exercise and through the implementation of actions to improve the management of frailty, which provide the prevention of DS. Thus, considering the modifiable relationship that exists in them, actions are taken to prevent or delay these conditions in older people.

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Association of self-perceived quality of life and health, physical activity and functional performance among older adults in the interior of Brazil

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Abstract

Objective: to analyze self-perception of health and quality of life associated with contextual factors in non-institutionalized older adults people in a rural municipality in the interior of Brazil. *Method:* Cross-sectional population-based study. Individuals aged 60 years or more, not institutionalized, living in a municipality with rural characteristics were included. Sociodemographic variables, self-perceived health and quality of life, level of physical activity and functional performance were used. Data were collected at home with application of interviews and instruments: WHOQOL BREF, International Physical Activity Questionnaire (IPAQ) and Timed Up and Go test (TUG). For the comparison and association analysis, the chi-square or Fisher's exact test and the Prevalence Ratio (PR) and confidence intervals (CI) were applied. *Results*: The study involved 142 older adults, 58.5% female, with a mean age of 72.4 (±8.0) years. Self-perceived health was associated with the practice of physical activity (PR=1.13, CI=1.01-1.27) and with functional performance (PR=1.24, CI=1.03 -1.48). The perception of good/very good health (PR=1.66, CI=1.57-1.76) and quality of life (PR=1.70, CI=1.60-1.79) was associated with positive to the practice of physical activity and functional independence. *Conclusion:* The practice of physical activity and maintenance of functional independence significantly contribute to a positive perception of health and quality of life. However, elderly people who are insufficiently active and independent may also have a good perception of health. Interventions in public policies that consider the intrinsic characteristics of each population are recommended, aiming to maintain or improve the perception of health and quality of life of the elderly.

Keywords: Aged; Self perception; Motor Activity; Functional physical performance; Health of elderly; Rural population.

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INTRODUCTION

The aging process is influenced by biological, environmental and psychological factors[1] and causes different changes that can impact the individual's life, their perception of health and quality of life[2]. Healthy aging can be considered a process of development and maintenance of functional capacity that enables well-being in old age[1].

Understanding the relationship between health, quality of life and functional capacity in the face of declines associated with aging is a challenge to offer better care to this population[3]. An active lifestyle contributes to the reduction of physical limitations and maintenance of the older person's autonomy, in addition, physical activity is shown to be a relevant factor for conditions of positive perception of quality of life and health[4]. Physical activity can be influenced by the place of residence[5] and reflect on individual and collective health.

Brazilian older people living in rural areas receive little attention, as the largest public investments in health are concentrated in urban settings[6]. Generally, studies address isolated topics such as physical activity[7,8], functional performance[9,10] and self-perception of health or quality of life[4,11], without analysis of possible associations capable of affecting the experience of these specific populations. Perceived health is associated with the perception of quality of life and consists of feeling good even in the presence of diseases that cause some impediment to the performance of skills and abilities[4].

Therefore, the objective of this study was to analyze the self-perception of health and quality of life associated with contextual factors in non-institutionalized older people in a rural municipality in the interior of Brazil..

METHOD

Cross-sectional, population-based study with an older population residing in a municipality in the interior of Brazil. The municipality of Trombas is located in the State of Goiás, in the Center-West region of Brazil, 418 kilometers from Goiânia, with an estimated population of 3,572 inhabitants. It also has a degree of urbanization below 75% and a population density of 4.32 inhabitants per square kilometer, characterizing it as a rural municipality[12].

The calculated sample size considered the size of the older population residing in the municipality (for the finite population correction factor) equal to 518, estimated frequency of physical activity practice of 67.0%[13], confidence limit of 5% and effect size equal to one. The sample size calculated was 206 individuals, considering a non-response rate of 10% after two attempts.

Older people aged 60 years or more, living in the city for at least five years and who had a preserved state of cognition for understanding simple commands, such as saying their full name, date of birth and expressing interest in participating in the research, were included. Those who were not located for data collection or who refused to participate in the study or who were in a situation of distance due to travel or hospitalization were excluded. All regions of the city were considered for data collection, the visits in each region occurred in different weeks, repeating only a second time according to the collection time, in situations where the older person was not located in the first visit.

Initially, 380 older people were identified with a record carried out by the family health teams of the Municipal Health Department. During the period from March 4th to July 26th, 2019, totaling 21 weeks of collection, 265 older people were visited, representing 69.7% of those registered and, of these, 142 (53.6%) accepted the invitation to participate in the research, a loss rate twice as high as expected.

Data were collected during home visits carried out by the researcher, registered in a database and the individual approach was standardized with the application of specific forms to collect sociodemographic information (gender, age group, education, marital status, skin color and individual income) and validated instruments to assess functional performance, physical activity and self-perception of quality of life and health.

The first two generic questions of the *World Health Organization Quality of Life bref* (WHOQOL BREF) questionnaire were used to assess self-perceived health and quality of life[14]. The first question is related to the self-perception of quality of life in general and the second, the individual's perception of their own health[14]. The answer scores range from 1 to 5 on the Likert Scale (1=very bad; 2=bad; 3=fair; 4=good; and 5=very good) or in percentage scores ranging from 0 to 100. The higher the score, better perception of quality of life and perception of health of the evaluated[14]. The results obtained were classified as bad/very bad, fair and good/very good.

The International Physical Activity Questionnaire (IPAQ), a long version adapted for older people, was used to assess the participants' level of physical activity. This instrument makes it possible to estimate the weekly time spent on physical activities of different intensities and in different everyday contexts[15]. It is an instrument applied internationally and validated for the Brazilian older people population[15]. The IPAQ adapted for older people is composed of five domains, with 15 questions. The instrument's questions include activities practiced at work, in transport, at home or in the garden and those performed at leisure, including walking, exercise or sport[16].

To categorize the IPAQ results, the classification in minutes/week[16] was used, considering as sufficiently active those who practiced at least moderate activity, at least 150 minutes per week; lower scores were classified as insufficiently active[17]. Sufficiently active older people were further categorized into those who performed leisure activities and those who performed activities at work or household chores.

To verify the functional performance, the *Timed "Up & Go" Test* (TUG) was used, which classifies the individual's functionality into categories, informing about their balance, gait speed and functional abilities[18]. The test measures, in seconds, the time required for the individual to get up from a standard armchair (height of approximately 46cm), walk a distance of 3 meters, turn around, walk back to the chair and sit again[18]. The test was applied three times on the same day (with a two-minute interval between tests), with each participant, and the best result was chosen as the final score. The following classification was considered for both genders: independent individual in activities of daily living (ADLs) (performs the test within 20 seconds) and dependent in ADLs (over 20 seconds)[18].

To perform statistical analysis, the significance level was set at $p<0.05$. Variables were descriptively analyzed using relative and absolute frequency, as well as measures of position and dispersion. Quantitative variables were presented as mean and standard deviation or as median and interquartile range (IQ) Q1 - Q3 (25% - 75%). Comparisons of proportions were made using the chi-square test or Fisher's exact test. As a measure of association, the Prevalence Ratio (PR) with a 95% confidence interval (CI) was used. Regression models were run and analysis strategies were applied to unveil possible results from the collected data. One of the missing assumptions for applying multiple regression was the frequency distribution of data in categorical variables.

Functional performance and physical activity level were aggregated, generating the following classification: sufficiently active and independent; sufficiently active and dependent; insufficiently active and independent and insufficiently active and dependent. Older people who were sufficiently active were identified, within this group there were those who were also independent and those who were dependent on their ADLs. Similarly, within the group of insufficiently active older people, those who were independent and those who were dependent on their ADLs were verified.

All study participants signed the Informed Consent Form and the project was approved by the Research Ethics Committee of the Hospital das Clínicas of the Federal University of Goiás, with opinion No. 3,157,986 and CAAE protocol: 03823418.4.0000.5078.

RESULTS

The final study sample consisted of 142 older people, which represented 37.4% of those registered in the Family Health Strategy in the city. Mean age

was 72.4 (±8.0), minimum 60 and maximum 97 years; median age of 71.5 years (IQ: 66–79 years), similar between sexes.

Female participants and younger older people (between 60 and 69 years of age) had a higher proportion. In addition, it was found that 38.7% of the older people attended from one to three years of formal school, 53.5% were married and most were retired (Table 1).

There was no significant association between sociodemographic variables and self-perceived health or quality of life categories (Table 2).

Table 1. Sociodemographic characteristics of the sample (n=142). Trombas, GO, 2019.

Variables	n (%)
Sex	
Male	59 (41.5)
Female	83 (58.5)
Education	
Never went to school, but knows how to read and write	21 (14.8)
Never went to school and can't read and write	17 (12.0)
Attended 1 to 3 years of formal school	55 (38.7)
Attended from 4 to 6 years of formal school	25 (17.6)
Attended more than 6 years of formal school	24 (16.9)
Age group	
60 to 69 years old	58 (40.8)
70 to 79 years old	52 (36.6)
80 years or more	32 (22.6)
Marital status	
Separated/divorced	10 (7.0)
Single/widower	56 (39.5)
Married	76 (53.5)
Skin color	
White	34 (23.9)
Brown	91 (64.1)
Black	17 (12.0)
Yellow	-
Individual income (MW[1])	
Less than 1	3 (2.1)
1 to 2	128 (90.1)
2 or more	8 (5.7)
No own income	3 (2.1)
Retirement	
Retired	120 (84.5)
Not retired	22 (15.5)

[1] MW: minimum wage in effect at the time; value = BRL 998.00.

Table 2. Sociodemographic characteristics of the sample according to self-perception of health and quality of life among the older people (n=142). Trombas, GO, 2019.

Variables	Self-perception of health		*p* value *	Self-Perception of Quality of Life		*p* value *
	bad/very bad/ fair n(%)	Good /Very good n(%)		bad/very bad/ fair n(%)	Good /Very good n(%)	
Sex			0.981			0.595
Male	25 (42.4)	34 (57.6)		23 (39.0)	36 (61.0)	
Female	35 (42.2)	48 (57.8)		28 (33.7)	55 (60.4)	
Education			0.597			0.186
Never went to school, but knows how to read and write	11 (52.4)	10 (47.6)		7 (33.3)	14 (66.7)	
Never went to school and can't read and write	8 (47.1)	9 (52.9)		6 (35.3)	11 (64.7)	
Attended 1 to 3 years of formal school	20 (39.2)	31 (60.8)		23 (45.1)	28 (54.9)	
Attended from 4 to 6 years of formal school	10 (40.0)	15 (60.0)		7 (28.0)	18 (72.0)	
Attended more than 6 years of formal school	7 (29.2)	17 (70.8)		5 (20.8)	19 (79.2)	
Age group			0.101			0.068
60 to 69 years old	19 (32.8)	39 (67.2)		17 (29.3)	41 (70.7)	
70 to 79 years old	23 (44.2)	29 (55.8)		17 (32.7)	35 (67.3)	
80 years or more	18 (56.2)	14 (43.8)		17 (53.1)	15 (46.9)	
Marital status			0.929			0.857
Separated/divorced	4 (40.0)	6 (60.0)		4(40.0)	6 (60.0)	
Single/widower	25 (44.6)	31 (55.4)		21 (37.5)	35 (62.5)	
Married	31 (40.8)	45 (59.2)		26 (34.2)	50 (65.8)	
Skin color			0.128			0.413
White	17 (50.0)	17 (50.0)		15 (44.1)	19 (55.9)	
Brown	33 (36.3)	58 (63.7)		29 (31.9)	62 (68.1)	
Black	10 (58.8)	7 (41.2)		7 (41.2)	10 (58.8)	
Individual income (MW[1])			0.278			0.143
Less than 1	1 (33.3)	2 (66.7)		0 (0.0)	3 (100.0)	
1 to 2	56 (43.8)	72 (56.2)		51 (39.8)	77 (60.2)	
2 or more	1 (12.5)	7 (87.5)		0 (0.0)	8 (100.0)	
No own income	2 (66.7)	1 (33.3)		0 (0.0)	3 (100.0)	

[1] MW : minimum wage in effect at the time; value = BRL 998.00. * Chi square.

The proportion of older people who presented good or very good self-perceived health and self-perceived quality of life was higher compared to the other categories (Figure 1).

As for the practice of physical activity, of the total number of participants, 95 (66.9%) were classified as sufficiently active and 33.1% as insufficiently active. Among those sufficiently active, 55.8% performed some type of leisure activity and 44.2% performed activities related to work or household chores.

Regarding functional performance, the TUG test identified that 124 (88.6%) of the older people evaluated were independent in the ADLs.

Of the total of sufficiently active older people, 64.2% (p=0.012) had good or very good self-perceived health. However, no associations were found between the type of physical activity (leisure or work and tasks) and self-perceived health and quality of life. As for functional performance, 62.1% (p=0.018) of the independent older people perceived their health as good or very good.

By categorizing the sample according to the practice of physical activity together with functional performance, it was found that 65.7% of the participants were sufficiently active and independent in their ADLs.

An association of self-perceived health with the practice of physical activity and independence in activities of daily living was observed, in which the largest proportion of this group had good/very good self-perceived health (Table 3). As for the self-perception of quality of life, associations were observed with the practice of physical activity and functional performance. The largest proportion of older people who perceived their quality of life as good/very good were sufficiently active and independent (Table 3).

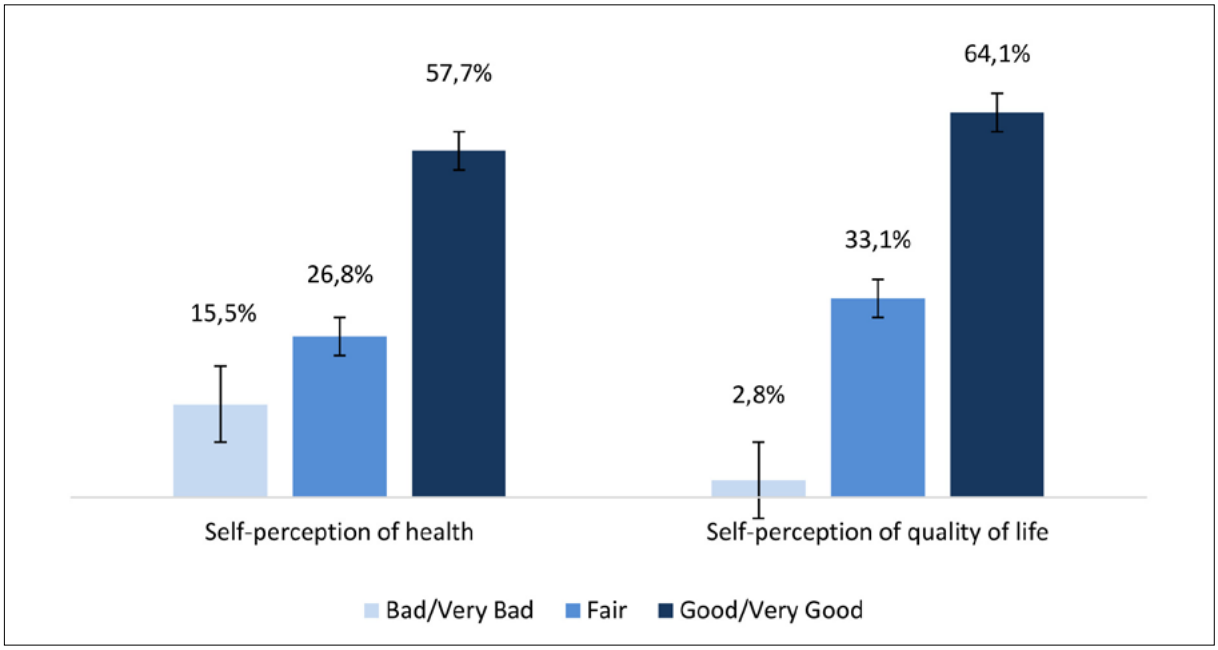

Figure 1. Assessment of the sample's self-perception of quality of life and health. Trombas, GO, 2019.

Table 3. Self-perception of health and quality of life and association with physical activity and functional performance among older people. Trombas, GO, 2019.

	Self-Perception of Health				
Physical Activity and Functional Performance	Bad/Very Bad/Fair	Good/ Very Good	PR	95% CI	*p* value*
	n (%)	n (%)			
Sufficiently Active					0.000
Dependent	2 (100.0)	0 (0.0)	1.66	1.57-1.76	
Independent	31 (33.7)	61 (66.3)			
Insufficiently active					0.368
Dependent	9 (64.3)	5 (35.7)	1.10	0.89-1.38	
Independent	16 (50.0)	16 (50.0)			
	Self-Perception of Quality of Life				
Sufficiently Active					0.000
Dependent	2 (100.0)	0 (0.0)	1.70	1.60-1.79	
Independent	28 (30.4)	64 (69.6)			
Insufficiently active					0.439
Dependent	7 (50.0)	7 (50.0)	1.08	0.88-1.33	
Independent	12 (37.5)	20 (62.5)			

PR: Prevalence Ratio, 95%CI: 95% Confidence Interval, *Chi-square

DISCUSSION

In this study, a smaller proportion of the older people had bad or very bad self-perceived health and quality of life, with more than half of the participants perceiving their health and quality of life as good or very good. Although no association with sociodemographic variables was identified in this specific population, it is recognized that self-perceived health can be influenced by age, gender, educational level, lifestyle, cultural, biological, psychological and social factors and place of residence[19].

A study carried out with the population of a small town in the interior of Goiás identified that the vast majority of respondents had good or very good self-perception of health[20].

The life story of each one reflects on how the aging process and even diseases are understood[21]. In the presence of physical, psychological, emotional and social problems, feelings of fragility and insecurity reflect on how health is perceived[22].

Self-perceived quality of life was significantly associated with the practice of physical activity and independence in ADLs, not being associated with any other variable in this study. This result was contrary to a study that verified the factors associated with the positive perception of quality of life in low-income older women in rural and urban areas of a city in northeastern Brazil. No associations were found between self-perceived quality of life and physical activity level[11]. However, several studies confirm the results presented, and report a positive relationship between the practice of physical activity and/or functional independence with good quality of life[7,10]. These results can be explained by the way of evaluating the quality of life. In some studies, the perception that the individual had of their own quality of life was evaluated. In others, domains of the WHOQOL OLD instrument were used, which investigates various factors related to quality of life (autonomy, sensory functioning, past, present and future activities, social participation, death and dying, and intimacy).

In the present study, it was found that two thirds of the older people were sufficiently active, which is in line with the prevalence of 67.0% found by Peixoto et al.[13] and with older people living in rural areas in Bahia (64.2%)[23]. These characteristics were only associated with self-perceived health.

It was observed in this study that older people who are sufficiently active and with greater independence in activities of daily living reported self-perception of health as good or very good, indicating an association in the way they perceive their own well-being. It was identified that the practice of physical activity and better functional performance were associated with a healthy aging process. It is noteworthy, in this study, that the type of physical activity did not influence the self-perception of health of the older people in rural areas, with only an association with the level of physical activity being observed. The practice of physical activity can be influenced by the environmental and social conditions to which the older people are inserted[23], and older people in rural areas may have a healthier lifestyle than when they live in large urban areas[5].

Walking has been the most frequent physical activity among the urban older people population in Brazil, according to what was revealed in a descriptive study carried out in all capitals and in the Federal District[24]. In the population of the present study, 44.2% of the older people remained active by carrying out domestic activities, gardening, commuting, growing crops and farming. While 55.8% included in their daily life some physical activity aimed at leisure, predominantly walking.

Studies in Brazil have shown that populations residing in rural areas have a more active behavior in the domains of work, commuting and home, such as physical activity[8,23]. On the other hand, there was a high frequency of insufficiently active individuals, especially in leisure activities, regardless of age, in this population[25].

Older people living in rural areas may have a healthier lifestyle, with better eating habits and more active behaviors in daily activities[8,23]. In rural southern Brazil, the participation of older people in leisure activities was high (79.8%) and was associated with gender, marital status, education and income. The authors included in leisure activities, both physical and manual/artistic, intellectual, associative and tourist activities, identifying 46.2% of the sample with the practice of leisure-time physical activity[26].

The results found in this research can be explained by issues related to health education actions promoted by the municipality itself, which address themes about the promotion of healthy eating and physical activity[27]. The older people expressed the need to perform physical activities such as walking and maintaining healthy lifestyle habits. Physical activity can favor the promotion of positive health perception among older people. In addition to increasing life expectancy and reducing the risk of chronic diseases, contributing to the maintenance of physical fitness and functional capacity[4].

In another study, carried out with older women who were former students of a University in North Carolina, in the United States, leisure-time physical activity and satisfaction with the time of leisure-time physical activity were positively correlated with self-perceived health[28]. Older Chinese people who were exposed to green spaces and exercised frequently were more likely to report a good perception of health compared to those who exercised infrequently[29].

With regard to self-perceived health, 64.2% of sufficiently active older people significantly perceived their health as good or very good. A cross-sectional study carried out with older people in a small town in the interior of Bahia did not find associations between the level of physical activity and self-rated health, with a prevalence of 53.9% of physical inactivity among the participants[7]. In an urban area in southern Brazil, physical activity was an important factor in the relationship between self-perceived health and quality of life in older women participating in a physical activity program[4].

Physical inactivity is considered a determining factor in the reduction of autonomy and independence of the older people population, as it exacerbates the damage to physiological and biomechanical systems caused by aging[3]. The beneficial effects of physical activity are well accepted, as is its importance for improving health conditions, especially in the older people population[7]. However, in this study, 69.6% of the insufficiently active older people were

independent in their ADLs and 50% had good or very good health perception.

Higher self-perceived health scores were associated with less limitation in performing activities[30]. On the other hand, a study in a rural population in northeastern Brazil did not show a significant association between self-perceived health and functional incapacity, with associations between functional incapacity and chronic diseases such as arterial hypertension and heart disease being observed. The negative self-perception of health reported by this population was 57.9%[31].

A possible explanation for the implications presented is due to the characteristic differences of each research, such as the type of instrument used to assess functional capacity. It is also highlighted that the functional capacity and the perception of health are influenced by issues intrinsic to each studied population[19].

In the present study, a large part of the older people who were independent in their ADLs were also sufficiently active, and of these, two thirds had a good or very good perception of health. A study with older people in Brazil, carried out in three different urban centers showed that having a negative perception of health (fair or bad), using more than two medications, having depressive symptoms and being insufficiently active (lowest quartile of physical activity level, ≤ 60 minutes/week) were factors associated with functional disability in ADLs. Short or prolonged sleep, smoking and physical inactivity were factors that increased the need for assistance in activities of daily living of rural older people[32].

Independence in performing usual tasks is a factor that determines the health of older people[33]. The decline in functionality is a reason for a worse perception of health[31]. A cross-sectional study carried out in the northeast region of Brazil, with older people living in rural districts, showed a low proportion of dependence on performing ADLs (3.4%) and functional disability (13.7%)[23]. In addition, the results of this research are consistent with studies in the northern region of Brazil, in which 94.0% of the older people studied in rural areas and 97.0% in urban areas presented good functionality[9,10].

Similar to the present investigation, other studies showed that functionality is directly linked to self-perception of the general health status[30,32,33]. A cohort study carried out with older people aged 60 to 69 years in a rural region of Norway highlighted that, after 11 years, low self-perception of health and depression were risk factors for the need for assistance in one or more activities of daily living[32].

A study in an urban area with active and sedentary older women in the State of Rio de Janeiro, Brazil, indicated that functional autonomy was classified as low for all groups. The authors suggested that the physical activities offered to the active groups did not represent enough stimuli to improve the physical capacity of the participants[3]. Activities that promote improvements in aerobic capacity can preserve the physiological functions affected by aging[3]. In this study, sufficiently active and insufficiently active older people had a level of 50% or more of functional independence.

Explanatory elements that enable the understanding of functional decline are still complex, however, there is a consensus on the preservation of functional conditions through certain habits, such as the practice of physical activity. However, the factors associated with functional disability and physical activity are still little explored, often limited to specific isolated surveys[33,34].

A recognized limitation of the present study was associated with data collection that lasted over time, reflecting possible measurement biases. To minimize this possibility, validated assessment instruments were used and measurements performed at home were made with calibrated devices and always applied by the same person.

Doubts arise about the relationship between being independent in ADLs and/or being sufficiently active, and which of the characteristics most significantly influence the perception of health in older people. Since, being independent in ADLs does not necessarily mean being active enough. In the literature, the concept of investigating the behavior (performing an activity) versus the outcome (the result of performing an activity) is growing, checking which would produce the greatest beneficial effects to the individual[35]. Therefore, studies that

can investigate in more detail the benefits of being independent in ADLs as an outcome and of being sufficiently active as a behavior are suggested.

Some other points should be highlighted as a strength of the study, such as the situational diagnosis of the living conditions of older people living in a rural municipality in the interior of Brazil. The questions answered during the home visits allowed for personal expressions from the older people, including claims to the government. Also during data collection, the researcher collected suggestions for interventions in public policies in the social and health area, with suggestions for immediate and late application.

Also noteworthy is the creation of a cohort with the older people participating in the study so that they are monitored in a health surveillance system in the city.

CONCLUSIONS

The practice of physical activity and maintenance of independence in activities of daily living are factors that contribute to a positive perception of health and quality of life. However, older people who are insufficiently active and independent also perceive their health as good or very good. Furthermore, the type of physical activity was not associated with perceived health.

Interventions in public policies in the social and health area are recommended, considering the specific characteristics of the population so that they can provide for the maintenance or improvement of a good perception of health and quality of life. These actions can contribute to the strengthening of family and community bonds, promoting autonomy and improving the quality of life and health of this population. We recommend that the Health Units and other social facilities in the city be used to offer activities guided by trained professionals.

It is expected that the contributions of this work, for the community of the studied municipality, extend to other municipalities with similar characteristics, collaborating to highlight the impact of science on society. It is suggested that more studies be carried out with older people in communities with rural characteristics, as the vast Brazilian territory presents different characteristics from one region to another.

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Prevalence and factors associated the use of potentially inappropriate medications by older adults in Rio Branco, Acre, Brazil: a population-based study

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Abstract

Objective: To verify the prevalence and analyze the factors associated with the use of potentially inappropriate medications (PIM) in the older adults in Rio Branco, Acre, Brazil. *Method*: This is a cross-sectional population-based study. The dependent variable was the use of at least one PIM, according to the criteria of the Brazilian Consensus on Potentially Inappropriate Medicines for the older adults, regardless of clinical condition. In evaluating the association between the use of inappropriate medications and the independent variables, a crude and adjusted analysis was performed using logistic regression, using the hierarchical model by odds ratio (OR). *Results*: The prevalence of using at least one PIM among the 1,016 participants was 25.9% (95%CI 22.3; 29.8), positively associated with female sex (OR=1.38; 95%CI 1.01; 1.90), dependence on instrumental activities of daily living (OR=1.37; 95%CI 1.02; 1.83), negative self-rated health (OR=1.54; 95%CI 1.12; 2.11), hospitalization in the last 12 months (OR=1.79; 95%CI 1.19; 2.69) and presence of more than three comorbidities (OR=2.56; 95%CI 1.97; 3.33). The most used subcategory was proton pump inhibitors by 11.3% (9.2; 13.8). *Conclusion*: The prevalence of PIM use by elderly in this population was a quarter, being associated with female gender and health conditions. Awareness actions are necessary to guarantee the benefits of using medications.

Keywords: Potentially Inappropriate Medication List. Older Adults. Inappropriate Prescribing. Survey.

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INTRODUCTION

Ensuring pharmacotherapeutic safety for older people is a major challenge, as, in addition to pharmacodynamic and pharmacokinetic changes, there may be barriers that interfere with their self-care. Among these, low health literacy, cognitive alterations, inadequate social support network, sensory deficiencies and other conditions that make it difficult to adhere to pharmacological treatments stand out[1].

In the midst of this reality, the risk of adverse drug reactions (ADRs) with negative outcomes becomes greater, so it is necessary to properly identify potentially inappropriate medications (PIM) for older people[2,3]. In order to improve the safety of prescribing drugs in this group, over the last few years several tools have been developed for the assessment of PIM. The Beers criteria, initially proposed in the 1990s, have been regularly revised by the American Geriatrics Society and include drugs that should be avoided or used with caution by older people[4,5].

Another widely used tool is the *Screening Tool of Older Person's Prescriptions (STOPP)* and *Screening Tool to Alert Doctors to Right Treatment (START)* criteria, which include a series of guidelines on drugs that should be avoided according to physiological systems, as well as those which should not cease to be prescribed under certain conditions[6]. In 2016, Galvão and colleagues developed a validated adaptation of the Beers and STOPP/START criteria called the Brazilian Consensus on Potentially Inappropriate Medications for Older People (CBMPII). This instrument plays an important role, since it only included drugs authorized by the National Health Surveillance Agency (ANVISA)[3].

In Brazil, in recent years some studies were carried out that evaluated the use of PIM according to the Beers or STOPP criteria in different regions of the country. Of these, the Health, Well-being and Aging (SABE) study stands out, carried out with 1,254 older people in the city of São Paulo (SP), which obtained a PIM prevalence in 28% of the participants[7]; a study conducted in Pelotas (RS)[8] with 1,451 individuals, in which the prevalence was 42.4%; a longitudinal study carried out in Goiânia (GO), which followed 418 older people for 10 years, in which an incidence of PIM use was found to be 44.1 cases per 1,000 people-year[9]; in Viçosa (MG)[10] the prevalence was 43.8% and 44.8% in 621 interviewees, according to the Beers and STOPP criteria, respectively.

Factors associated with PIM use are polypharmacy, female sex, presence of comorbidities, low education, age greater than or equal to 80 years and non-white skin color[9-12]. Despite the great relevance of these publications, it is important to highlight that they did not use instruments validated for Brazil. In addition, it is necessary that the prevalence of PIM be evaluated in populations with different characteristics, since in the country there is great social inequality, low level of human development and heterogeneity in terms of educational and cultural levels and access to health services. In this sense, the objective of this study was to verify the prevalence and analyze the factors associated with the use of PIM in older people in Rio Branco, Acre, Brazil.

METHOD

This is an observational, cross-sectional, population-based study with individuals aged 60 years or older, non-institutionalized and residing in urban and rural areas of the municipality of Rio Branco, Acre, from April to September 2014.

Rio Branco has a territorial unit of 8,834,942 km^2 and had approximately 21,620 older people, representing 6.4% of the population, of which 91.8% lived in the urban area. That same year, the Municipal Human Development Index (IDHM) was 0.727[11].

Data previously collected within the scope of the Study of Chronic Diseases (EDOC) were used. Older people (from 60 years old) of both sexes, domiciled in Rio Branco, were eligible. Those identified by the interviewers with some cognitive impairment that made it difficult to communicate or understand the questions (or that such information was given by family members) were excluded from the study.

Sampling was complex, of the probabilistic type, by clusters in two stages, with 40 census sectors in the primary unit. 73 households were then drawn from each of these sectors, which constituted the

secondary unit, in which all residents aged 60 years or older and able to answer the questions were invited to participate in the study. The selection of sectors was made with probability proportional to their number and private households in the 2010 Demographic Census (CD2010) of the Brazilian Institute of Geography and Statistics (IBGE). To perform the sample calculation, a prevalence of alteration of kidney function among older people was adopted of 40.0%, confidence level of 95% and error of 3%. In order to cover probable losses and refusals, 20% were added, totaling a final sample of 1,016 individuals[12].

After recruiting the participants, home interviews were carried out by properly trained researchers. The questionnaires included the application of an instrument structured in thematic modules with information on socioeconomic, demographic, behavioral and health conditions, in addition to physical assessments and medication use.

The variables surveyed included age (in years and categorized as 60-69; 70-79; 80 and over); sex (male; female); skin color (white; non-white (brown, black, yellow and indigenous)); marital status (with a partner; without a partner); education (no education (illiterate/never studied); elementary school; high school; higher education); practice of physical activity (yes; no); body mass index (eutrophic; underweight; overweight); smoking (yes; no); degree of dependence on the Instrumental Activities of Daily Living (IADL) scale (dependent; independent); degree of dependence on the Basic Activities of Daily Living (BADL) scale (dependent; independent); health self-assessment (positive (very good/good); negative (fair/poor/very poor); hospitalization in the last 12 months (yes; no); more than three comorbidities (yes; no); and signs and symptoms of depression (GDS) (yes; no).

For the self-assessment of health, the question *In general, would you say that your health is: very good, good, fair, bad or very bad* was suggested. For the investigation of functional capacity, the IADL scale was used, consisting of seven items (doing housework, preparing food, going shopping, using the telephone, getting around using means of transport, managing money and using medication[13]), with reliability for use in the country[14]; and the BADL scale modified by Katz and adapted to Brazilian Portuguese[15], which includes the following items: eating, going to the bathroom, choosing your own clothes, getting ready and taking care of personal hygiene, keeping yourself continent, dressing and bathing. Based on the Katz scale, older people were classified as independent (6 to 5 points) and dependent (partial, with 4 to 3 points, and total, with less than 3 points). The questionnaires were applied directly to the study participants. For the IADL scale, those who reached 21 points were classified as independent, and those with 20 points and less were classified as dependent.

To screen the presence of symptoms of depression in older people, the Geriatric Depression Scale (GDS-15)[16] was used, which has a score between 0 and 15 points. For the analysis of this work, a cut-off point of 6 points was considered, in order to define symptoms suggestive of depression.

In the analysis of body mass index (BMI) - weight (kg) by height (in meters) squared (m^2) -, the *Nutrition Screening Initiative* (NSI) cut-off points for older people being overweight (>27kg/m^2) and underweight (<22kg/m^2)[17]. Anthropometric data were collected by a properly trained professional, using a Bal Gl 200 *G-Tech*® digital scale and a *Sanny*® portable stadiometer.

Through self-report, the following chronic diseases were evaluated to describe comorbidities: systemic arterial hypertension, peripheral venous system diseases, diabetes mellitus, stroke, insomnia, cardiac arrhythmias, arthritis/arthrosis, osteoporosis, chronic kidney disease, congestive heart failure, acute myocardial infarction, anemia, autoimmune diseases, cirrhosis, dyslipidemia, cancer, depression, asthma, bronchitis, psoriasis, repetitive strain injury/tendinitis, and hepatitis. The morbidities listed were included because they were the most prevalent, each one being asked individually and answered as yes/no. The option of reporting those not previously listed and that entered the calculation of comorbidities was also added to "other morbidities".

The use of medication was verified through the questions *Do you use any medication?* and *If yes, which medications, dose and frequency?* The use of medications was verified by means of the active ingredient, dosage

and frequency, based on checking the prescription or packaging of those being used at the time. For the definition of polypharmacy[18], the concept of the concomitant use of five or more drugs was chosen. The variable was dichotomized into yes (use of five or more drugs) and no (use of zero to four drugs). The characterization of the drugs was performed according to the *Anatomical Therapeutic Chemical Code* (ATC) adopted by the World Health Organization (WHO)[19]. To define PIM, the dependent variable of the study, the CBMPII3 was used. This variable was defined as the use of at least one PIM category, regardless of clinical condition.

For the quality control of the information, interviews and physical assessments were carried out with 30 older people in a pilot study carried out in a census sector not included in the sample[12] for training and calibration of procedures.

Frequency measures were estimated for the categorical data. In order to compare the proportion between the groups, Pearson's chi-square test was used. Then, univariate and multivariate logistic regression models were developed to estimate the association between the independent variables and the dependent variable.

In the logistic regression analysis, the variables that presented a p value lower than 0.10 in the crude analysis were selected for inclusion. In evaluating the association between the use of inappropriate medication and the independent variables, a crude and adjusted analysis was performed using logistic regression, using the hierarchical model by odds ratio (OR). At the distal level, PIM use was adjusted for sex and skin color; at the intermediate level, the variables degree of dependence (IADL), signs and symptoms of depression (GDS) and self-rated health were introduced; finally, at the proximal level, the variables hospitalization and presence of three or more comorbidities were incorporated, in order to control possible confounding factors. The adjustment was initially performed within each level of the model, including variables with $p<0.10$ in the bivariate analysis; in the final model, the variables that reached $p<0.05$ were kept. A significance level of 5% was adopted, analyzed by the Wald test.

In all analyses, the effect of the sample design and the weights of the observations were taken into account, which were calculated by the inverse of the inclusion probabilities at each stage and later calibrated for extrapolation to the population by "estimate (n)", by sex and age groups, using a post-stratification estimator, in order to deal with typical household survey biases and correct for differential non-response. For that, the maximum pseudo-likelihood (MPL) method was used, considering the sample weights and the structural information of the sampling plan. The inferences were evaluated by Wald's statistics based on the sampling plan, together with the F distribution.

The study was approved by the Research Ethics Committee (CEP) of the Federal University of Acre, under protocol number 518,531 on 01/30/2014. Participants signed the Free and Informed Consent Term (ICF), guaranteeing the right to refuse and the confidentiality of the data collected.

RESULTS

After evaluating the exclusion criteria, a final sample of 1,016 older people was obtained, with 59 individuals being eliminated. Subsequently, correction for weights was performed, reaching an estimated expanded population of 23,416 participants. The prevalence of use of at least one PIM in this population was 25.9% (95% CI: 22.3 – 29.8).

Most older people were female, that is, 53.5% (95% CI: 50.3 – 56.6), mean age of 71.1 years (95% CI: 69.7 – 70.6), non-white skin color, lived without a partner, illiterate, did not practice physical activities, was independent in terms of instrumental activities of daily living, had no symptoms of depression and was overweight, as shown in Table 1.

Table 1. Clinical and sociodemographic variables and bivariate association with the proportion of older people using PIM (n=1,016). Rio Branco, AC, 2014.

Variables	Total		PIM		*p-value*[a]
	Estimate (n)	% (95% CI)	Estimate (n)	% (95% CI)	
Sex					0.213
Male	10,554	46.5 (43.4 – 49.7)	2,462	22.6 (18.0 – 27.9)	
Female	12,862	53.5 (50.3 – 56.6)	3,597	28.7 (24.4 – 33.5)	
Age (years)					0.048
60-69	13,383	57.2 (54.7 – 59.6)	3,383	25.3 (21.3 – 29.8)	
70-79	6,698	28.6 (26.2 − 31.1)	1,569	23.4 (18.6 − 29.1)	
80 and over	3,335	14.2 (12.2 − 16.6)	1,106	33.2 (25.9 – 41.3)	
Skin color					0.416
Non white	17,802	76.0 (71.8 – 79.8)	4,500	25.3 (21.5 – 29.5)	
White	5,614	24.0 (20.2 – 28.2)	1,558	27.8 (22.1 – 34.2)	
Marital status[b]					0.513
With partner	9,097	39.1 (35.8 – 42.6)	2,490	27.4 (21.1 – 34.7)	
Without partner	14,161	60.9 (57.4 – 64.2)	3,545	25.0 (21.5 – 28.9)	
Education[b]					0.789
No education	17,471	75.2 (68.4 – 81.0)	4,520	25.9 (21.8 – 30.4)	
Elementary School	1,963	8.5 (6.2 – 11.5)	477	24.3 (17.3 – 33.1)	
High school	2,802	12.1 (9.1 – 15.8)	801	28.6 (19.1 – 40.4)	
University education	987	4.2 (2.7 – 6.7)	216	21.9 (12.0 – 36.6)	
Practice of physical activity[b]					0.743
Yes	3,480	14.9 (11.9 – 18.4)	865	24.9 (17.9 – 33.5)	
No	19,904	85.1 (81.6 – 88.1)	5,193	26.1 (22.5 – 30.0)	
BMI[b]					0.505
Eutrophic	8,449	38.3 (34.1 – 42.7)	1,998	23.7 (18.3 – 30.0)	
Underweight	2,789	12.7 (10.5 – 15.2)	825	29.6 (20.8 – 40.1)	
Obese	10,797	49.0 (44.0 – 54.1)	2,863	26.5 (21.8 – 31.8)	
Smoking					0.374
Yes	4,163	17.8 (15.4 – 20.4)	980	23.5 (17.4 – 31.1)	
No	19,253	82.2 (79.6 – 84.6)	5,078	26.4 (22.9 – 30.2)	
IADL dependence degree					0.002
Independent	11,907	51.1 (46.7 – 55.5)	2,627	22.1 (18.6 – 26.0)	
Dependent	11,402	48.9 (44.5 – 53.3)	3,432	30.1 (25.2 – 35.5)	
BADL dependence degree					0.916
Independent	17,550	75.3 (70.4 – 79.6)	4,547	25.9 (22.5 – 29.6)	
Dependent	5,759	24.7 (20.4 – 29.6)	1,512	26.3 (19.7 – 34.1)	
Health self-assessment					0.001
Positive	8,598	36.7 (33.4 – 40.1)	1,726	20.1 (16.1 – 24.7)	
Negative	14,818	63.3 (59.9 – 66.6)	4,333	29.2 (24.9 – 34.1)	

to be continued

Continuation of Table 1

Variables	Total		PIM		*p-value*[a]
	Estimate (n)	% (95% CI)	Estimate (n)	% (95% CI)	
Hospitalization in the last 12 months[b]					<0.001
Yes	3,746	16.6 (14.5 – 18.8)	1,463	39.0 (31.5 – 47.2)	
No	18,868	83.4 (81.2 – 85.5)	4,442	23.5 (19.8 – 27.7)	
More than three comorbidities					<0.001
Yes	6,845	29.2 (25.9 – 32.8)	2,819	41.2 (35.8 – 46.7)	
No	16,571	70.8 (67.2 – 74.1)	3,240	19.6 (16.1 – 23.6)	
Signs and symptoms of depression GDS[b]					0.002
Yes	7,546	32.5 (28.9 – 36.3)	2,409	31.9 (26.3 – 38.1)	
No	17,601	67.5 (63.7 – 71.1)	4,389	15.7 (13.3 – 18.5)	
Total	23,416	100.0	6,059	25.9 (22.3 – 29.8)	

Results were shown in numbers, and percentages corrected for weight; Estimate (n): extrapolation to population; a: Pearson's chi-square test; 95%CI: 95% confidence interval; b: missing data in this variable due to non-response; IADL: instrumental activities of daily living; BADL: basic activities of daily living; BMI: body mass index; GDS: geriatric depression scale.

The most prevalent comorbidities found were: systemic arterial hypertension (61.2%), peripheral venous system diseases (37.5%), diabetes mellitus (18.1%), arthritis/arthrosis (16.6%), osteoporosis (16.5%), dyslipidemia (14.3%), depression (12.5%), insomnia (10.5%), anemia (7.8%) and bronchitis (7.7%).

Still in Table 1, it is possible to see that there was an association between the use of at least one PIM and the following variables: age, dependence for IADL, negative self-rated health, history of hospitalization in the last 12 months, presence of three or more comorbidities and depression symptoms.

In the logistic regression analysis adjusted by hierarchical level, there was an association between the use of PIM at the distal level, sex, and at the intermediate level, dependence according to IADL and self-rated health ($p<0.05$). At the proximal level, there was an association with hospitalization in the last 12 months and the presence of three or more comorbidities ($p<0.05$), as shown in Table 2.

Table 3 describes the percentages of PIM categories in older people. According to the CBMPII, the categories of drugs that should be avoided in these people, regardless of clinical condition, were the majority of the gastrointestinal system, followed by the central nervous system and psychotropic drugs and the cardiovascular system. The most used subcategory was use of proton pump inhibitors by 11.3% (9.2 – 13.8).

Table 2. Crude and adjusted hierarchical logistic regression model, having as dependent variable the use of at least one PIM by older people. Rio Branco, AC, 2014 (n=1,016).

Variables	OR_{Brute} (95%CI)	*p-value*	$OR_{Adjusted}$ (95%CI)	*p-value*
Distal level[a]				
Sex		0.049		0.046
Male	1		1	
Female	1.38 (1.00 – 1.91)		1.38 (1.01 – 1.90)	
Age (years)		0.049		0.065
60-69	1		1	
70-79	0.90 (0.69 – 1.19)		0.90 (0.69 – 1.18)	
80 and over	1.47 (0.99 – 2.17)		1.47 (0.99 – 2.17)	
Intermediate level[b]				
IADL dependence degree		0.002		0.015
Independent	1		1	
Dependent	1.52 (1.17 – 1.97)		1.39 (1.07 – 1.81)	
Health self-assessment		0.001		0.011
Positive	1		1	
Negative	1.65 (1.23 – 2.21)		1.50 (1.10 – 2.04)	
Signs and symptoms of depression GDS[b]		0.002		0.053
No	1		1	
Yes	1.54 (1.18 – 2.03)		1.31 (0.99 – 1.73)	
Proximal level[c]				
Hospitalization in the last 12 months		<0.001		0.007
No	1		1	
Yes	2.08 (1.42 – 3.05)		1.79 (1.19 – 2.69)	
More than three comorbidities		<0.001		<0.001
No	1		1	
Yes	2.88 (2.23 – 3.72)		2.56 (1.97 – 3.33)	

95%CI: 95% confidence interval; OR – Odds Ratio; p – Wald test value; a: distal level (adjusted for sex and age); b: intermediate level (adjusted for significant variables at the distal level plus self-rated health, signs of depression symptoms (GDS) and degree of dependence (IADL)); c: proximal level (adjusted for significant variables at the intermediate level, plus hospitalization in the last 12 months and presence of three or more comorbidities).

Table 3. Frequency of use of potentially inappropriate medication categories in the assessed older people (n= 1,016), regardless of clinical condition. Rio Branco, AC, 2014.

Category	N	% (95%CI)
Gastrointestinal system	2,684	11.5 (9.4 – 14.0)
Proton pump inhibitors (omeprazole, pantoprazole, esomeprazole)	2,647	11.3 (9.2 – 13.8)
Gastrointestinal antispasmodics (scopolamine)	52	0.2 (0.1 – 1.0)
Metoclopramide	93	0.4 (0.1 – 1.1)
Mineral oil (orally)	18	0.1 (0.0 – 0.6)
Central nervous system and psychotropic medications	1,795	7.7 (5.8 – 10.0)
First-generation antihistamines (bronpheniramine, cyproheptadine, chlorpheniramine, dexchlorpheniramine, dimenhydrinate, doxylamine, meclizine, promethazine)	319	1.4 (0.8 – 2.4)

to be continued

Continuation of Table 3

Category	N	% (95%CI)
First-generation (chlorpromazine, haloperidol, levomepromazine) and second-generation (quetiapine, risperidone) antipsychotics for behavioral problems in dementia	261	1.1 (0.6 – 2.0)
Barbiturates (phenobarbital)	129	0.6 (0.2 – 1.4)
Benzodiazepines (alprazolam, bromazepam, clonazepam, cloxazolam, diazepam, flunitrazepam, lorazepam, midazolam, nitrazepam)	1,163	5.0 (3.5 – 6.9)
Tertiary tricyclic antidepressants (amitriptyline, imipramine, nortriptyline, maprotiline) alone or in combination	338	1.4 (0.8 – 2.5)
Cardiovascular system	1,104	4.7 (3.5 – 6.3)
Alpha-1 blockers for the treatment of hypertension (doxazosin)	117	0.5 (0.2 – 1.2)
Centrally acting alpha agonists for routine treatment of hypertension (methyldopa)	128	0.5 (0.2 – 1.7)
Class Ia, Ic, III antiarrhythmic drugs (amiodarone)	84	0.4 (0.1 – 0.9)
Aspirin at a dose > 150 mg/day	291	1.2 (0.6 – 2.4)
Digoxin > 0.125 mg/day	243	1.0 (0.6 – 1.8)
Loop diuretics (furosemide) as first-line monotherapy for hypertension	55	0.2 (0.1 – 0.7)
Nifedipine, immediate-release capsule	267	1.1 (0.7 – 1.9)
Endocrine system	1,335	5.7 (4.3 – 7.5)
Estrogens (with or without progesterones). Avoid oral forms and transdermal patches	24	0.1 (0.0 – 0.8)
Glibenclamide	1,311	5.6 (4.2 – 7.4)
Musculoskeletal system	331	1.4 (0.9 – 2.3)
Muscle relaxants (carisoprodol, cyclobenzaprine, orphenadrine)	331	1.4 (0.2 – 2.3)
Several	18	0.1 (0.0 – 0.6)
Theophylline as monotherapy for chronic obstructive pulmonary disease	18	0.1 (0.0 – 0.6)

DISCUSSION

In this study, a prevalence of 25.9% (95%CI: 22.3 – 29.8) of the use of at least one PIM was observed, regardless of the clinical condition. There was also an association between PIM use and the following variables: female sex, IADL dependence, negative self-rated health, hospitalization in the last 12 months and more than three comorbidities. Among PIM, proton pump inhibitors were the most used (11.3%, 95%CI: 9.2 – 13.8), followed by drugs acting on the central nervous system (7.7%, 95%CI: 5.8 – 10.0) and on the cardiovascular system (4.7%, 95%CI: 3.5 – 6.3).

When evaluating similar studies carried out in other countries in South America, the Middle East, Asia and Africa, a heterogeneous prevalence of PIM use according to the Beers and STOPP criteria can be seen, ranging from 15.7%, as that observed in Nigeria among individuals aged 65 years and over according to the STOPP criterion and from 30.3% according to the Beers criterion, up to 72.7% in Argentina in 2,231 individuals aged 65 years and over according to the Beers criterion[20-22]. It is believed that this variability is related to the type and place of study, sample conditions such as older age, socioeconomic and other conditions of each population, since several factors can lead to a greater use of PIM[20-22].

Comparing the results of this study with Brazilian population studies, there is a lower prevalence of PIM use, since other authors found a frequency that ranged from 28% to 44.8% in different regions of the country[7-10,23]. Considering that the population in this study has less education, access to medication use may be impaired, which partly explains these findings.

Our work stands out for being the first national, population-based study that used PIM criteria adapted to the Brazilian reality, in accordance with ANVISA[3] regulation. In 2018, a study evaluated the same criteria as the CBMPII in a cross-sectional survey carried out with 227 older people from two basic health units and found a higher prevalence of PIM: 55.9%[24]. However, it is important to highlight that the study by these authors includes a convenience sample, regularly seen in primary care centers, which probably may have influenced the results. No other population-based studies were found that used the same criteria for PIM.

As already described, this study evidenced an association between several variables and the use of PIM. As in other studies carried out in Brazil, in the final adjusted model it was observed that the female gender was related to the dependent variable[7-10]. A possible explanation would be that, in our country, older women culturally tend to seek health services more, which can lead to a higher risk of PIM use. In addition, there is a greater life expectancy in female individuals, which, consequently, may be associated with a higher prevalence of chronic diseases that require continuous pharmacological treatment[25].

It was also observed that older people with dependence for at least one instrumental activity of daily living were more likely to use PIM. This association can be explained by the fact that these individuals, with loss of functional capacity, demand more from health services, which, therefore, would lead to an increase in the frequency of consultations and pharmacotherapeutic follow-up. This follow-up, however, is essential, since individuals with loss of functional capacity need more intense attention with the aim of rehabilitation and loss reduction.

Another important issue is that these individuals with greater vulnerability are often assisted by caregivers with low education, inadequate training and work overload, and this can amplify the negative impacts of polypharmacy[26,27]. Therefore, it is important to develop formal training programs for caregivers of older people, who are often responsible for their medication.

Individuals who rated their health as negative were also at higher risk of using PIM. Currently, the concept of health is seen in a complex way, since it involves multiple dimensions, and self-assessment is a global indicator based on subjective perception, which encompasses physical, emotional, social and well-being components[28]. Other authors had already pointed out that self-rated health can be a marker associated with the use of PIM, being useful even as a prognostic tool[29,30].

There are some hypotheses that could explain this finding. First, it is believed that older people with a negative health perception tend to seek greater support in health services, therefore, they would have greater exposure to different medications. Another possible explanation would be that the indiscriminate use of drugs can increase the chances of adverse events, which impacts self-rated health. However, these hypotheses cannot be explained by the design of the present study.

Hospitalization in the last 12 months was also a factor associated with PIM use. It is important to emphasize that it can be configured both as a complication of the use of these drugs and as a risk factor for their use at hospital discharge. In an Italian population-based retrospective cohort that followed 1,480,137 older people between 2003 and 2013, it was observed that 15.6% of hospitalizations during this period occurred in the context of using at least one PIM[31].

Additionally, a cross-sectional study carried out with older people hospitalized in medical clinic and geriatric units of a Brazilian public hospital showed, at the time of hospital discharge, a frequency of 58.4% of PIM use, according to the CBMPII criteria. The authors also observed that hospitalization in the geriatrics ward proved to be a protective factor for the use of these drugs, suggesting that specialists in the care of older people are better prepared for quaternary prevention of iatrogenic diseases, which highlights the importance of global and multidisciplinary care for older people[32].

The presence of more than three comorbidities was associated with the use of PIM. Similar results

were found in other studies, such as the one carried out in Pelotas (RS)[8], and the SABE study, developed in the city of São Paulo (SP)[7]. These data indicate the importance of primary care for older people, avoiding the fragmentation of care, since the figure of the generalist and the multidisciplinary team play a fundamental role in the evaluation of the patient as a whole. In this way, care centered on older people with multimorbidities facilitates an approach aimed at deprescription and prevention of iatrogenic events[33].

In the present study, the most common PIM categories were from the gastrointestinal system. The most used subcategory was the use of proton pump inhibitors, and the most used PIM was omeprazole. This same drug was also the most found in a population-based study carried out in the city of Viçosa (MG), which showed a frequency of use of 20%[12]. In a study carried out in two primary care centers located in the city of Belo Horizonte (MG), the main class of PIM found was also the prolonged use of proton pump inhibitors (30.1%)[24].

The use of proton pump inhibitors for more than eight weeks is a common finding, and their use should be cautious in the geriatric population, as it is associated with the development of osteoporosis, fractures, dementia and kidney failure. The physician should always weigh its use for long periods and think about non-pharmacological strategies to avoid prolonged use[4,5].

In this study, a high frequency of use of PIMs that act on the central nervous system and cardiovascular system was also observed. These same categories were also found in other Brazilian population-based surveys. In the one carried out in Pelotas (RS), the most common PIM category was that of the central nervous system, which corresponded to 48.9% of inappropriate medications[10]; in the SABE study, most PIM found belong to drugs acting on the cardiovascular system[9]. Therefore, there is a heterogeneity of PIM classes found in the main population-based studies carried out in Brazil, but also a visible predominance among drugs acting on the digestive system.

This work had some limitations. First, as it is a cross-sectional observational study, it was not possible to infer causality. Second, no cognitive test was performed to exclude patients with cognitive decline, which may have interfered with the assessment of some patients. This may also influence the application of questionnaires to assess activities of daily living, since individuals with unidentified cognitive deficits may not adequately report such activities. Finally, it was not possible to assess the duration of use of proton pump inhibitors, as this information was not available.

Population-based studies that aim to assess associated factors and frequency of PIM use, using the CBMPII as a criterion, are scarce and do not encompass all Brazilian regions. This data is important for the development of public policies and identification of patients at iatrogenic risk, as well as to reinforce teaching about the particularities of pharmacotherapy for older people for professionals able to prescribe medication.

CONCLUSION

The prevalence of PIM use among older people in Rio Branco, Acre, Brazil was 25.9%, being associated with female gender, IADL dependence, negative self-rated health, hospitalization in the last 12 months and presence of more than three comorbidities.

Data on the use of PIM using a national criterion are important for the standardization of this measurement and for adapting to the particularities of pharmaceutical care in Brazil. This is justified by the fact that there are medicines registered here that are not available in other countries, and vice versa. In addition, information on PIM use is heterogeneous across the country according to the criteria adopted by the studies. Therefore, carrying out this investigation will be one more piece that will make it possible to understand the particularities of pharmacotherapeutic care in Brazil.

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Association between leisure-time physical activity and knowledge and participation in public physical activity programs among Brazilian older people

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Abstract

Objective: To evaluate the prevalence of leisure-time physical activity among elderly Brazilians and its association with knowledge and participation in public programs to promote this practice. *Method*: Cross-sectional study with data from 11,177 older adults from the 2013 National Health Survey. The response variable was the practice of leisure-time physical activity. The explanatory variables were knowledge and participation in public programs to promote physical activity, sociodemographic and lifestyle characteristics. The crude and adjusted association was estimated by Poisson regression with robust variance. *Results*: Most of the elderly were female and were between 60 and 69 years old; 17% knew but did not participate in public programs to promote physical activity, and only 3.2% knew and participated. The prevalence of active leisure time was 13.3%. In the adjusted analysis, it was higher among older adults who knew but did not participate and kew and participated in public programs to promote physical activity, in men, aged 60 to 79 years old, with five years old or more education; from the Northeast and Midwest regions, with chronic diseases, who had three or more medical appointments in the last 12 months and consumed fruits and vegetables five or more days a week. Conclusion: The study showed a low adherence of the elderly to the practice of physical activity, and little knowledge and participation in public programs. Efforts are needed to expand the dissemination of these programs, promote the involvement of the population in these practices, and contribute to active aging.

Keywords: Elderly. Physical activity. Health Promotion. Health Survey.

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INTRODUCTION

Physical inactivity has been a problem in the world, considered one of the main risk factors for chronic non-communicable diseases (NCDs) and responsible for 7.2% and 7.6% of deaths from all causes and cardiovascular diseases, respectively[1,2]. Physical inactivity increases with age, being more frequent among women and in high-income countries[3,4]. This condition is worsened by demographic growth, urbanization and the aging of the population[5]. Inequalities in access and opportunities for physical activity, such as the lack of adequate places and equipment, socioeconomic factors and access to information are shown to be barriers to adopting an active lifestyle[6,7].

In this context, in 2006, in Brazil, the National Health Promotion Policy (PNPS) was implemented to face non-communicable diseases and conditions and their risk factors within the scope of the Unified Health System. One of the priority themes of the PNPS was body practices and physical activities. In 2011, the Health Academy Program (PAS) was implemented at the national level, which aims to promote the health of the population through the implementation of centers with infrastructure, equipment and qualified professionals to guide body practices and physical activity and healthy lifestyles8. Despite the growing number of actions to promote physical activity, its distribution is uneven among population subgroups and regions of the country[9-11].

The practice of physical activity is influenced, in addition to individual and social factors, by knowledge and access to adequate facilities and spaces. However, in Brazil there is a low prevalence of knowledge and participation in public programs to promote physical activity among adults[12] and older people[13], and variation between regions of the country[12]. A systematic review showed that there are still few studies that assessed this theme, and among the studies carried out, it was possible to observe that in Curitiba, about 91.6% of the interviewees knew about it and 5.6% participated in the activities offered, in Recife 54.3% knew because they had seen a pole of the program, and in Vitória 31.5% reported knowing it and only 1.5% participated[14].

Thus, assessing knowledge and participation in community programs can contribute to the planning of measures that favor intersectoral approaches that include creating and improving access to places for physical activity[15,16] and promoting active aging[4,6]. Thus, the objective of this study was to assess the prevalence of leisure-time physical activity among Brazilian older people and its association with knowledge and participation in public programs to promote this practice.

METHOD

Study based on the analysis of secondary data from the 2013 National Health Survey (PNS), a nationwide population-based survey, available on the website of the Brazilian Institute of Geography and Statistics – IBGE[17]. The first edition of the PNS was in 2013, with an expected sample of 80,000 households and aimed to investigate the lifestyles of the Brazilian population, such as the practice of physical activity, food, among others[18].

The study population comprised residents of permanent private households, that is, for the sole purpose of housing in all regions of Brazil. The PNS sample excluded households located in special or sparsely populated census sectors. A cluster sampling was adopted in three stages: census tracts; households and residents over 18 years of age. A total of 60,202 interviews were carried out with a percentage of losses of 25%. More information is available in the study by Szwarcwald et al[18]. In the present study, all interviewed individuals aged 60 and over (n=11,177) were included.

The PNS questionnaire was divided into three parts, the first two being answered by a resident of the household and covering questions about the characteristics of this household and the socioeconomic and health status of all residents. The other questionnaire was individual, answered by a resident aged 18 years and over, with questions addressing the main NCDs, lifestyles, and access to medical care.[18].

The practice of physical activity during leisure time, the response variable of this study, was obtained through a score by multiplying the weekly frequency by the duration of the activity performed (in minutes).

In the present research, the final score was divided into two categories: active and inactive during leisure time. Participants were considered active if they practiced at least 150 minutes per week of light or moderate physical activity, or at least 75 minutes/week of vigorous leisure-time physical activity, or a combination of moderate and vigorous physical activities totaling 150 minutes per week, according to the World Health Organization (WHO) recommendation[19].

The main explanatory variable refers to knowledge and participation in community programs to promote physical activity and was obtained from the combination of two questions: "Do you know of any public program in your municipality that encourages physical activity? (yes and no)" and "Do you participate in this program? (yes and no)", and were considered as answer options do not know, know, but do not participate or know and participate.

The other explanatory variables were: a) sociodemographic characteristics: age group (60-69, 70-79 and 80 or more); sex (female and male); education in years of study (0-4, 5-8, 9-11 and 12 or more); geographic region (North, Northeast, South, Southeast and Midwest); marital status (married, unmarried), and the unmarried person comprises the alternatives legally separated or divorced, divorced, widowed, single; b) lifestyle: number of NCDs (none, one, two, three or more) was obtained by adding the questions "Has a doctor ever diagnosed you with high blood pressure, diabetes, high cholesterol, heart disease (heart attack, angina, heart or other failure), stroke, asthma (or asthmatic bronchitis), arthritis or rheumatism, WMSD (work-related musculoskeletal disease), lung disease or COPD (Chronic Obstructive Pulmonary Disease), (emphysema, chronic bronchitis or other), cancer, chronic kidney failure or other chronic physical or mental illness or long-term illness?", "Do you have any chronic back problems, such as chronic back or neck pain, low back pain, sciatica, spinal or disc problems?" and "Has a doctor or mental health professional (such as a psychiatrist or psychologist) ever given you a diagnosis of depression or another mental illness (schizophrenia, bipolar disorder, psychosis or OCD (Obsessive Compulsive Disorder), another mental illness)?" answer options: yes or no; number of medical appointments in the 12 months prior to the interview (none, 1-2, 3 or more); and consumption of fruits and vegetables (less than 5 days a week, 5 days or more a week) obtained from the combination of the following questions: "How many days a week do you usually eat lettuce and tomato or salad of any other raw green or vegetable?", "How many days a week do you usually eat cooked greens or vegetables, such as cabbage, carrots, chayote, eggplant, zucchini? (not counting potatoes, cassava or yams)", "How many days a week do you usually drink natural fruit juice?", "How many days a week do you usually eat fruits?".

In the statistical analysis, relative frequency distribution was performed for the categorical variables. The prevalence of knowledge, participation and leisure-time physical activity and their respective 95% confidence intervals (95%CI) were estimated, according to sociodemographic and lifestyle variables. The association between knowledge and participation and sociodemographic and lifestyle variables was verified using Pearson's chi-square test. For the analysis of the adjusted and unadjusted association between the practice of physical activity during leisure time and the independent variables, the prevalence ratio and respective 95%CI were estimated using Poisson regression with robust variance. To assess the quality of fit of the final model, the *Goodness-of-fit* test was used. All analyzes were performed in the *survey* module for complex sample data analysis. A significance level of 5% was adopted. The PNS was approved by the National Research Ethics Commission (CONEP), under Opinion No. 328,159, of June 26, 2013. All participating individuals signed an informed consent form.

RESULTS

Among the 11,177 respondents aged 60 years or older, most were female, aged 60 to 69 years, married, with 0 to 4 years of education, residing in the Southeast region, with three or more chronic diseases, with a history of medical consultations in the last 12 months, and did not consume fruits and vegetables regularly (Table 1).

In the population studied, 17.0% (95%CI:15.6-18.4) knew about, but did not participate in,

community programs, and only 3.2% (95%CI:2.7-3.8) knew and participated in these programs. Knowledge and participation were higher among females, 60 to 69 years old, 9 to 11 years of education, South region, two or three or more chronic diseases, three or more medical consultations in the last 12 months, and who consumed fruits and vegetables regularly. A similar profile was observed for those who reported knowing but not participating, with the exception of the education variable, in which the highest frequency was among those with 12 years or more of education and the Southeast region (Table 2).

Table 1. Relative frequency distribution and 95% confidence interval (95%CI) of sociodemographic and lifestyle variables. National Health Survey, Brazil, 2013.

Variables	% (95%CI)
Sociodemographic	
Sex	
Male	43.6 (42.0-45.2)
Female	56.4 (42.0-45.2)
Age group	
60-69 years	56.4 (54.7-58.1)
70-79 years	29.9 (28.5-31.5)
80 or more	13.7 (12.6-14.8)
Marital status	
Married	53.2 (51.6-54.8)
Not married	46.8 (45.1-48.4)
Education	
0-4 years	61.2 (59.4-63.0)
5-8 years	15.9 (14.6-17.2)
9-11 years	12.5 (11.5-13.6)
12 or more	10.4 (9.2-11.8)
Region	
Southeast	48.0 (46.4-49.4)
North East	25.2 (24.1-26.4)
South	15.1 (14.2-16.0)
Midwest	6.4 (5.9-6.8)
North	5.4 (5.0-5.8)
Lifestyle	
Number of chronic diseases	
None	21.6 (20.3-23.1)
One	25.6 (24.4-26.9)
Two	22.0 (20.6-23.4)
Three or more	30.6 (29.1-32.3)
Number of medical appointments in the last 12 months	
None	15.4 (14.4-16.6)
One to two	30.1 (28.6-31.6)
Three or more	54.5 (52.8-56.1)
Consumption of fruits and vegetables	
5 days or more per week	44.5 (42.8-46.3)
Less than 5 days a week	55.5 (53.7-57.2)

Table 2. Knowledge and participation of older people in public programs to promote physical activity according to sociodemographic and lifestyle variables. National Health Survey, Brazil, 2013.

Variables	Public programs to promote physical activity			
	Does not know % (95%CI)	Knows but does not participate % (95%CI)	Knows and participates % (95%CI)	p[1]
Sociodemographic				
Sex				
Male	83.4 (81.3-85.3)	14.6 (12.8-16.6)	2.0 (1.4-2.8)	<0.001
Female	77.0 (74.9-78.9)	18.8 (16.9-20.8)	4.2 (3.5-5.0)	
Age group				
60-69 years	78.0 (76.2-79.8)	18.1 (16.5-19.9)	3.9 (3.0-4.8)	<0.001
70-79 years	79.4 (76.5-82.0)	17.6 (15.1-20.4)	3.0 (2.3-3.8)	
80 or more	87.9 (85.4-90.2)	10.8 (8.7-13.3)	1.2 (0.7-2.0)	
Marital status				
Married	79.5 (77.5-81.5)	17.1 (15.3-19.1)	3.4 (2.6-4.3)	0.833
Not married	80.1 (78.2-81.9)	16.8 (15.1-18.6)	3.1 (2.5-3.8)	
Education				
0-4 years	83.7 (81.9-85.3)	13.2 (11.7-14.9)	3.1 (2.5-3.9)	<0.001
5-8 years	78.8 (75.3-81.9)	17.5 (14.5-20.9)	3.7 (2.6-5.2)	
9-11 years	70.2 (66.1-73.9)	26.0 (22.4-30.0)	3.8 (2.6-5.5)	
12 or more	70.2 (64.8-75.2)	27.2 (22.3-32.8)	2.5 (1.7-3.7)	
Region				
North East	87.1 (85.1-88.8)	10.9 (9.3-12.6)	2.0 (1.4-3.0)	<0.001
Southeast	75.9 (73.4-78.3)	20.4 (18.0-22.9)	3.7 (2.9-4.7)	
South	76.1 (72.3-79.4)	20.0 (16.9-23.5)	3.9 (2.7-5.7)	
Midwest	81.0 (77.4-84.1)	15.7 (12.8-19.0)	3.3 (2.3-4.8)	
North	89.5 (85.7-92.3)	8.1 (6.0-10.9)	2.4 (1.4-4.1)	
Lifestyle				
Number of chronic diseases				
None	84.9 (81.9-87.5)	13.2 (10.7-16.1)	1.9 (1.3-2.9)	<0.001
One	81.4 (78.8-83.7)	16.4 (14.1-18.8)	2.2 (1.6-3.1)	
Two	78.7 (75.4-81.7)	17.1 (14.3-20.3)	4.2 (3.0-5.8)	
Three or more	75.7 (72.9-78.4)	20.1 (17.4-22.9)	4.2 (3.2-5.5)	
Number of medical appointments in the last 12 months				
None	85.5 (82.3-88.1)	12.6 (10.1-15.5)	1.9 (0.9-3.8)	<0.001
One to two	81.3 (79.1-83.4)	16.6 (14.6-18.8)	2.1 (1.5-2.8)	
Three or more	77.4 (75.3-79.3)	18.4 (16.5-20.4)	4.2 (3.5-5.1)	
Consumption of fruits and vegetables				
5 days or more per week	75.0 (72.7-77.1)	20.5 (18.5-22.7)	4.5 (3.6-5.6)	<0.001
Less than 5 days a week	83.7 (81.9-85.3)	14.1 (12.5-15.8)	2.2 (1.7-2.8)	

Key: 95%CI: 95% confidence interval; [1] p-value by Pearson's chi-square test.

The prevalence of leisure-time physical activity was 13.3% (95%CI: 12.2-14.4), being, in the unadjusted analysis, higher among older people who knew, but did not participate or knew and participated in community programs to promote the practice of physical activity, aged 60 to 69 years, married, with 12 years or more of education, residing in the Midwest region, who had two chronic diseases, had three or more medical consultations in the last 12 months and consumed fruits and vegetables regularly (Table 3).

In the adjusted analysis, only marital status lost statistical significance. The highest prevalence ratio of leisure-time physical activity was among older people who knew but did not participate (PR=1.39; 95%CI:1.13-1.70) or knew and participated (PR=4.32; 95%CI:3.49-5.33) of programs, male (PR=1.32; 95%CI:1.13-1.53), aged between 60 and 69 years (PR=2.14; 95%CI:1.48-3.10), with 12 years or more of education (PR=3.09; 95%CI:2.52-3.78), residing in the Midwest (PR=1.46; 95%CI:1.02-2.08), and Northeast (PR=1.65; 95%CI:1.17-2.33) regions, which had two chronic diseases (PR=1.53; 95%CI:1, 21-1.94), had three or more medical consultations in the last 12 months (PR=1.37; 95%CI:1.01-1.85) and regularly consumed fruits and vegetables (PR=1.73; 95%CI:1.47-2.04) (Figure 1).

Table 3. Prevalence and prevalence ratio of leisure-time physical activity according to knowledge and participation in public programs to promote physical activity, sociodemographic and lifestyle variables. National Health Survey, Brazil, 2013.

Variables	Prevalence (95%CI)	Unadjusted analysis	
		PR	95%CI
Public programs to promote physical activity			
Knows and participates	52.0 (43.0-60.9)	4.86	3.98-5.91*
Knows but does not participate	18.5 (15.2-22.2)	1.73	1.39-2.13*
Does not know	10.7 (9.7-11.8)	1.00	
Sociodemographic			
Sex			
Male	14.2 (12.5-16.1)	1.13	0.96-1.33
Female	12.6 (11.3-13.9)	1.00	
Age group			
60-69 years	16.1(14.8-17.8)	2.93	2.02-4.23*
70-79 years	11.4 (9.6-13.5)	2.07	1.38-3.05*
80 or more	5.5 (3.9-7.8)	1.00	
Marital status			
Married	14.9 (13.3-16.7)	1.30	1.10-1.53*
Not married	11.5 (10.2-12.9)	1.00	
Education			
0-4 years	8.3 (7.2-9.5)	1.00	
5-8 years	14.0 (11.4-17.1)	1.69	1.32-2.16*
9-11 years	20.3 (17.0-24.1)	2.45	1.95-3.05*
12 or more	33.2 (28.1-38.7)	4.00	3.23-4.93*
Region			
North East	13.2 (11.4-15.3)	1.67	1.16-2.42*
Southeast	13.3 (11.6-15.1)	1.68	1.17-2.41*
South	14.8 (12.4-17.5)	1.87	1.28-2.73*
Midwest	14.9 (12.5-17.9)	1.89	1.29-2.78*
North	7.9 (5.6-11.0)	1.00	

to be continued

Continuation of Table 3

Variables	Prevalence (95%CI)	Unadjusted analysis	
		PR	95%CI
Lifestyle			
Number of chronic diseases			
None	11.6 (9.6-14.2)	1.03	0.79-1.34
One	13.7 (11.7-15.9)	1.21	0.97-1.52
Two	17.3 (14.7-20.2)	1.53	1.21-1.93*
Three or more	11.3 (9.6-13.2)	1.00	
Number of medical appointments in the last 12 months			
None	8.8 (6.5-11.9)	1.00	
One to two	14.0 (12.2-16.1)	1.59	1.14-2.22*
Three or more	14.2 (12.8- 15.7)	1.61	1.17-2.21*
Consumption of fruits and vegetables			
5 days or more per week	19.1 (17.2-21.0)	2.20	1.85-2.60*
Less than 5 days a week	8.7 (7.6-19.1)	1.00	

Key: PR: Prevalence Ratio; 95%CI: 95% confidence interval; *p<0.05.

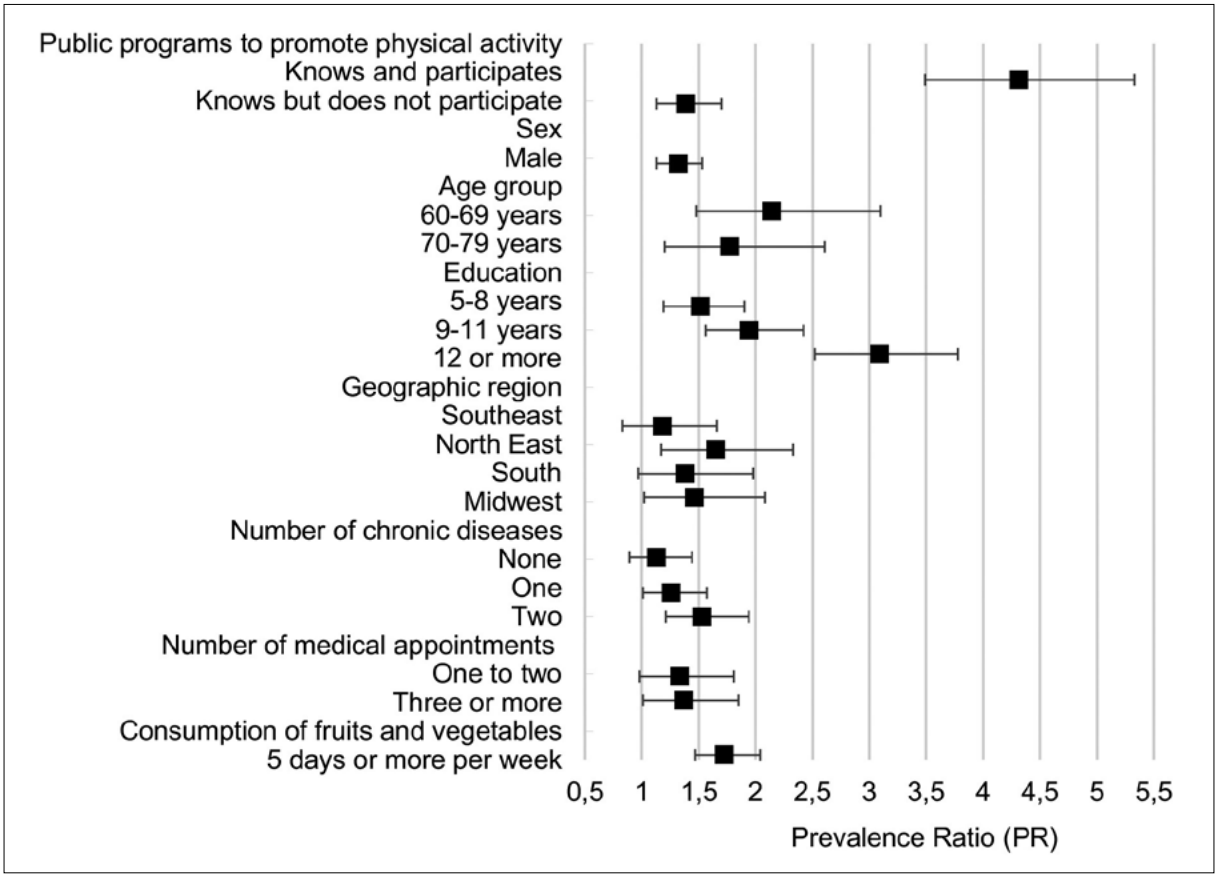

Figure 1. Adjusted prevalence ratio of leisure-time physical activity according to knowledge and participation in public programs to promote physical activity, sociodemographic and lifestyle variables. National Health Survey, Brazil, 2013.

DISCUSSION

In the present study, a low prevalence of recommended levels of leisure activity was observed among older people, as well as low knowledge and participation in community programs to promote physical activity. Knowledge, but not participation, and knowledge and participation were higher among older people aged 60 to 69 years, female, married, living in the South and Southeast regions, who reported three or more chronic diseases, three or more medical appointments in the last 12 months and regular consumption of fruits and vegetables. Knowledge, but not participation, was higher among older people with education greater than or equal to 12 years, and knowledge and participation among those aged 9 to 11 years. The highest prevalence of leisure-time physical activity was associated with knowledge, but not participation, and knowledge and participation in community programs to promote physical activity, male, aged between 60 and 69 years, with 12 years or more of education, with two chronic diseases, who reported three or more medical appointments in the last 12 months, consumed fruits and vegetables regularly, and lived in the Northeast and Midwest regions.

The low prevalence of knowledge, but not participation and knowledge and participation of older people in public programs to promote physical activity, was identified in the present study. This result is similar to that found in the study by Ferreira et al[12], in which 20% of Brazilians aged 18 years or older reported being familiar with the programs, and of these, 9.7% participated. This study also showed that knowledge and participation were more frequent in older age categories. A study that assessed Brazilian older people, with data from the 2013 PNS, found that the most frequent reason for non-participation was lack of interest, lack of time and health problems[13].

This result indicates that despite the transfer of 170 million reais, in the period from 2006 to 2010, to state and municipal departments in all regions of Brazil, which integrated the National Health Promotion Network, the coverage of these programs at the national level is still small[8]. This can be partly explained by the fact that these are recent policies, which are still under construction and that some municipalities may not have sufficient administrative organization to implement the actions. In addition, the lack of diversity in physical activities offered by public programs may impose restrictions on participation for different age and social groups[12,13].

The greater knowledge and participation among women can be attributed to the fact that they are more concerned with health, availability of time and consider the activities offered in the programs appropriate for their preferences[20-23]. Greater knowledge but not participation and knowledge and participation among older people aged 60 to 69 years may be related to health conditions. According to Silva et al[22] who carried out a study with users of programs to promote physical activity developed in primary health care in Pernambuco, the main barrier reported was the current health condition. Biehl-Printes et al[13], who investigated the reasons for not participating in public physical activity programs among Brazilian older people, showed that lack of interest and health problems were the most reported barriers among older people aged 80 years or older compared to those aged from 60 to 79 years.

Our results showed a higher frequency of knowledge, but not participation in public physical activity programs among older people with 12 years of education or more. These findings are consistent with the literature, since education can interfere with the acquisition of knowledge about aspects related to health care, benefits of regular physical activity, in addition to influencing access to public and private places that are adequate and safe to pracice physical activities[7,12]. While knowledge and participation was higher among those with 9 to 11 years of education. Studies have shown that participants in these programs have low levels of education20,23. In this sense, policies to promote physical activity at the community level can contribute to reducing health inequities and promoting the adoption of an active lifestyle by the population.

The prevalence of knowledge, but not participation, and knowledge and participation was uneven across regions in Brazil, which can be attributed to differences in policies and actions to promote physical activity at the local and federal

levels, as well as the lack of specialized human resources in the area of physical activity and health promotion. In 2013, the year in which the PNS was carried out, all regions of Brazil had actions for the development of public programs to promote physical activity through the National Physical Activity Network that make up the actions of the PNPS. The Midwest region had the highest number of physical activity programs financed by the Ministry of Health (MS) of Brazil, followed by the Southeast, Northeast, South and North[9]. In 2017, 48% of the country's municipalities had at least one pole of the program, a total of 3,821 qualified poles, being higher in the North and Northeast regions (55.3% and 54.7%, respectively)[10].

Public programs to promote physical activity in Brazil are aimed primarily at serving older people and groups with chronic diseases or specific conditions, such as diabetes, hypertension and obesity, among others. These spaces also carry out health education actions and promote healthy eating[9,11]. Which could explain greater knowledge, but not participation, and knowledge and participation among older people who reported three or more chronic diseases, three or more medical appointments in the last 12 months and regular consumption of fruits and vegetables.

The prevalence of leisure-time physical activity in the present study was lower compared to other studies[24-26]. The WHO showed that 45% of the world's older population were active in 2010[24]. In the 26 capitals and the Federal District, in 2019, the prevalence of leisure-time physical activity was 39.0%, and with a decrease with increasing age, being 24.4% (95%CI 23.1 - 25.6%) among older people (65 years and over)[25]. A study carried out with older people in the city of São Paulo/SP, 2014/2015, identified 25.3% of active people in leisure time (32.1% for men and 20.3% for women)[26]. The differences in the prevalence of leisure-time physical activity between the studies may be related to the form of data collection, telephone or face-to-face interviews, as well as the sample representativeness.

An important aspect observed in this study was the association between the higher prevalence of physical activity in leisure time and knowledge, but not participation and knowledge and participation in public physical activity programs, with a higher prevalence ratio among those who participated and knew. According to a systematic review that synthesized the evidence available in the literature on physical activity promotion programs in the Brazilian Unified Health System, those who attended the programs were more physically active in their free time and walking, when compared with those who did not participate or did not know[14]. Peixoto et al[27] found a higher prevalence of global physical activity among adults aged 50 years or older who reported knowing about or participating in a public program to encourage this practice, even after adjusting for other individual variables.

Previous studies that investigated the effectiveness of implementing community programs to promote physical activity in Brazil, such as the Academia da Saúde Program (PAS) in Recife/PE, Aracaju/SE and Belo Horizonte/MG, and other initiatives developed in the cities of Curitiba/PR and Vitória/ES, demonstrated the ability of these programs to provide the population with greater access to spaces for physical activity and contribute to the increase in recommended levels of physical activity[8, 9, 28].

A study carried out in Recife showed that the prevalence of physical activity was higher among individuals exposed to PAS, whether through participation or having heard about or seen an activity, compared to those not exposed[29]. In Belo Horizonte, the PAS proved to be able to influence the practice of leisure-time physical activity by non-users who lived close to the poles of the program[30]. The presence of these programs, as well as the implementation process based on the articulation of public policies in the area of urbanization and environment, can provide alternatives to overcome the barriers related to the practice of physical activity, from more distal factors, such as the characteristics of the context, to the more proximal[28].

As consistently reported in the literature, an association was observed between leisure-time physical activity and the variables gender, age group and education[4,31]. A study carried out with individuals aged 10 years or older participating in programs to promote physical activities in primary health care in municipalities in the state of Pernambuco, observed

that although women had greater participation, they reported the existence of more barriers to performing the physical activity[22]. The reduction in the prevalence of leisure-time actives with increasing age, even among the population over 60 years of age, as in the present study, can be explained by biological factors, such as limitations imposed by age and the burden of disease, even related to the environment, such as safety aspects, availability of public and private structures (gyms, squares, courts, health centers and banks) and social support[6,7]. Education is related to a better level of knowledge and understanding of the importance of physical activity for health, as well as an association with economic status that can facilitate access to private places to practice physical activity[12,24].

In the present study, older people living in the Northeast and Midwest regions were more active in leisure time. A study that investigated regional differences in leisure-time physical activity with data from the PNS showed that among those aged 65 and over, the prevalence of active individuals was always lower in the North region, and that the North and Northeast regions were those that presented the highest differences between age groups, while the South region showed the smallest difference[32]. Regional differences could be explained by: i) difference in age structure between regions, with a greater presence of young population in the North region; ii) socioeconomic inequalities that influence opportunities to access spaces conducive to physical activity; iii) development of local and federal actions and policies to promote physical activity[32]. The Northeast and Midwest regions, in 2013, represented 35% of cities with physical activity promotion programs financed by the Ministry of Health in Brazil[9].

The results showed that the prevalence of active leisure time was higher among older people who reported having two chronic diseases, having three or more medical appointments in the last 12 months and consuming fruits and vegetables five or more times a week. Ribeiro et al[21], in a study carried out with participants aged 60 years and over in the Núcleo de Atividades para a Terceira Idade (Nucleus of Activities for Older People) program in the city of Pelotas/RS, observed that one of the reasons for older people to practice physical activity was to seek to avoid or prevent health problems (68.8%) and because the doctor advised (59.8%). Silva et al[33], in a study with individuals aged 60 years or older, participants of the Health Survey of the Municipality of Campinas (ISACAMP), showed that inadequate consumption of dietary fiber (tubers and roots, whole grains, legumes, fruits and vegetables) was more frequent among physically inactive older people. The higher consumption of fruits and vegetables on a regular basis can be attributed to a search for healthier habits among active people.

Knowing the factors associated with the practice of physical activity among older people, especially knowledge and participation in community programs to promote physical activity, can indicate priority groups, for which specific actions can be directed. The practice of physical activity should become a habitual reality in the lives of older people, and can improve quality of life, increase life expectancy, prevent diseases, control the progression and symptoms of diseases.[9,12,34,35]. Community programs to promote physical activity are a promising action, as they contribute to the promotion of the population's health, reducing health inequalities[8]. With the increase in the older population, it is important to maintain actions that promote active aging[5,6].

In this sense, the Physical Activity Guide for the Brazilian Population was recently published, prepared by the MS in partnership with researchers in the area of physical activity and health[35]. The guide provides information on the health benefits of physical activity and recommendations for different groups and life cycles. In addition to presenting messages to overcome the main barriers of physical activity and informing about existing support networks, such as public programs to promote this practice[35].

Regarding the limitations of the study, the cross-sectional design and the use of referred information should be considered. The practice of physical activity was measured only in the leisure domain, chosen because of its potential for intervention. Knowledge but not participation and knowledge and participation were measured by single and general questions about the interviewee's perception of these aspects, not allowing the identification of the type of program (incentive, educational, recreational, welfare, among

others), the scope population and management sphere. In addition, the only socioeconomic variable included in the study was education, and studies have shown an association between income and physical activity[5-7] and participation[12,34]. However, the present study has as a strong point being a sample with representation from all regions of Brazil.

CONCLUSION

A small portion of Brazilian older people reported knowing, but not participating, and knowing and participating in public physical activity programs, and reached the recommended levels of leisure-time physical activity. Sociodemographic and lifestyle factors were associated with knowledge, but not participation, and knowledge and participation, allowing the identification of the most vulnerable groups: older people aged 80 years and over, male, who had not attended medical appointments in the last 12 months, with irregular consumption of fruits and vegetables, and living in the North region. The practice of leisure-time physical activity was higher among older people who knew, but did not participate and knew and participated in public places to promote this practice, male, aged between 60 and 69 years, with 12 years of esducation or more, residents of the Midwest and Northeast, who had two chronic diseases, had three or more medical appointments in the last 12 months and consumed fruits and vegetables regularly.

The study results reinforce the need to expand informative, environmental and public policy approaches to improve access to public places for physical activity. Disseminating information, in the media and in the community, regarding the benefits of physical activity and promoting the involvement of the population in these practices can increase knowledge, understanding and appreciation of the multiple benefits of regular physical activity. Aspects related to the supply, accessibility and quality of spaces must be assessed in order to promote equitable access to safe spaces that provide opportunities and programs in different contexts for all ages.

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Prevalence and factors associated to polypharmacy in older adults from a rural area

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Abstract

Objective: Evaluate the prevalence and factors associated to polypharmacy in older adults from a rural area. *Method:* Cross-sectional, quantitative study carried out with older adults residents from a rural area in Ponta Grossa city, Paraná, Brazil (n = 80). For data collection, a structured questionnaire was used. Polypharmacy was considered as a dependent variable and sociodemographic, lifestyle characteristics, presence of chronic diseases, self-perceived health, falls in the last year, suggestive of cognitive impairment and level of fragility were considered as independent variables. Chi-Square and Logistic Regression tests were performed. *Results:* The prevalence of polypharmacy was 40.0%. Most were female (52.5%), aged between 60 and 74 years old (61.2%), white (76.2%), married (62.5%), and incomplete Elementary School (66,2%). Polypharmacy was associated to level of frailty (OR=3.73; CI95$_{\%}$=1.09-12.74; p=0.036), indicative for sarcopenia (OR=5.02; CI95%=1.39-18.13; *p*=0.014) and diabetes (OR=9.20; CI95%=2.37-36.05; *p*=0.001). *Conclusion:* There was a high prevalence of polypharmacy in rural older adults, and this condition is linked to factors inherent to a greater degree of frailty, indicative of sarcopenia and diabetics.

Keywords: Elerly; Polypharmacy; Rural Health; Rural Areas.

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INTRODUCTION

The epidemiological transition associated with the increase in life expectancy has contributed to an increase in the burden of Chronic Non-Communicable Diseases (NCDs) present in the population[1]. This fact corroborates the occurrence of polypharmacy, a condition defined by the World Health Organization (WHO) and by recent studies as the simultaneous use of five or more medications, with or without prescription[1-3]. The use of medications is extremely important in the treatment of various diseases, but their excessive use is a serious public health problem, and may be associated with a large number of adverse drug reactions (ADRs), drug interactions (DI) and iatrogenic events[4].

Polypharmacy is an increasingly frequent condition among older adults, since they have a large number of diseases[4]. A cross-sectional study carried out in six capitals in the Northeast, South and Southeast regions showed that 28.6% of the older adults used more than five medications[5].

Thus, age is one of the main risk factors for the use of polypharmacy. When submitted to the use of five or more medications, older people may be more exposed to the risk of developing geriatric syndromes, mental confusion, incontinence and falls, increasing the number of hospitalizations[6].

In addition to the high morbidity rate, people over 60 years of age are more susceptible to missed doses or medication administration errors, which can compromise treatment adherence, since the greater the number of problems, the greater the possibilities of prescriptions[2,7].

When it comes to older people living in rural areas, it is worth considering the difficulties that these individuals experience in accessing health care, considering geographic barriers, location of health services, as well as low availability of public or private transport[8], which can lead to changes in medication use patterns.

In view of the above, it is important to identify the characteristics and factors associated with the excessive use of medicines by this age group, with a view to contributing to the creation of action planning for the rational use of medicines and, consequently, an improvement in quality of life of this population, which resides in rural areas. Thus, the objective of the study was to evaluate the prevalence and factors associated with polypharmacy in older people in a rural area in the city of Ponta Grossa (PR).

METHOD

This is a cross-sectional, quantitative, exploratory, descriptive study, developed with older people living in the rural area of the municipality of Ponta Grossa (PR). The municipality occupies the 4th place in the state of Paraná in population size, with an estimated population of 358,838 inhabitants for the year 2021, distributed in a territorial area of 2,054,732 km^2, with the population density of the last census of 150.72 inhab/ km^2 [9]. The population is predominantly urban (97.8%) and adults (47.3%)[9]. The rural population represents 2.2% of the total population, of which 10.8% are older people[9]. The Municipal Human Development Index in 2010 was 0.763. Regarding the provision of health services at the primary level, it has 41 basic health units, two in rural areas and 39 in urban areas[10].

The territory belonging to the family health unit (FHU) of the present study has an estimated population of 3,102 inhabitants, with a density of 3.81 inhabitants per km^2 [8]. The access roads are dirt roads, the distances between residents and health services and other services are large. The family health team is itinerant among the small health units implemented in the territory to meet the health demands of the population and minimize geographical barriers.

The data of the present study are the result of an extension project developed in the territory belonging to the FHU[8], which has a partnership with the State University of Ponta Grossa, hosting several extension projects.

Sampling was by convenience, considering the totality of individuals residing in the territory ascribed to the aforementioned FHU, who were 60 years of age or older (n=131). Individuals who were not at home at the time of the consultation and who did not respond to the questionnaire that gave rise to the dependent variable of the study were excluded.

Resulting in a final sample of 80 older people.

Data collection was carried out, in the interstice of 2018-2019, between the months of February and December, at home, individually, directly with the older person, caregiver or family member who lived with the older person. It was conducted by trained and calibrated researchers, with a view to explaining the object of the research, its voluntary and non-identifying nature, as well as the form of data collection, analysis and destination. Those who agreed with their participation did so, initially, by completing a Free and Informed Consent Term and then were evaluated using four instruments, which will be elucidated below, composed of questions that should be answered by the older person or companion, with self-reported information.

To collect sociodemographic and health characteristics, an instrument was developed with variables related to sex, age, color, marital status, income for the year 2018 (minimum wage BRL 954.00), education, lifestyle (alcoholic, smoker, physical activity) and previous history (hypertension, obesity, diabetes, surgery and previous hospitalization).

Another instrument used was the Mini-Mental State Examination (MMSE), which is used and validated worldwide to assess cognitive function[11]. The instrument works with a scale, whose maximum score to be reached by the patient is 30 points, and its interpretation takes education into account. For the illiterate, the standard cutoff (no suggestion of impaired cognition) is 20 points; for individuals with one to four years of education, the cut-off score is 25 points; for older people with five to eight years of education, it is 26.5 points; for others with 9 to 11 years of education, it is 28 points; and for those with more than 11 years of education, the standard cut-off score (no suggestion of impaired cognition) is 29 points.

The Clinical-Functional Vulnerability Index (IVCF 20)[12] was also used, an instrument validated and recommended by the health care network for older people in Paraná to assess frailty. It consists of 20 questions distributed in dimensions: age, self-perception of health, functional disabilities, cognition, mood, communication and multiple comorbidities[12]. The values are stratified as follows: from 0 to 6, the older person is robust; from 7 to 14, the older person is potentially frail; and the value ≤15, the older person is characterized as frail[12]. For the present study, the potentially frail and frail were grouped, due to the small number of frail subjects, which reduces the accuracy of the statistical test.

In addition to the final score of the IVCF-20[12], some questions were used as independent variables of the study, namely self-perception of health, which was addressed through the question: "In general, compared to other people your age, would you say your health is:", with the answer: "excellent, very good or good; fair or bad". Falls in the last year, with the question: "Have you had two or more falls in the last year?". The variables: "stopped shopping, controlling money and performing small household chores because of physical health" came from the questions: "Due to your health or physical condition, did you stop shopping?"; "did you stop controlling your money, spending or paying your house bills?"; "Due to your health or physical condition, have you stopped doing small housework, such as washing dishes, tidying the house or doing light cleaning?" respectively and had as a pattern of answers: "yes, and no or not for reasons other than health". The indication of sarcopenia was measured through physical assessments as indicated by the instrument, having as a guiding question: do you have any of the four conditions listed below? Unintentional weight loss of 4.5 kg or 5% of body weight in the last year or 6 kg in the last 6 months or 3 kg in the last month; Body mass index (BMI) less than 22 kg/m2; Calf circumference <31 cm; Time spent in gait speed test (4m) >5 seconds[12].

The fourth questionnaire applied was for pharmacological evaluation, the active principles used by the older people were investigated, with a view to quantifying the medications used continuously, without considering a minimum time of use, and dichotomizing the use or not of polypharmacy (use of five or more medications[1,2]).

Polypharmacy was used as the dependent variable. As independent variables, sociodemographic and lifestyle characteristics, presence of self-reported chronic diseases, self-perception of health, falls in

the last year, independence to perform instrumental activities of daily living, suggestive of sarcopenia and cognitive impairment and level of frailty were considered.

The results were analyzed using absolute and relative frequency. To verify the association between the dependent variable and the independent variables, the chi-square test was performed. Then, logistic regression was performed considering the input of variables using the stepwise technique that presented p value ≤0.20, remaining in the model the variables that presented p value ≤0.05 or that adjusted the model.

The research was approved by the Ethics Committee in Research with Human Beings of a Higher Education Institution, opinion 3,591,149, respecting the dictates of Resolution 466/12 of the National Health Council and the Declaration of Helsinki.

RESULTS

The final sample consisted of 80 older people, predominantly women, aged between 60 and 74 years, married, white, with incomplete primary education, income of up to two minimum wages, presenting themselves as retirees or pensioners and with no need for a caregiver (Table 1).

It could be seen that 40.0% of the older people evaluated used polypharmacy. When analyzing the association of sociodemographic characteristics with polypharmacy, an association was found only with the need for a caregiver (p=0.002) (Table 1).

Regarding lifestyle and health, it was noted that most older people did not use alcohol and tobacco, did not perform physical activities, had high blood pressure, did not have obesity and diabetes, were not hospitalized and had no falls in the last year. Still, most older people reported having undergone surgery previously and self-rated their health as good. Individuals who didn't stop shopping, didn't stop controlling money and didn't stop doing small housework due to physical condition prevailed. Furthermore, older people who showed signs of sarcopenia, considered robust and with suggestive impairment, made up most of the sample (Table 2).

The characteristics that were associated with polypharmacy were: diabetes (p<0.001), hospitalization in the last year (p=0.002), self-perception of health (p=0.034), stop shopping because of physical condition (p=0.014), stop controlling money because of physical condition (p=0.009), stop doing small housework because of physical condition (p=0.011), indicative of sarcopenia (p<0.001) and frailty level (p<0.001) (Table 2).

The multivariate analysis showed that older people considered potentially frail or frail were 3.73 times more likely to use polypharmacy when compared to non-frail (p=0.036). The same occurred with indication of sarcopenia and diabetes, as individuals with such conditions were 5.02 and 9.20, respectively, more likely to use 5 or more medications (p<0.05) (Table 3).

Table 1. Sociodemographic characteristics of older people residing in a rural area of a medium-sized municipality, according to the use of polypharmacy (N=80). Ponta Grossa (PR), 2020.

Variables	Yes n(%)	No n(%)	Total n(%)	*p* value
Presence of Polypharmacy	32 (40.0)	48 (60.0)	80 (100.0)	
Age				0.188
60-74 years	17 (34.7)	32 (65.3)	49 (61.2)	
75-80 years	12 (42.9)	16 (57.1)	28 (35.0)	
≤ 85 years	3 (9.4)	0 (0.0)	3 (3.8)	
Sex				0.143
Female	20 (47.6)	22 (52.4)	42 (52.5)	
Male	12 (31.6)	26 (68.4)	38 (47.5)	
Color				0.830
White	24 (39.3)	37 (60.7)	61 (76.2)	
Others	8 (42.1)	11 (57.9)	19 (23.8)	
Education				0.306
Illiterate	10 (55.6)	8 (44.4)	18 (22.5)	
Incomplete primary education	19 (35.8)	34 (64.2)	53 (66.2)	
Complete primary education	3 (33.3)	6 (67.7)	9 (11.2)	
Marital status				0.637
Married	19 (38.0)	31 (62.0)	50 (62.5)	
Others	13 (43.3)	17 (56.7)	30 (37.5)	
Average monthly income				0.265
Up to 2 minimum wages*	25 (37.3)	42 (62.7)	67 (83.8)	
2 to 5 minimum wages	7 (53.8)	6 (46.2)	13 (16.2)	
Retired or pensioner				0.901
Yes	27 (40.3)	40 (59.7)	67 (83.8)	
No	5 (38.5)	8 (61.5)	13 (16.2)	
Has a caregiver				0.002
It is not necessary	23 (33.3)	46 (66.7)	69 (86.2)	
Yes	9 (81.8)	2 (18.2)	11 (13.8)	

* Minimum wage in 2018: BRL 954.00

Source: Authors, 2021.

Table 2. Lifestyle and health of older people residing in a rural area of a medium-sized municipality, according to the use of Polypharmacy. Ponta Grossa (PR) (2020) (n=80).

Variables	Yes n(%)	No n(%)	Total n(%)	*p* value
Alcoholic				0.819
No	26 (40.6)	38 (59.4)	64 (80.0)	
Yes	6 (37.5)	10 (62.5)	16 (20.0)	
Smoker				0.926
No	19 (40.4)	28 (59.6)	47 (58.8)	
Yes	13 (39.4)	20 (60.6)	33 (41.2)	

to be continued

Continuation of Table 2

Variables	Yes n(%)	No n(%)	Total n(%)	*p* value
Performs physical activity				0.565
No	22 (42.3)	30 (57.7)	52 (65.0)	
Yes	10 (35.7)	18 (64.3)	28 (35.0)	
Hypertension				0.080
No	4 (22.2)	14 (77.8)	18 (22.5)	
Yes	28 (45.2)	34 (54.8)	62 (77.5)	
Obesity				0.332
No	28 (38.4)	45 (61.6)	73 (91.2)	
Yes	4 (57.1)	3 (42.9)	7 (8.8)	
Diabetes				0.001
No	16 (27.6)	42 (72.4)	58 (72.5)	
Yes	16 (72.7)	6 (27.3)	22 (27.5)	
Hospitalization in the last year				0.002
No	22 (32.8)	45 (67.2)	67 (83.3)	
Yes	10 (76.9)	3 (23. 1)	13 (16.2)	
Falls in the last year				0.205
No	19 (35.2)	35 (64.8)	54 (67.5)	
Yes	13 (50.0)	13 (50.0)	26 (32.5)	
Previous surgery				0.066
No	7 (25.9)	20 (74.1)	27 (33.8)	
Yes	25 (47.2)	28 (52.8)	53 (66.2)	
Self-perception of health				0.034
Excellent, very good or good	13 (29.5)	31 (70.5)	44 (50.0)	
Fair or bad	19 (52.8)	17 (47.2)	36 (45.0)	
Stopped shopping because of physical health				0.014
No	25 (35.2)	46 (64.8)	71 (88.8)	
Yes	7 (77.8)	2 (22.2)	9 (11.2)	
Stopped controlling money due to physical condition				0.009
No	26 (35.6)	47 (64.4)	73 (91.2)	
Yes	6 (85.7)	1 (14.3)	7 (8.8)	
Stopped doing small housework				0.011
No	28 (35.0)	48 (60.0)	76 (95.0)	
Yes	4(5.0)	0 (0.0)	4 (5.0)	
Indicator of sarcopenia				0.001
No	9 (22.0)	32 (78.0)	41 (51.2)	
Yes	23 (59.0)	16 (41.0)	39 (48.8)	
Frailty level				<0.001
Robust	6 (16.7)	30 (83.3)	36 (45.0)	
Pre Frail / Frail	26 (59.1)	18 (40.9)	44 (55.0)	
Cognitive assessment				0.429
No suggestive impairment	11 (13.8)	21 (26.3)	32 (40.0)	
With suggestive impairment	17 (21.3)	22 (27.5)	39 (48.8)	
No answer	4 (5.0)	5 (6.2)	9 (11.2)	

Source: Authors, 2021.

Table 3. Adjusted multiple analysis of association between polypharmacy and independent variables (n=80). Ponta Grossa (PR), Brazil, 2020.

Variables	OR (95% CI)	*p* value
Frailty		
Robust	1.00	0.036
Pre Frail or Frail	3.73 (1.09-12.74)	
Indication of sarcopenia		
No	1.00	0.014
Yes	5.02 (1.39-18.13)	
Diabetes		
No	1.00	0.001
Yes	9.20 (2.37-36.05)	

Source: Authors, 2021.

DISCUSSION

The present study discusses the prevalence and factors associated with polypharmacy in older people in a rural area, and it is possible to verify that the level of frailty, the indication of sarcopenia and diabetes were factors that increased the chances of older people using polypharmacy.

When stratified by area of residence, there are few studies on the prevalence of polypharmacy among older people in rural areas, with the focus being mostly on individuals from urban areas[13], denoting the importance of the research in question.

The prevalence of polypharmacy found in cross-sectional studies carried out in the urban area in the city of Airaquara (BA) identified that 29.0% of the older people used five or more medications[7]. Another cross-sectional study carried out with older people living in urban areas in seven Brazilian cities found that 18.4% used polymedication[14]. On the other hand, older people residing in rural areas tend to make greater use of polypharmacy when compared to residents in urban areas, since they have less accessibility to health services, due to geographic barriers and low concentration of public and private transport, increasing the chances of using several medications simultaneously[15]. A cross-sectional study carried out with older people living in a rural area of Spain, showed the prevalence of polypharmacy in 56.0% of the older people[16], corroborating the high prevalence found in the investigated rural area.

In the present study, the level of frailty can significantly increase the chances of using polypharmacy, in line with the national and international literature[15,17]. It is noteworthy that frailty is a condition related to physiological, neuromuscular, endocrine and immunological changes[18] and may be associated with multimorbidity, functional impairment and hospitalizations, factors that corroborate the use of polypharmacy[19,20].

Moraes et al.[12], emphasize that frailty is conceptualized as a decrease in homeostatic reserve or in the ability to adapt to biopsychosocial aggressions, increasing vulnerability to functional decline. Thus, older people considered frail tend to decrease the level of physical activities, reduce gait speed and, consequently, limit the ability to perform basic activities of daily living (BADL), developing a negative impact on social relationships and autonomy[21]. These conditions contribute to the increased exposure of the older person to physical and psychological diseases, falls and hospitalizations, increasing the use of medications simultaneously[22].

Furthermore, frail older people tend to develop unintentional weight loss, weakness and excessive use of medications[18]. These factors may lead to the development of sarcopenia, a condition that can be

defined as a progressive and generalized skeletal muscle disorder that involves accelerated loss of muscle mass and function[23].

The presence of sarcopenia contributed significantly to increasing the chances of older people using polymedication. The loss of muscle mass tends to make older people more susceptible to dependence and functional disability, increasing the chances of the individual suffering falls, fractures and being hospitalized[24]. It is worth mentioning that the etiology of sarcopenia results not only from frailty, but from other factors such as metabolic, nutritional and hormonal factors, which may favor or be a consequence of the use of multiple medications[25].

In addition, studies show that sarcopenia may be related to obesity[26,27]. Despite not having influenced the use of medications in the present study, it is possible to observe that obese older people tend to have a decrease in muscle mass, with the function of the muscles supplied by adipose tissue. Furthermore, obese individuals have worse physical performance, lower cognitive development and worsening of cardiovascular diseases, conditions that justify the use of several medications simultaneously[26].

In addition, living in rural areas can contribute to the development of frailty and sarcopenia, increasing the chances of using five or more medications, since older people face difficulties imposed by the environment, such as low income, low education and difficulties in accessing health services[7,8]. These conditions can make it difficult to carry out educational actions aimed at a better quality of life for these individuals, as well as to carry out early interventions for health-related complications[28].

Another factor that was associated with polypharmacy was diabetes. In Brazil, the National Health Survey (PNS) estimated that 19.9% of older people aged between 65 and 74 years reported a medical diagnosis of diabetes[29]. In addition, in a longitudinal census study carried out in Mexico, it was found that 16.16% of men and 19.91% of women over 60 years of age had diabetes[30].

Older people with diabetes are more likely to use several medications simultaneously[31], since it is associated with several complications, such as diabetic retinopathy, chronic kidney disease and peripheral neuropathy[32]. It is worth mentioning that the risk factors for diabetes are also considered risks for the development of other chronic diseases, including arterial hypertension, acute myocardial infarction and heart failure, which can lead the older person to develop other morbidities[33]. Also, diabetes can cause cognitive disorders, a condition that can interfere with the autonomy of the older person, being a predisposed factor for the development of frailty syndrome, which, already mentioned, also increases the chances of polypharmacy[34].

Despite the scarcity of environments intended for physical exercise in rural areas, studies show that walking and occupational activities developed in the countryside can be considered strategies to provide a better quality of life and help reduce the number of medications used by these older people[35].

In view of the above, there is an imminent need to monitor the health condition, at the population and individual level, of the older people, especially those who live in rural areas, in order to encourage good living habits, so that there is a reduction in the number of prescription medications[6].

Also, health professionals, especially the nursing team, must know the organic changes characteristic of aging, as well as develop a vigilant role regarding the conditions addressed here for polypharmacy. In this way, they can elucidate together with the city managers strategies for the rational use of medicines, as well as ways to cover the population residing in rural areas, in order to avoid possible iatrogenic events.

The limitations of the study were characterized by the scope of the sample being with individuals from a single rural location, allowing to consider the results found only for the population in question, in addition to the sampling process being by convenience, without considering a sample calculation and small number of subjects in some classes of variables, the confidence interval being very large, which compromises the accuracy of the estimate. Still, it is a cross-sectional study, it is not possible to establish cause and effect relationships, it is also known that the data come from self-reports, and there is a memory bias. However, the findings

shown here are extremely relevant for the deepening of knowledge about the subject, since there are few studies that deal with the subject.

CONCLUSION

The prevalence of polypharmacy among older people living in the investigated rural area was high. Factors such as level of frailty, diabetes and indication of sarcopenia were significantly associated with polypharmacy.

The findings discussed in this study will favor the health team, as well as managers, to investigate strategies aimed at the prevention and intervention of polymedication in older people, such as encouraging the practice of physical activities and balanced diet, aiming at non-pharmacological actions within the rural environment.

In addition, monitoring by the multiprofessional team is necessary to assess the demands for maintaining the healthy aging of older people, in particular, performing medication reconciliation periodically, to avoid possible adverse drug reactions, drug interactions and iatrogenics, aggravating the health condition of these people.

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Older people and life conditions: analysis from household budget research, Viçosa (MG) Brazil, 2019-2020

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Abstract

Objective: The study aimed to identify the socioeconomic profile of the older population in Viçosa, MG, Brazil, and their living condition and verify the influence of the age, sex and education factors on the income of family members and the older people in particular. *Methods*: This is a cross-sectional and descriptive study, based on data from the Household Budget Survey (POF) (2019-2020), from the Department of Economics at the Federal University of Viçosa (DEE-UFV). Three hundred and seven households participated in the study and the sample was composed by 167 older people. *Results*: Most of the older people were female, with an average age of 69.8 (±8.07) years old, education level referring to complete high school and retired (74.90%). As to their income, most of them had R$2,914.10 on average, which is above the range considered low by the Brazilian Government Registry named "Cadastro Único". They also had the retirement as their exclusive income. The older people were satisfied with their living conditions, especially in regard to housing. The variables gender, age, and education influenced the family members' income. But the age factor did not influence the older people's income when it was singularly analyzed. *Conclusions*: The studied sample had more satisfactory and favorable income, schooling and living conditions than the older population in the country when compared to studies that used data from the national POF. However, this reality could be linked to the existence of the UFV in the city where great part of the population studies and/or works therefore achieving better educational levels and earning higher incomes once education has a positive impact on the access to better jobs and wages.

Keywords: Older People. Life conditions. Income.

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INTRODUCTION

Greater longevity leads to changes in older people's consumption profile, generating demands for differentiated goods and services[1], with prices and brands that meet their needs[2]. Contemporary older people present a different profile from the older people of decades ago, as they are more active and consumerist, being considered a new segment of the population, with market potential[3].

In addition to living longer, the older person lives healthier, works longer, has greater purchasing power and consumes more, both out of necessity and for pleasure and fun[4].

At the same time, it is necessary to consider that older people do not constitute a homogeneous group, differing in terms of income, education, sex, race, cohort, among others. Thus, in addition to the heterogeneity evidenced by sex and age factors, Camarano and Pasinato[5] point out that the older people age group is composed of individuals who have total autonomy, contribute to socioeconomic development and play relevant roles in the family, as well as those who are unable to cope with daily activities and who have no income.

Allied to this issue, there is a concern about the older people's expenses in view of the demands imposed by aging. The older people's income is not always able to meet their needs with food, housing, health, among others[6], especially in cases where they are responsible for or the ones who contribute most financially to the family unit.

Therefore, greater longevity, linked to a greater number of older people, will impact public policies, reflecting on living conditions, economy, consumption, among others. In turn, consumption is influenced by factors such as income, age, preferences, habits and culture[2].

Thus, it is problematized that characteristics such as education, income, sex and age of the older people interfere in their consumption pattern. Thus, the study identified the older people's socioeconomic profile and their living and housing conditions, and verified the existence of factors that can influence their income, since it is one of the main determinants of consumption.

Knowing the living conditions of the older person is important to understand the scenario in which they are inserted, with a view to implementing public and social policies that support this segment. Such a survey can be an instrument in the formulation of policies, especially in the areas of health, leisure, education and transport, considering the needs of the older people and the reality experienced.

In terms of literature, few studies were found nationwide, such as Almeida and Kassouf[6], Melo et al.[7] and Melo et al.[2]. These studies evaluated the socioeconomic characteristics of the Brazilian older population, while the present study was carried out with the older population of Viçosa (MG), using data from the local Family Budget Survey (POF), which more accurately portrays the reality of the municipality.

METHOD

This is a cross-sectional and exploratory-descriptive study based on data from the POF (2019-2020), carried out by the Department of Economics (DEE) of the Federal University of Viçosa (UFV), in which data from families that included older people in their composition were analyzed.

In the city of Viçosa (MG), the Municipal Human Development Index (IDHM) was 0.778 in 2010. The value, considered high (between 0.700 and 0.799), was reached by the contribution of the longevity (0.883), income (0.758) and education (0.696) factors[8]. The municipality hosts the UFV, which allows the older people who were part of its technical-administrative or teaching staff to have access to a better income when compared to older people retirees from other sectors.

The POF obtains general information about households, families and people, consumption habits, household expenses and incomes, having households as a collection unit[9] and, as a function, updating the basic consumption basket and obtaining new weighting structures for the price index calculation.

In addition, the POF aims to measure consumption structures, expenditures, income and part of the families' equity variation to provide information on the domestic budget composition and living conditions of the population, as well as the subjective perception of quality of life, in addition to generating databases and studies on the nutritional profile of the population[10].

The POF questionnaire is subdivided into blocks containing questions about household characteristics; Residents of the household; Expenses for product groups related to Food, Clothing, Housing, Household items, Transport, Communication, Health and personal care, Education, Personal expenses, Income and Living conditions.

To categorize the older people's socioeconomic profile, the following variables were considered: age in years, sex, education, professional occupation, source of income and monthly income. In order to know the living conditions of the older population, aspects such as type of household, number of rooms (total, bedrooms and bathrooms) and occupancy condition of the property, perception of sufficient monthly income, minimum monthly income to reach the end of the month, perception of the sufficiency of the amount of food consumed by the family monthly, water service, garbage collection, street lighting, rainwater drainage, water and electricity supply, structural problems in the home and delay in paying expenses.

For the nominal variables, the data found were described by absolute and relative frequency. For scalar variables, in addition to Exploratory Data Analysis (EDA), multiple linear regression analysis was performed with cross-sectional data.

Regarding the last analysis, two regression models were developed to explain the determinants of the older people's income and of those living in households with older people. In both cases, the dependent variable is explained by independent variables such as age, sex and education level, which characterizes a multiple linear regression. The choice of independent variables was based on Cirino[11] and Loureiro[12], who used the Human Capital theory as a theoretical model. Thus, the linear regression equation was estimated:

$$\log(\text{Income}_i) = \beta_1 + \beta_2 \text{Age}_i + \beta_3 \text{Age}^2 + \beta_4 \text{Sex}_i + \beta_5 \text{Pre-School}_i + \beta_6 \text{BasicEducation}_i + \beta_7 \text{HigherEducation}_i + u_i$$

in which $log(Income_i)$ is the explained variable expressed by the total monthly income of the older people for one regression, and of family members with older people in the composition, for the other regression; Age_i is the individual's age measured in years, being also included in its quadratic form, in order to capture a possible non-linear relationship between $log(Income_i)$ and Age_i, as suggested by the Human Capital theory. Sex_i is a dummy variable that takes the value 1 for men and 0 for women, $Pre\text{-}School_i$, $BasicEducation_i$, and $HigherEducation_i$ are dummy variables that present the individual's level of education, with the base group formed by High School, since this level of education was the most common among the older people in the sample. Finally, B_j, with j ranging from 1 to 7, are the model parameters, while u_i is the stochastic error term.

The possible non-linear relationship between Income and Age would be the result of the normal depreciation of human capital with age. This is because, initially, more years in the labor market tend to mean greater skill and training for work. However, over time, the older age of the worker begins to be seen as a negative point, since the employer starts to associate this variable with the greater difficulty in learning new technologies and the high delay in work activities[11].

As the equation was estimated using the Ordinary Least Squares Methods (OLS) in order for the estimators to be efficient and unbiased, it is important that all desirable properties of the method are met. In this sense, cross-sectional data may contain the problem of heteroscedasticity, that is, the dispersion of the error term is not the same throughout the analysis. In this study, this may be due to the fact that some people have very high incomes while others have very low incomes.

The test used to detect heteroscedasticity was the *Breusch-Pagan* test. This has the null hypothesis

of homoscedasticity (constant variance) against the alternative hypothesis of the presence of heteroscedasticity. To correct this possible violation, estimation by robust standard errors is performed.

To spatially demonstrate the average income of households with older people in their composition according to the neighborhood where the research was carried out, the Quantum-Gis program was used, which is a geographic information system that allows viewing, editing and analysis of georeferenced data.

RESULTS AND DISCUSSION

The socioeconomic conditions of the older people in Viçosa

To carry out the POF, 307 households in Viçosa (MG) were visited. In 113 of these (36.81%) there was at least one older person residing, totaling 167 older people in the sample. There was an average of 2.93 people residing in such households. According to Almeida and Kassouf[6], the presence of an older person in the family nucleus, with their stable income, changes the family's consumption structure, in addition to helping to reduce poverty in that unit. Thus, households containing at least one older person were selected for the sample.

The family arrangements identified in the sample were: older person living alone or as a single person (9.74%), older person living with a spouse (23.89%), older person living with a spouse and children (23.89%), older person living with a spouse, children, grandchildren and other relatives (8.85%) and older person people living with children, grandchildren and other relatives without a spouse (33.63%). In 89.38% of the households, the reference person or head of the family was an older person, 46.90% male and 42.48% female.

The high percentage of households headed by older people is noteworthy. According to data from the National Household Sample Survey (PNAD) 2018[13], from 2016 onwards, there has been an increase in the number of households headed by older people. This can be associated with the stability of the income of the older person, from retirement and pensions, and reflections of the economic crisis and unemployment[14]. Furthermore, the head of household is usually associated with the person with the highest or most stable income, which may also explain the result found.

The older people had a mean age of 69.8 (±8.07) years, with a median and mode of 69 years. Most were female (52.10%), corroborating the trend pointed out by Arango and Peláez[15] about the feminization of old age. As Melo et al.[2] point out, this greater female life expectancy may be linked to a greater and earlier demand for health care by women compared to men, which, consequently, results in a longer life, however, not always healthier. Therefore, despite living longer, women suffer more from functional disabilities, living longer with diseases in the last years of life and tend to have lower levels of life satisfaction than men[7,16,17].

Regarding education, the older people had a higher level of education when compared to the national average found in the study by Melo et al.[7], who identified a low level of education of the older population in the country, consistent with elementary education, when analyzing data from the POF 2008-2009[10].

As for professional occupation, most of the older people were retired, with income ranging between R$1,500.00 and R$3,000.00 and sources of income solely from retirement (Table 1).

Table 1. Socioeconomic profile of the older people in Viçosa. Viçosa, MG, 2020.

Variables	Frequency (%)
Gender	
Male	80 (47.90%)
Female	87 (52.10%)
Age (in years)	
60 to 64	50 (29.94%)
65 to 69	49 (29.34%)
70 to 74	26 (15.57%)
75 to 79	19 (11.38%)
80 to 84	15 (8.98%)
85 to 89	3 (1.80%)
90 to 94	3 (1.80%)
95 to 99	2 (1.20%)
Schooling	
Not educated	3 (1.83%)
Preschool (Kindergarten)	4 (2.44%)
Elementary School I Incomplete	12 (7.32%)
Elementary School I Complete	31 (18.90%)
Elementary School II Incomplete	7 (4.27%)
Elementary School II Complete	20 (12.20%)
High School Incomplete	11 (6.71%)
High School Complete	39 (23.78%)
Youth and Adult Education (YAE)	1 (0.61%)
University Education Incomplete	4 (2.44%)
University Education Complete	25 (15.24%)
Techinical Education	3 (1.83%)
Master´s degree	1 (0.61%)
Doctorate degree	3 (1.83%)
Occupation	
Private employee	7 (4.67%)
Pulic employee	11 (7.33%)
Housekeeper or housemaid	2 (1.33%)
Street vendor	1 (0.67%)
Employer	1 (0.67%)
Self-employed	7 (4.67%)
Retired	112 (74.67%)
Housekeeper or housewife	9 (6.00%)

to be continued

Continuation of Table 1

Variables	Frequency (%)
Income source	
Private employment	7 (4.67%)
Public employment	11 (7.33%)
Housework	1 (0.67%)
Self-employment or business owner	7 (4.67%)
Alimony, allowance or non-resident donation	2 (1.33%)
Rent, use or exploitation of real estate	1 (0.67%)
No income	8 (5.33%)
Housework and public retirement	1 (0.67%)
Retirement (public or private)	110 (73.33%)
Private retirement and alimony, allowance or non-residence donation	1 (0.67%)
Pulic retirement and rent, use or exploitation of real estate	1 (0.67%)
Monthly income (R$)	
Up to 1,500.00	46 (34.85%)
1,500.01 to 3,000.00	50 (37.88%)
3,000.01 to 5,000.00	21 (15.91%)
5,000.01 to 7,000.00	5 (3.79%)
7,000.01 to 10,000.00	6 (4.55%)
More than 10,000.00	4 (3.03%)
Did not answer	35 (20.95%)

Source: POF/DEE/UFV, 2020.

The average monthly income of the older people was R$2,914.10, with a median of R$2,150.00 and mode of R$954.00. Among the respondents, a large portion had an income of up to R$5,000.00, with a variable range between R$444.00 and R$15,500.00. Considering the low-income concept used for registration in the Single Registry[18], which states that "low-income families must be registered: those earning up to half a minimum wage per person (R$522.50); or who earn up to 3 minimum wages of total monthly income (R$3,135.00)", values in force in 2020, and the average income found for older people, that is, income per person, R$2,914.10, it can be observed that they were above the range considered as low income in the country.

Although data from the local POF do not allow associating the source of income of these older people with pensions from work at UFV, the relationship is likely, given the income values of 65.16% of older people who had incomes above the minimum wage in force in 2020 (R$1,045.00). Thus, it is inferred that the older people retired from UFV had access to higher wages and better living conditions than the national average, portrayed in studies such as those by Melo et al.[7], since they had, throughout their lives, a better income, which consequently allowed them to live in better socioeconomic conditions than the older people in the country as a whole.

Bento and Lebrão[19] emphasize that older people with lower incomes generally have worse health and physical function conditions, and less use of health services, in addition to the prevalence of chronic-degenerative diseases.

In this sense, Melo et al.[7] argue that higher income levels allow the older people to acquire better health services, monitoring, support equipment and a more active social insertion, providing them with better living conditions. In addition, according to the authors, income levels are important not only to understand the older person as a potential consumer, but as an active individual, who has needs arising

from age and personal, family, social, economic and cultural characteristics.

Figure 1 shows the average income of households with older people according to the neighborhood of residence. The smallest of them was found in the Novo Silvestre neighborhood (R$700.00) and the largest, in Acamari (R$15,500.00).

It was observed that 31.25% of the households with older people had an average income ranging between R$4,000.00 and R$6,000.00, with the highest incomes belonging to households located in neighborhoods characterized as middle and upper class in the municipality, such as Acamari, Clelia Bernardes and Lourdes.

The older people had the highest income in 74.34% of the households, which draws attention to the large number of older people heads of families, who have assumed the role of collaborating with the family income. This income of the older person, within the family structure, becomes relevant due to its stability, increasing the family's purchasing power[20].

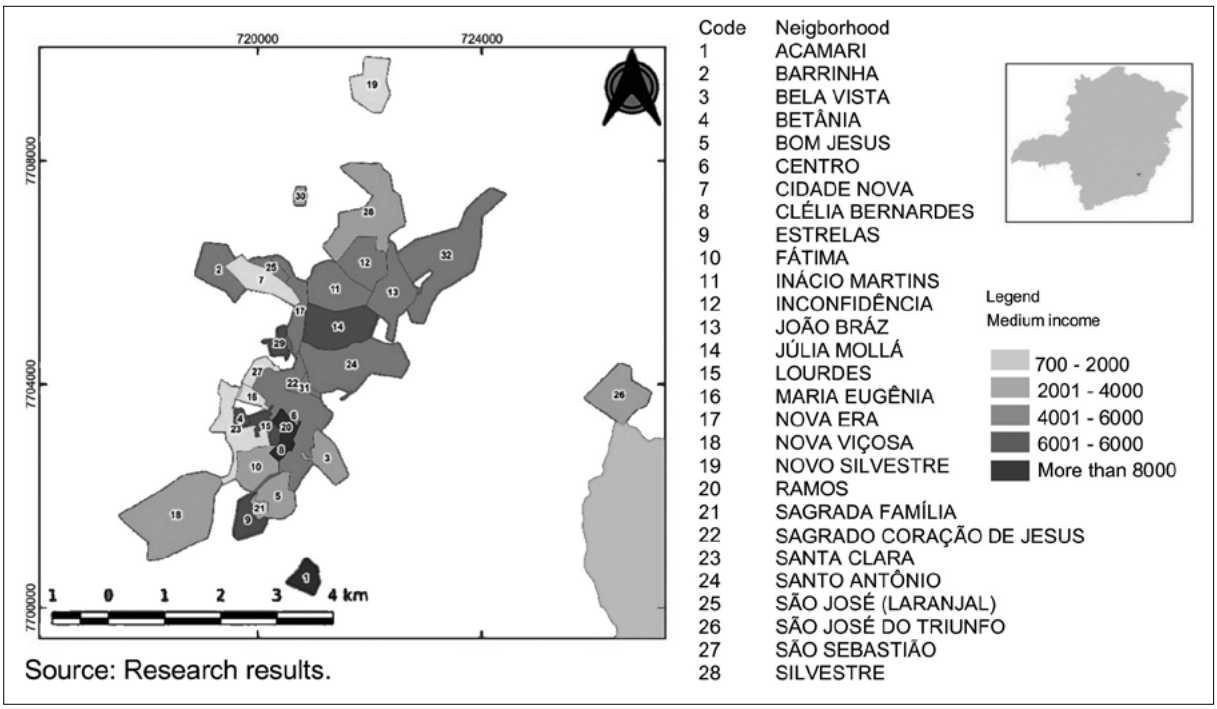

Figure 1. Distribution of the average family income of households with older people, according to the neighborhood of residence. Viçosa, MG, 2020.

As for the housing conditions of the older people's homes (113 homes), 58.18% were non-rustic houses and 20.91%, apartments. The households had, on average, 8.58 rooms, with 3.11 bedrooms and 2.02 bathrooms, with 83.18% owned, already paid off, 2.65% owned, in acquisition, 9.73% rented, 2, 65% transferred, and 1.77% did not inform.

In general, the older people considered water services (62.96%), garbage collection (49.07%), public lighting (56.48%), rainwater drainage (46.73%), water supply (57.94%) and electricity (82.41%) good. It should be noted that only the supply of electricity received satisfactory approval. The satisfaction level of around 50% for the services provided by the municipality indicates the need for significant improvements.

Regarding the older people's perception of the conditions of their homes, they were satisfied with the space (93.52%), house lighting (85.19%), roof (92.52%), foundation, walls and floor (88.79%), windows and floors (90.65%), street or neighbors (66.67%), pollution or environmental problems

(82.41%), and violence or vandalism in the vicinity (50.00%). It is believed that this last question is of great concern to the community as a whole, because, as stated by Siqueira et al.[21], the crime rate in the municipality of Viçosa (MG) grew from the 2000s onwards, requiring the authorities to invest in security and fighting crime.

Regarding the perception of the sufficiency of the total income received, 71.30% considered that the amount received did not allow reaching the end of the month without some degree of difficulty, with R$5,000.00 considered the minimum monthly income necessary to reach the end of the month for 15.00% of respondents (Table 2).

Table 2. Perception of the older people from Viçosa regarding their income. Viçosa, MG, 2020.

Variables	Frequency (%)
Minimum monthly income required to reach the end of the month (R$)	
Até 1,000.00	6 (7.5%)
1,000.01 to 2,000.00	14 (17.5%)
2,000.01 to 3,000.00	17 (21.25%)
3,000.01 to 4,000.00	13 (16.25%)
4,000.01 to 5,000.00	12 (15.00%)
5,000.01 to 6,000.00	4 (5.00%)
6,000.01 to 7,000.00	4 (5.00%)
7,000.01 to 8,000.00	4 (5.00%)
More than 8,000.00	6 (7.50%)
Did not answer	33 (29.20%)
The total income allows you to reach the end of the month:	
With great difficulty	5 (4.63%)
With difficulty	14 (12.96%)
With little difficulty	33 (30.56%)
With some difficullty	25 (23.15%)
With ease	22 (20.37%)
Very easily	9 (8.33%)
Did not answer	5 (4.42%)
The amount of food consumed by your family is:	
Usually not enough	1 (0.93%)
Sometimes not enough	5 (4.67%)
Always enough	101 (94.39%)
Did not answer	6 (5.31%)
Delay in the payment of rent or real estate mortgage or financing	
Yes	1 (0.94%)
No	105 (99.06%)
Did not answer	7 (6.19,%)
Delay in the payment of water, electricity and other bills	
Yes	6 (5.61%)
No	101 (94.39%)
Did not answer	6 (5.31%)
Delay in the payment of goods and services	
Yes	2 (1.87%)
No	105 (98.13%)
Did not answer	6 (5.31%)

Source: POF – DEE/UFV. 2020.

The data revealed a certain paradox regarding the sufficiency of income for the older people. Although 71.30% considered that the total income received was not enough to reach the end of the month without difficulty, the amount of food consumed in the month was considered sufficient by 94.39% of them (Table 2). One aspect that can be assumed is that, despite the income not being sufficient, the families of these older people can prioritize the purchase of food. Melo et al.[7] point out that income is directly related to the family's purchasing power. Bento and Lebrão[19] clarify that the satisfaction of what is understood as minimum needs, consumption habits and preferences of individuals vary according to the environment in which they are inserted. In this way, income would not be the only factor preventing individuals from consuming or not achieving something, as the physical and social characteristics acquired affect their lives.

Regarding the amount of food consumed in the month, it was found that the households where it was stated that this amount was sometimes not enough were in the income bracket of up to R$2,000.00 per household. Regarding the sufficiency of monthly income, there were households that had a total income of R$954.00 and considered that it allowed them to reach the end of the month with little difficulty, revealing an overestimation of income. On the other hand, an underestimation of income was identified in households that accounted for incomes from R$4,000.00 and that also highlighted a little difficulty to spend the month.

Thus, it is inferred that the perception of income sufficiency differed between households with older people, showing that this perception is subjective and dependent on factors such as the context in which one lives, lifestyle, number of people in the household and their needs. Bento and Lebrão[19] emphasize that it is important to understand the understanding of the older person about the care, or not, of their basic and human needs, as this is related to the perception of income sufficiency.

Studies indicate that older seniors tend to overestimate their income satisfaction by underestimating their financial difficulties. As they are older, these people would have better information about their health condition, would know more precisely the discontinuities to which they are susceptible and would have greater experience in managing their resources according to their income level and in relation to younger seniors[19]. Still, according to the authors, there would be the theory of cognitive dissonance, in which the older people, when experiencing a decrease in their income, would change their interpretation of how much they would actually need to survive satisfactorily.

Thus, it is not possible to generalize the perception of income sufficiency in the studied sample, as it is individual and relative, depending on factors and peculiar characteristics of each family.

In 71.30% of the households, it was considered that the total monthly income did not allow them to reach the end of the month without difficulties. However, on average, in 97.19% of the households there were no delays in the payment of expenses such as rent, water and electricity bills and the provision of goods and services, which may reveal satisfactory administration of the budget by the families.

Influence of age, sex and education variables on earnings

The results of the *Breusch-Pagan* test for the general and older person-only models presented test statistics equal to 0.52, with a *p*-value of 0.47. As these statistics were not significant, being interpreted as acceptance of the null hypothesis of homoscedasticity, estimation by robust standard errors was not necessary.

For the general model, the results of the multiple linear regression estimation showed that age had a positive influence on the individual income of family members (Table 3). That is, for each year of age of the individual, his income increases by 3%. This result can be explained by the fact that as age can be seen as a proxy for experience in the labor market, the greater the experience, the greater the possibility of reaching jobs with better salary. The age squared was not significant to explain the individual's income, indicating that for the sample in question, there was no depreciation of human capital suggested by the Human Capital theory.

As for the case in which only the older person's income was analyzed, it was observed that age and age squared did not influence the income received by the older person. That is, for these older people, advancing age will most likely not imply an increase in income, since 74.67% were retired and their sources of income came exclusively from retirement.

The results showed that the gender variable had an influence on the individual's income, with males having an income greater than females by 34% and 40%, respectively, for the general models and for older people. Barros[22] found in his study a difference of 22% in female income compared to male income. Regarding the gender income differential, Freisleben and Bezerra[23] point out that although women are generally more educated, there is still a wage differential in favor of men not explained by the difference in attributes, indicating the existence of discrimination in the labor market. Cirino[11] found that there was a reduction of 6.2 percentage points in income discrimination between genders between 2002 and 2014, although there is still a gap of about 30% more in unexplained income between men and women.

Some qualitative variables of education level were included in the analysis, keeping high school as a base. For the general model, it was observed that the individual who had only preschool had an income 53% lower than those who had completed high school. While the individual with higher education, or some level above, had an income 50% higher than those who did not have this level of education. In relation to elementary school, as this qualitative variable was not statistically significant, individuals with this level of education had an income similar to those with high school.

Table 3. Results of the cross-sectional analysis for the individual income of family members and for the income of the older person. Viçosa, MG, 2020.

Explanatory variable	Explained variable	
	Individual income of family members Coefficient / p-value	Older person income Coefficient / p-value
Age	0.031 / 0.018* (0.013)	0.128 / 0.175 (0.094)
Age^2	-0.000 / 0.186 (0.000)	-0.008 / 0.224 (0.006)
Gender	0.345 / 0.000*** (0.088)	0.404 / 0.001*** (0.114)
Preschool	-0.534 / 0.153 (0.372)	-0.895 / 0.055*** (0.462)
High school	-0.145 / 0.204 (0.114)	-0.248 / 0.064* (0.133)
University education	0.504 / 0.000*** (0.108)	0.458 / 0.003*** (0.151)
Constant	6.081 / 0.000*** (0.342)	2.298 / 0.509 (3.467)
Number of observations	207	130

*** and * demonstrate the statistical significance of the coefficient at 1% and 10%, respectively. Values in parentheses are standard errors.

Source: Research results.

For the model considering the monthly income of the older people, in cases where the older person had only preschool, their income was 89% lower than that of the older person with high school. For those with elementary education, income was also lower, however, at only 24%. The specific results for the older people showed that those who had higher education, or some level above, also had an income 45% higher than those with secondary education.

The result is in line with the findings of Bento and Lebrão[19] and Cirino[11], who emphasize that these results on schooling are in line with what is recommended by the Human Capital theory. In this way, the income generated by the individual is attributed to their competence, one of the components being education. That is, the more educated the individual, the greater the income earned in the labor market.

CONCLUSIONS

The study identified the socioeconomic profile of the older population of Viçosa, as well as their living and housing conditions, and verified the existence of factors that can influence the income of individual members and older people in the city of Viçosa (MG).

The data referring to the socioeconomic profile of the sample participants revealed that the majority of the older people were female, average age of 69 years old, level of education referring to complete high school, retired, average income above the national average, coming exclusively from retirement .

In general, in households with older people, the level of satisfaction with living and housing conditions was favorable and satisfactory, which may be associated with the fact that they have a significant average per capita income and above the range considered low. Older people with higher levels of education and male sex had the highest incomes, evidencing the influence of education and gender on income.

It is concluded that the older people studied had more satisfactory and favorable living conditions, income and education than the older people in the country in general, demonstrated in studies based on data from the national Family Budget Survey. This reality, however, can be linked to the existence of the Federal University of Viçosa in the municipality, where a large part of the population studies and/or works, earning better educational levels and higher incomes, since education has a positive impact on access to better jobs and wages.

The scientific contribution of this study stems from the fact that there are no other studies with the older population of the municipality, especially using data from the local or national Family Budget Survey (POF). Thus, this will serve as a reference for future works in the evaluation of the socioeconomic conditions of this population from a new local POF.

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Construction and validation of care-educational gerontechnologies: integrative review

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Abstract

Objective: identify in the literature how care-educational gerontechnologies have been constructed and validated and recommended propositions for their development. *Method:* integrative literature review carried out in the Web of Science, LILACS, CINAHL, BDENF, MEDLINE and SciELO databases following the recommendation of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). We selected studies that presented the construction and validation of gerontechnologies. For data extraction, we used an instrument adapted from the international RedENSO. We also classified the level of evidence of the studies according to Melnyk and Fineout-Overholt *Results:* We analyzed 17 studies. The year 2019 had the highest number of publications on the subject, with the majority coming from Brazil. The development of material gerontechnologies, as booklets, leaflets, manuals, games, software and multimedia materials, was more reported. Regarding the method of construction of gerontechnologies adopted in the studies, situational diagnosis through interviews, dialogues and scales, and literature reviews on the themes stood out. In most studies, validation was performed with the elderlies and, in some studies, validation was also performed with specialists. *Conclusion:* We found that the process of development of care-educational gerontechnologies is recent and requires improvement in the validation stage and not always performed by researchers. Regarding the recommendations for their development, we highlight the use of language accessible to older people and the association of theoretical and practical knowledge.

Keywords: Educational Technology. Elderly. Validation Study. Review. Evidence-Based Nursing.

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INTRODUCTION

Population aging is a global concern that involves issues about health, financial security and the distribution of families' financial resources to care for the older person. The Decade of Healthy Aging (2021-2030) was declared by the United Nations (UN) General Assembly in May 2020, with the aim of improving the lives of older people, their families and communities[1].

In Brazil, the strategic agenda of the Ministry of Health has among its objectives the guarantee of comprehensive health care for older people and those with chronic diseases at all levels of health care[2]. Meeting the demands caused by aging proves to be a challenge for the health system, since assisting this specific public requires a new form of health care and humanization of the care provided[3].

Comprehensive health care for the older person seeks to maintain functional capacity, promote autonomy and, consequently, quality of life. It is important to consider that aging does not mean being disabled. All assistance provided to older people must take into account their ability to judge and make decisions. It is important to encourage and ensure the exercise of autonomy in the older person's health care relationships[4].

In this sense, there are gerontechnologies, which seek to assist in the older person's daily activities[5]. It is an interdisciplinary field of study, as it involves technology, gerontology and aging, encompassing the development of techniques, products and services based on knowledge of the aging process[6].

Gerontechnologies have a vast field of action, including research, design and development of various technologies aimed at promoting the older person's quality of life. The possibility of action is wide, as in health, safety, assistance, communication and stimulation, for example[5].

Several types of gerontechnologies can be developed to expand the possibilities of health professionals in carrying out innovative and care-producing practices. Among them, care-educational gerontechnologies (CEGT) stand out, known as extremely important resources to complement health care and encourage patient participation, by encouraging self-care, and the family in the care process[7-9]. Some examples are: manuals, booklets, games, workshops, educational programs and software[10].

The CEGT enable the dissemination of knowledge, cause changes and influence the older person's health standard, in addition to increasing the possibilities of using new resources for care practices and health education[11]. From the shared construction of knowledge and the development of cognitive and affective skills, they encourage the patient to use their senses to think and relate these activities to their reality[7-9].

The development of these technologies in everyday practice should be encouraged, but they must be valid to prove their effectiveness before using them with the target audience[12]. Understanding how CEGTs are constructed and validated is useful for professionals who seek to develop them or who use them to support the care provided to the older person, using scientifically based materials with real results.

The present study aimed to identify in the literature how CEGTs have been constructed and validated and to propose recommendations for their development.

METHOD

This is an Integrative Review (IR), which plays a fundamental role in the development of Evidence-Based Practice (EBP)[13]. It was conducted in six steps: identification of the theme and selection of the research question; criteria for inclusion and exclusion of studies/literature search; categorization of studies; evaluation of included studies; evaluation of results and synthesis of knowledge. The period from study planning to completion was from June to October 2020[14,15].

The route taken to define the procedures for searching, selecting and analyzing articles followed the recommendations of the *Preferred Reporting Items for Systematic Reviews and Meta-Analyses* (PRISMA) protocol[16].

The theme was the development and validation of gerontechnologies, aiming to answer the following guiding question: "What do methodological research articles reveal about the construction and validation of gerontechnologies?". For its elaboration, the PICo[17] strategy was used, acronym for population (older people), interest (methodological research articles on the construction and validation of care-educational gerontechnologies) and context (health care), adapted for use in non-clinical research.

Inclusion criteria were defined as being an original research article related to the construction and validation of care-educational gerontechnology, which was available in full online and free of charge, published in Portuguese, English and/or Spanish, with no time frame. Duplicate articles, other reviews and studies in which older people were not the target population were excluded.

The search for articles included in the review was carried out from secondary sources. Descriptors and Boolean terms were used in each database in a standardized way. To search for articles, the Web of Science, Latin American and Caribbean Literature on Health Sciences Information (LILACS), Database on Nursing (BDENF), Medical Literature Online (MEDLINE) and Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Scientific Electronic Library Online (SciELO) databases were selected.

The descriptors used for the search were consulted in the Descriptors in Health Sciences (DeCS) and their synonyms or equivalents in the English language in the Medical Subject Headings (MeSH) and CINAHL Titles. These were combined with the Boolean operators AND and OR, according to the systematic search strategy presented in Table 1.

Two reviewers independently gave their opinion on the inclusion of each study, and those that reached mutual agreement were selected, in order to avoid biased results. In this study, there was no need for a third reviewer to resolve conflicts. This step took place during the month of August 2020.

For data collection, an instrument composed of two sections was used, adapted from the form of the *Red de Enfermería em Salud Ocupacional* (RedENSO Internacional)[18], the first consisting of basic information about the publications, such as: title, name and training of the authors, year, country, database, language, journal, study type and level of evidence. The second part of the instrument contains questions related to the topic of interest, consisting of questions that addressed the name, type, classification, objective and content of the technology developed, essential characteristics for its development and validation and/or evaluation process.

The level of evidence (LE) was determined according to the classification by Melnyk and Fineout-Overholt[19] in: level I – systematic review or meta-analysis; level II – randomized controlled trial; level III – controlled study without randomization; level IV - case-control study or cohort study; level V – systematic review of qualitative or descriptive studies; level VI – qualitative or descriptive study; and level VII – opinion or consensus.

Table 1. Systematized search strategies. Picos, PI, Brazil, 2020.

Source	Strategy
MEDLINE	aged AND "educational technology"
WEB OF SCIENCE	aged AND ("educational technology" OR "health education") AND "validation studies")
CINAHL	aged AND "educational technology"
SciELO	aged AND (educational technology OR health technology)
BDENF	aged AND educational technology AND validation studies aged AND educational technology
LILACS	aged AND educational technology AND validation studies educational technology AND idoso.

Source: prepared by the authors.

The gerontechnologies found in the studies were determined according to the classification of educational health technologies by Teixeira[20,21] into material educational technologies – which are products, and intangible educational technologies – dynamic processes.

The selected studies were critically analyzed, and the extracted information was categorized according to the objects of interest and presented in tables containing the profile of the publications, the characterization of the gerontechnologies constructed, the methodological validation processes and the main recommendations for the development of gerontechnologies.

RESULTS

A total of 242 studies were retrieved, and 215 publications were excluded after reading the title and abstract because they did not answer the research question or because older people were not the target audience. Consequently, 27 publications were read in full, of which 10 articles were excluded, resulting in the composition of 17 primary studies for this integrative review, as detailed in Figure 1.

Among the studies analyzed, most did not exceed the limit of 10 years of publication, with 2019 being the year with the most publications. As for the place where the studies were carried out, Brazil was the outstanding country. The professionals who stood out in the construction of care-educational gerontechnologies were nurses, with a significant number of published studies.

Material gerontechnologies predominated, represented by booklets, leaflets, manuals, games, even software and multimedia materials. Immaterial gerontechnologies were also contemplated with the development of empowerment techniques and socio-educational groups. Table 2 was constructed by the authors to present the synthesis of data from each primary study included in the review.

As for the methodological characteristics for the construction and validation of the CEGT identified in the studies, they are presented in Table 3. Regarding the construction method, different processes performed by the authors were observed. Common points were found, such as the older people's situational diagnosis, reported by eleven studies, guided by the application of semi-structured interviews[24,25,27,30,35,36], dialogue[6,22,31] and scales[26,29,30], selected according to the purpose of each research. Six studies report carrying out a literature review on the topic to be addressed to support the subsequent elaboration of the technology content[21,24,25,31,34,36].

Regarding the validation process, six studies present gerontechnologies validated by specialists and older people[24,27,28,31,33,35], seven were validated only by older people[6,21,22,25,26,29,30], and four were not validated by the authors[23,32,34,36]. Regarding the methodological approach, qualitative studies stood out (n=15)[6,21-30,32,34,36], of which six were guided by the principles of Convergent Care Research[6,21,22,26,29,30], on the other hand, three studies had a quantitative approach, of the methodological research type[28,31,35], and two studies were quantitative-qualitative[28,34].

Considering the particularities of each study in the elaboration of gerontechnologies, respecting the peculiarities of the target audience, the recommendations considered essential for the construction process were summarized in Table 4, noting that they refer mainly to language, content and appearance. Level IV evidence was found on the construction and validation of gerontechnologies, being classified as such because they come from descriptive or qualitative studies.

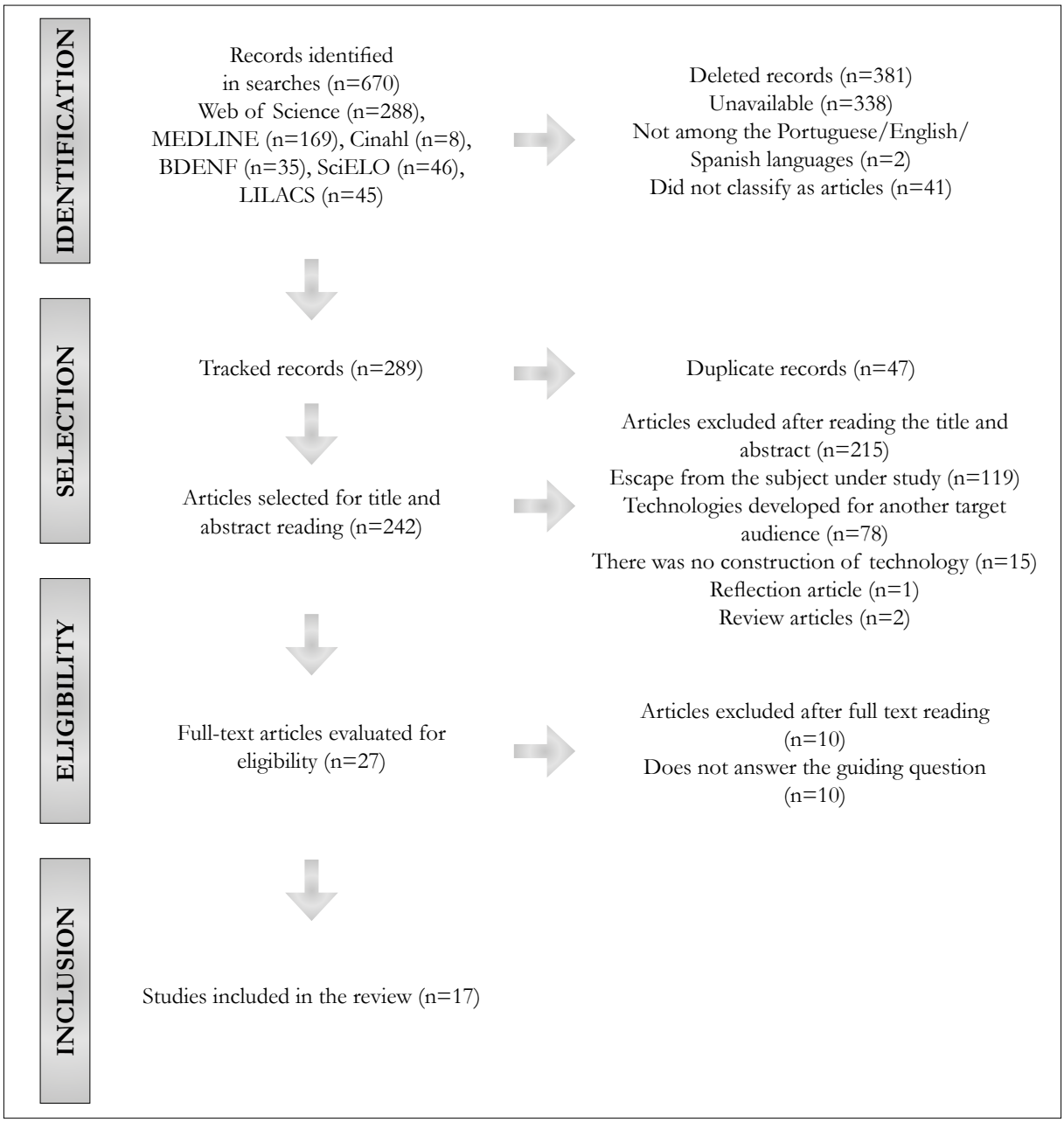

Figure 1. Flowchart for the selection of primary studies, adapted from the PRISMA recommendation. Picos - PI, Brazil, 2020.

Source: prepared by the authors.

Table 2. Characterization of the studies analyzed in the review. Picos - PI, Brazil, 2020.

Study coding	Authors/Training/ Year	Country	Type of Gerontechnology / Classification according to Teixeira[17]	Objectives
A1	Lucca et al.[21]/ Nurses/ 2020	Brazil	Cards game / Material	Promote the understanding of the older person undergoing hemodialysis treatment about the influence of their attitudes on their current health condition and quality of life.

to be continued

Continuation of Table 2

Study coding	Authors/Training/ Year	Country	Type of Gerontechnology / Classification according to Teixeira[17]	Objectives
A2	Gonçalves et al.[22] / Nurses / 2005	Brazil	Socio-educational Action Program / Immaterial	Favor self-care behaviors for the autonomy, independence and interdependence of hospitalized geriatric patients and their accompanying family members.
A3	Hammerschmidt et al.[23]/ Nurses / 2010	Brazil	Empowering Techniques / Immaterial	Develop the care process, encouraging the participation and active decision of older people with diabetes.
A4	Barros et al.[24]/ Nurses / 2012	Brazil	Educational booklet / Material	Educate caregivers and older people with a stoma about stoma care and prevention of complications.
A5	Pennafort et al.[25]/ Nurses / 2019	Brazil	Educational activity – banner and rag doll / Material	Guide older people with chronic kidney disease on hemodialysis about self-care in maintaining arteriovenous fistula, ensuring adequate access to effective dialysis therapy.
A6	Goes et al.[26]/ Nurses / 2016	Brazil	Convergence groups / Immaterial	Ensure the older person access to health services with transformative practices, providing well-being and quality of life in the family and community.
A7	Throfast et al.[27]/ Pharmacists / 2019	Sweden	*e-learning* modules / Material	Distribute information, through the internet, on the use of medicines.
A8	Rocha et al.[28]/ Nurses / 2019	Brazil	Guidance manual / Material	Mediate health education actions at the time of hospital discharge for family members and older people undergoing brain surgery.
A9	Costa et al.[29]/ Nurses / 2016	Brazil	Story telling / Immaterial	Stimulate older people's cognition and memory, social interaction and knowledge sharing.
A10	Ferreira et al.[30]/ Nurses / 2019	Brazil	Educational booklet, memory games / Material	Provide health promotion through the prevention of falls in older people with Parkinson's.
A11	Olympio et al.[6]/ Nurses / 2018	Brazil	Board game / Material	Promote active and healthy aging by maintaining functional capacity, cognitive stimulation, social interaction and obtaining knowledge about self-care.
A12	Carvalho et al.[31]/ Nurses / 2019	Brazil	Educational booklet / Material	Promote sleep hygiene in older people.
A13	Santos et al.[32]/ Physical therapists / 2018	Brazil	Software – Mobile Platform Application / Material	Stimulate older people's functional capacity to maintain functional independence.
A14	Macedo et al.[33]/ Speech therapists / 2020	Brazil	Educational guide / Material	Promote older people's vocal health through strategies, self-reflections and guidance on vocal self-care.
A15	Nakamura et al.[34]/ Speech therapists / 2018	Brazil	Multimedia material – interactive archive / Material	Guide and advise older people candidates for the use of hearing aids.
A16	Delatorre et al.[35]/ Nurses / 2013	Brazil	Educational guide / Material	Promote self-care of older people undergoing Percutaneous Transluminal Coronary Angioplasty (PTCA)
A17	Campos et al.[36]/ Speech therapists / 2010	Brazil	Multimedia material – didactic film / Material	Provide information for hearing-impaired seniors on the use and handling of the Personal Sound Amplification Device (PSAD)

Source: prepared by the authors.

Table 3. Methodological path for the construction and validation of care-educational gerontechnologies of the analyzed studies. Picos – PI, Brazil, 2020.

Coding / Study Type	Construction method	Validation by specialists	Validation by target audience	Validation method
A1/ Assistance Convergent Research	- Design (technical visits to the research site, problem definition and research objective, literature review for the synthesis of knowledge regarding the topic) - Instrumentation (delimitation/detailing of the physical space of the research, choice of participants and data collection instruments) - Scrutiny and analysis (researchers' entry into the reality of practice. Semi-structured interviews and conversation, unsystematic participant observation and analysis of medical records were used).	No	10 older people on hemodialysis.	Analysis: guided by apprehension, synthesis, theorization and transference. An evaluative instrument was used with the older people, with questions focused on the patients' feelings before and after the application of the game, for the recurrent learning and experience.
A2/ Assistance Convergent Research	Based on Orem's Self-Care Theory Built through dialogue with the subjects of care and self-care: the hospitalized older person, the accompanying family (future post-discharge caregiver) and the nurse, in an inpatient unit.	No	Does not specify number of participating older people	Assessment permeates the entire socio-educational action and takes place collectively in the group space. At the end of the meeting, the participants express themselves with their appreciations, suggestions and elaborations ("thinking") in the face of the group experience.
A3/ Experience report	Construction based on the professional routine of the authors themselves.	No	No	Not validated by the authors.
A4/ Qualitative	Semi-structured interviews with older people with stomas registered at the Stomatherapy Service (4 older people participated in this stage, chosen for being talkative, lucid and in good health). The data were organized by themes and scientific references were consulted to aid in the construction of the material.	1 nurse working for more than 16 years in the stomatherapy service	4 older people participating in the construction stage and 45 registered in the stomatherapy service	Problematized item by item with each participant and after fifteen days they were consulted about suggestions for changes in the text and images.

to be continued

Continuation of Table 3

Coding / Study Type	Construction method	Validation by specialists	Validation by target audience	Validation method
A5/ Action search	Established 04 phases: Situational diagnosis (semi-structured interview to identify the demand for information) Planning (development of educational technology guided by relevant literature) Action (carrying out the educational intervention with the application of the banner and rag doll built to guide fistula care) Assessment (performed after one month of the educational activity)	No	13 older people on hemodialysis.	Semi-structured interview about the knowledge learned by the older person with chronic kidney disease about the care provided by the researchers. Analysis by thematic category.
A6/ Assistance Convergent Research	Diagnostic assessment of living conditions and health of the older person (application of the Health Handbook of the Older Person and the Smilestein Family APGAR) with 30 participants. Strategic educational planning of the TCE, applied to older people selected by convenience, participants in the initial sample (Among the 30 in the initial sample, a group of 13 was formed that met the inclusion criterion of attending seven weekly meetings for two months).	No	13 older people	The assessment was based on the observation of empowerment for self-care, in signs emitted in the speeches: awareness of old age issues, changes in care practice related to coping with health complications in the course of aging.
A7/ Quanti-qualitative	Topics included in the modules were selected in collaboration with pharmacists through frequently asked questions asked by older patients on hospital wards or in pharmacies.	5 specialists (pharmacy, e-learning, web design, health informatics and medication informatics). Representatives of 2 pensioners associations	Initial assessment - 4 older people Final assessment - 16 older people	Initially, a prototype was developed, evaluated and validated by a small test group. The revised version of the prototype was then evaluated by a group of older people with a questionnaire about the content, layout and level of knowledge of the modules. A Likert-type rating scale was used. The results of the questionnaires were analyzed quantitatively using frequency analysis on an ordinal scale. Open questions were analyzed using qualitative content analysis.

to be continued

Continuation of Table 3

Coding / Study Type	Construction method	Validation by specialists	Validation by target audience	Validation method
A8/ Methodological research	The study deals only with the validation of gerontechnology.	11 specialists (5 nurses, 3 doctors, physiotherapist, pedagogue and graphic designer)	4 older people undergoing neurosurgery 4 family members	A Likert-type questionnaire was applied. Descriptive statistics were used to obtain the content validity index and semantic validity index.
A9/ Assistance Convergent Research	The research team performed immersion at the study site and experienced the context of the care and educational practice of the BHU among older people who circulated and participated in actions specific to the Senior Program. Technology planning: a diagnostic evaluation of the participating older people was carried out, applying the multidimensional instrument of active aging - AA and the WHOQOL–BREF quality of life assessment. The storytelling training plan for each older woman was drafted, in detail, when the stories to be told or retold were defined. The story was selected by the older woman herself, and there were weekly training sessions for three months, until the day of the presentations, which lasted about 3 hours.	No	8 older people	After the presentation of the stories, each of the older women storytellers made a subjective assessment of their own experience, guided by the question: "Tell me a little about your experience of having prepared and told a story". The WHOQOL – BREF was applied again in order to compare the quality of life results of the older women before and after the experience. The data obtained, of a subjective nature, were analyzed and interpreted from the process of storytelling appropriation.
A10/ Assistance Convergent Research	The study does not detail the construction of the gerontechnologies used, only that they were developed through clinical evaluation through scales, semi-structured interviews and applied in workshops, being later evaluated by the older people.	No	9 older people	Data from the workshops and interviews were transcribed in full and analyzed according to the thematic analysis, which consisted of three stages: pre-analysis, material research and treatment of results/inference/interpretation of the speeches exposed by the older people.

to be continued

Continuation of Table 3

Coding / Study Type	Construction method	Validation by specialists	Validation by target audience	Validation method
A11/ Assistance Convergent Research	Insertion of the researcher in the study setting Recruitment of participants through a lecture on the proposed topic. Individual interviews, creativity and sensitivity technique (CST) 'Almanaque', group discussion and participant observation were carried out.	No	31 older people	Research data were organized according to production techniques; The transcripts of the group discussions were recorded in audio, with electronic media, and the organization and digitization of the individual artistic productions. After the last group meeting, a conversation circle was held, with a script containing open questions that addressed the participation of each group member in the proposed educational strategy. After the floating reading of the corpus of the report of the data produced, the French discourse analysis was applied based on the triangulation of the data.
A12/ Methodological research	The content to compose the booklet was obtained through the guidelines of the Brazilian Sleep Association, the manual on the health of the older person and demands identified from a focus group with older people assisted at the study site. The content of the educational material was organized according to the theoretical framework of the health belief model.	22 specialists (nurses)	22 older people	For validation with the specialists, the Educational Content Validation Instrument (ECVI) was used, validated, For the target audience, an instrument adapted from the Suitability Assessment of Materials (SAM) was used, with 19 questions (regarding the understanding of the material) and with space for suggestions. Data analysis from the Content Validation Index and the binomial test.
A13/ Experience report	Construction based on the professional routine of the authors themselves.	No	No	Not validated by the authors.

to be continued

Continuation of Table 3

Coding / Study Type	Construction method	Validation by specialists	Validation by target audience	Validation method
A14/ Methodological research	The study only describes the items contained in the guide. It reveals that the design and layout work of the images was carried out by professionals in the specific area of communication and advertising.	13 specialists (speech therapists)	9 older people	For the evaluation of the specialists, an instrument developed by the authors was used on the content and appearance of the guide and it consists of the objective, structure, presentation and relevance of the product. The analysis consisted of matching the agreement and relevance of each item with a Likert-type scale. For statistical analysis, the Content Validity Index was used. For the target audience, initially, a Mini Mental exam was carried out. For evaluation, an instrument containing basic data was used to outline the profile, in addition to the response of its degree of agreement on the Likert scale, for the criteria of content, information, knowledge, illustrations, sensitivity and motivation, with an open question for possible comments. Statistical analysis was performed using the Content Validity Index and for the analysis of the open question, the Content Analysis Method proposed by Bardin was used.
A15/ Qualitative	A bibliographic study was carried out (survey of design factors to be incorporated in the elaboration of educational materials in the health area, and content of orientation and counseling to the older person candidate for hearing aids) Planning (defining and characterizing the target audience) Development of the multimedia material	No	No	Not validated by the authors.

to be continued

Continuation of Table 3

Coding / Study Type	Construction method	Validation by specialists	Validation by target audience	Validation method
A16/ Methodological research	Interviews (recorded) were carried out with 20 older people using a semi-structured questionnaire to identify the needs related to self-care when undergoing percutaneous transluminal coronary angioplasty to support the development of the technology. The interpretation, transcription of data and thematic content analysis were performed, from which the component categories of the educational manual emerged.	12 specialists (the study does not specify the professional category).	9 older people	For the specialists, a validation instrument was used on identification, instructions, objectives, structure and presentation, relevance of educational technology, using a Likert scale. For the target audience, the instrument evaluated instructions, objectives, organization, writing style, appearance and motivation, using a Likert scale. Statistical analysis was based on the simple frequency of the number of times the specialists and the older people chose the different assessments in each block of the instrument.
A17/ Qualitative	A multiple-choice questionnaire was applied, consisting of questions that addressed general aspects of the use and handling of the device and/or earmold, specific aspects of the difficulties presented and the user's opinion. A literature review was carried out on the subject for the construction of a script, used to guide the recording of the videos.	No	No	Not validated by the authors.

Source: prepared by the authors.

Table 4. Essential recommendations for the construction of a care-educational gerontechnology. Picos, PI, Brazil, 2020.

Study coding	Recommendations	Dimension	Evidence Level
A4, A7, A11, A12, A15	Association of theoretical and practical knowledge. Correct, reliable and current information. Included only necessary information. Relevance and level of content knowledge	Content	VI
A4, A8, A11, A12, A13, A14, A15	Easy-to-read content. Prioritization of basic information.		
A4, A8, A11, A12, A13, A14, A15	Simple, clear and understandable language and presentation, compatible with the older people's understanding. Avoid using jargon, technical or scientific terms, acronyms or abbreviations.		
A4, A8, A11, A14, A15	Alternate verbal and non-verbal communication. Incorporation of figures, diagrams or illustrations. Clear and understandable images. Use familiar images and symbols that appeal to the reader.	Language	
A4, A11, A15	Use of short phrases or key concepts.		
A4, A11, A14, A15	Consistency between text and image		
A13, A14	Adequate accessibility for older people. Accessibility intelligibility (content written in a simpler, easier to understand way).		
A15	Use familiar words, phrases and sentences. Repeat main words, phrases and ideas. Use active voice. Tell the reader what to do.		
A7, A8, A12, A13, A15	Proper layout. Participatory, simple and accessible design (text size, colors and audio clarity). Use of appropriate colors.	Appearance	
A1, A8, A12, A15	Adequate font size – 14, Times New Roman font, black color on white background and no gloss. Fonts for titles two points larger than those for the text. Appropriately sized material (neither short enough to compromise the quality of the information, nor long enough to be tiring) – 25 and 39 pages. Clear, understandable, enlightening and appropriately sized images.		
A1	Coating with Contact-type material – allowing asepsis before and after use.		
A1, A10	It should be playful, interactive and low production cost. Easily reproducible for independent use.		

Source: prepared by the authors

DISCUSSION

The findings of the study demonstrate that the scientific production on care-educational gerontechnologies is recent. Brazil was highlighted and the nurse was the professional with a significant number of publications. Studies with a qualitative approach and the construction of material technologies predominated. The technologies were built after carrying out a situational diagnosis and literature review, respecting important recommendations for the particularities of older people. Most studies carried out the validation process only with the target audience.

Brazil was the country where almost all the analyzed productions were carried out, which can be explained by the fact that the search was carried out mostly in electronic databases in Latin America and the Caribbean. Even so, this situation is connected with the care model adopted by the Unified Health System (SUS), which is based on the guidance of care practices and the search for a care model focused on health promotion and disease prevention[37].

The findings highlight the nurse as the professional with the greatest participation and contribution in the development of CEGT, which is related to the competences inherent to the profession, such as being responsible for guiding and educating, encouraging self-care. Nursing is usually surrounded by various educational practices, ranging from the communication and empowerment of older people to the development of software and educational materials[38].

The participation of nursing professionals in the development of CEGT corroborates the review study[39] in which Brazilian and nursing productions were highlighted. Another literature review[38] found advances in the development of technologies by these professionals in favor of care for older people, which leads us to perceive the insertion of this class both in the use and in the development of CEGT.

It is noticed that the field of study of care-educational gerontechnologies is in development when analyzing the timeline of the analyzed articles. This condition may be related to the decrease in reproductive rates and the decrease in the mortality of adults and older people, characterizing the population aging phenomenon. With the increase in life expectancy, chronic degenerative diseases are more frequent, which presses for new forms of care that preserve older people's autonomy and functionality[40].

It was possible to observe that for the construction of the CEGTs, a path formed by three stages was followed: situational diagnosis, literature review/planning and technology development. In the first stage, the researcher is inserted in the chosen place to seek information about the health situation of the population in question[41]. In the second stage, the search for scientific references that can support the writing of content and appropriate recommendations for the appearance of technologies aimed at older people is carried out[34]. After these two steps, the actual elaboration of the material takes place.

There are no specific methods, consolidated in the literature, for the construction of CEGT, however, based on what has been analyzed, the aforementioned steps are a path that can be followed by researchers, as some similarity in the conduct of the studies can be affirmed. They are important, because by following them, they allow the development of CEGT suited to the needs of the target audience, with language, content and appearance that allow older people to access true and current information and that are applicable during the care and self-care process[34, 41].

Regarding the characteristics of CEGT, there was a predominance of material gerontechnologies, among these, printed technologies were the most frequent, developed in six studies[24,28,30,31,33,35] and, although they bring different nomenclatures (manuals, guides, booklets), they are considered equivalent due to its printed form. In a review[42] carried out to identify educational technologies in health related to Cerebral Vascular Accident in the literature, there was also a higher frequency of use of printed materials.

Another review[38] points to the use of printed material as an effective technological tool by enabling the apprehension, exchange of knowledge and development of skills at home. A study[31] developed an educational booklet to mediate guidance on care for the peristomal skin of people with stomas, and they corroborate by highlighting that printed educational materials play an important role in health education, as they favor learning by having the possibility of being available to the patient and his family whenever doubts arise.

Two studies developed educational games, one with board[6] and the other with cards[21]. The use of the game as a gerotechnological product represents a break with the concept of educational activities based on the centrality of the disease, and emerges as a playful, natural and motivating strategy to promote self-determination, psychological, cognitive and social development, enhance self-esteem, exchanged experiences and shared learning among older people.

Still in relation to the material CEGT, it is possible to observe the production of digital educational technologies (DET), such as *e-learning* modules[27], multimedia materials (interactive archive and film)[34,36] and a software[32]. What these gerontechnologies have in common is that they need to be associated with Information and Communication Technologies (ICT), such as internet access and a smartphone, DVD or computer, to be used.

Therefore, the advantages of developing DET for older people involve visual, tactile and auditory stimuli that allow the use of several simultaneous and playful resources, instigating the construction of mental images, facilitating the memorization of information[43]. The studies that developed and used DET obtained satisfactory results in relation to the objective of the technology, in addition to the approval of its use by the target audience[27,32].

Regarding immaterial care-educational gerontechnologies, the development of educational actions was identified in four studies that carried out educational programs/group activities[22,26,29,44] and one study carried out individualized action, associated with the assistance provided[23]. Immaterial CEGTs work as instruments that favor autonomy and improve the living conditions of older people and contribute to the maintenance of biopsychosocial balance[45] through dialogic relationships between the educational and care process, which are essential to gerontechnology, humanizing relationships and promoting health care for the older person.

Regarding the development of care-educational gerontechnology, the validation process is essential, as it guarantees the quality and effectiveness of the product, which enhances health education carried out through technology. Validation is almost always done by specialists in the field to suit the material for the target audience. It can be carried out in line with the target audience or just with it depending on the type of technology and the researcher's objectives[20].

In this review, we observed a prioritization of validation with the target audience. The option of using an interview instead of a questionnaire for the validation of the CEGT by older people is very common and happens because it allows greater flexibility considering the specificities of this public. The interview is less tiring and when working with older people, the influence of limitations that may interfere with the success of data collection, such as decreased visual acuity and low level of education, must be mitigated, so that such factors do not mask the results of the technological intervention[46].

Regarding quantitative research for the creation and validation of CEGTs, it is considered that they have a more structured process that can be reproduced by researchers. This research method favors the availability of numerical measures that are more easily comparable to those of other validation studies. The three studies[28,31,33] that used it, validated gerontechnology both with specialists and the target audience, and used corresponding assessment instruments for each stage, such as the Educational Content Validation Instrument (ECVI) and the Suitability Assessment of Materials (SAM), very common in ET validation for other audiences.

It is necessary to draw the attention of researchers who develop gerontechnologies to the importance of validating these materials. Four studies[23,32,34,36] did not adopt any form of evaluation of the technology developed or applied, which becomes a risk, since in the case of older people, the adequacy of these materials must be even more careful and directed, taking into consideration the possible decay related to aging[34].

In view of the essential recommendations for the development of materials for older people, in terms of language and content, intelligibility and accessibility should be prioritized, with the content being written in a simple, easy to understand way. The suggestions are that the language used should be simple and clear, compatible with the older person's understanding. One should opt for short phrases or key concepts, avoid the use of jargon or technical terms, use verbal and non-verbal communication, and when using images and symbols, prioritize the most familiar ones, which are related to the older person's routine[6, 24,28,31-34].

If the purpose of creating an educational technology is to facilitate the apprehension of information, then readability and legibility must be taken into account in the construction process, as this will make it as easy as possible for readers to understand even when they have lower levels of literacy. It is reinforced that when it comes to materials aimed at older people, the possible sensory and cognitive decay of this audience must be considered[7].

One of the recommendations highlighted in this study refers to the alternation between verbal (written or spoken language) and non-verbal (illustrations) languages. A study[34] reinforces that the illustrations increase the attention and understanding of the

material, even by people with low levels of literacy. They also demonstrate that the recommendations regarding the design provide a greater understanding and help in the correct decision making. Thus, clear and understandable illustrations that are familiar to older people should be incorporated.

Abreu et al.[47] demonstrated that the structure and presentation of the technology is the most complex stage of the material because it involves aspects such as: layout, graphics, design and appropriate language for the target audience. The authors emphasize that the technology must present an adequate layout, appropriate colors and adequacy of scientific language to the language of the target audience, in addition to attractive and adequate illustrations so that the material is considered suitable for older people. As for immaterial technologies, they should stimulate social interaction and knowledge sharing and provide group coexistence[29].

Other recommendations found refer to playfulness and interactivity, factors that facilitate learning[48], and the type of material to be used for the preparation of care-educational gerontechnology, as it is recommended that the material allows asepsis before and after use, such as the Contact-type coating[21].

In the board game that was developed for older people[48], the researchers made it out of vinyl, with the application of Polyvinyl Chloride (PVC) and transparent lamination to protect the images. In addition, the game is stored inside a wooden box to ensure the durability of the material.

As for the level of evidence, the studies analyzed are categorized as descriptive or qualitative, being considered, by the tool used, as low level. However, this classification should not be associated with the poor quality of the method used, but with the nature of the construction and validation studies. It is essential that, for the development of CEGT, researchers take into account the level of evidence of the method used, developing research that can actually support the clinical practice of the health professional, considering the safety and ethics of the actions[49].

As limitations of the study, we point out the influence of the bases used, which are mostly from Latin America and the Caribbean, in relation to the scarcity of international studies on the subject; the low level of evidence by the classification of the evaluation tool used, since it only qualifies the methodological design used, but other points such as risk of bias and methodological quality were not evaluated in this review.

Even so, this research is relevant because it shows current knowledge about the construction and validation of CEGT, which will serve as a theoretical subsidy for nurses and other health professionals who seek to develop new instruments for the care of older people, associating scientific knowledge with dialogic educational care.

CONCLUSION

It was found that the process of developing care-educational gerontechnologies is recent and requires improvement in terms of the validation stage, which is not always performed by researchers.

As for the construction method, the common point was the realization of the older people's situational diagnosis, guided by the application of interview, dialogue and scales. The validation step, when carried out, was conducted most of the time with the target audience, and in some studies this process was also carried out with specialists.

The main gerontechnologies are of the material type, such as booklets, leaflets, manuals, games, software, multimedia materials. Still, immaterial technologies are present, such as empowerment techniques and socio-educational groups. Regarding recommendations for the development of gerontechnologies, aspects such as accessible language and the association of theoretical and practical knowledge stand out.

It is noteworthy, therefore, that this study presents a current synthesis on the subject, and shows the reader important information about the methodological path to be followed, contributing to the development of care-educational gerontechnologies that meet the specificities of the target audience and are validated by specialists and older people, with the aim of being accessible and reliable educational materials.

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Factors associated with worsening of self-rated health in older people: a longitudinal study

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Abstract

Objective: to identify factors associated with worsening self-perception of health in community-dwelling older people over time. *Method*: This is a prospective and analytical longitudinal study. At baseline, data collection took place at home, based on random sampling by clusters. The second data collection was performed after an average period of 42 months. Sociodemographic variables related to health and use of health services were analyzed. Self-perception of health was investigated by the question: "How would you classify your health status?". The results of the health classification of each older person were compared between the two moments of the study (first wave and baseline) defining the dependent variable. Adjusted prevalence ratios were obtained by multiple *Poisson* regression analysis with robust variance. *Results*: 394 older people participated in the two stages of the study, 21.1% worsened their self-perception of health, 26.7% improved and 52.2% showed no change. The variables that remained statistically associated with the transition to a worse self-rated health assessment were: asthma, systemic arterial hypertension and frailty. *Conclusion*: self-perception of health is characterized by a transition between levels of self-rated health. Chronic diseases and frailty showed a longitudinal association with worsening of self-rated health.

Keywords: Self-Conception. Elderly. Risk Factors. Health Status. Longitudinal Studies.

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INTRODUCTION

The Brazilian population aging is recent and occurs in an accentuated way[1]. This demographic phenomenon has important epidemiological implications for the country, as older people require permanent health care and, consequently, an increasing demand for health services[2].

This reality represents an important challenge for the structuring of the care network that needs to be organized in order to adequately welcome this public. Therefore, some lines of care must be adopted in order to assist in the organization of these services and for this it is essential to know the health conditions of the older population. The assessment of the older person's self-perception of health status is a relevant construct to analyze health conditions[3]. It is a qualitative indicator of the perception of one's own health, which can be applied to population groups in an effective, immediate and low-cost manner[3,4]. It encompasses physical, cognitive and emotional components, as well as aspects related to well-being and satisfaction with one's own life[5,6], capable of consistently predicting morbidity and mortality and the decline in functional capacity[3,7]. Inadequate lifestyle[6] including smoking, physical inactivity and obesity, presence of chronic diseases[6,8] such as hypertension, diabetes and asthma and aspects related to mental health[9] have been associated with negative self-perception of health in some cross-sectional studies[6,8,9]. Few studies carried out serial assessments of the population's self-perception of health over time, and in the case of these studies, the population was primarily composed of adults[10,11]. There is a need for more studies to investigate the factors that actually interfere, over time, in the self-perception of health of older people and, consequently, in a healthy longevity from a clinical and emotional point of view.

Investigating these factors is recommended, in view of the possibility of developing actions for their control and thus positively impacting a more functional and fruitful longevity with better health self-assessment.

The need to study changes in health states has already been signaled[3] and may represent relevant tools for public health guidelines[3]. This reiterates the relevance of the present investigation, which aims to identify changes in the self-perception of health over time, in addition to the health conditions that lead to a worsening of the older person's self-perception of health. It will be relevant for the elaboration of proposals that can prevent its progression and possible consequences. Therefore, this study aimed to identify factors associated with worsening self-perception of health in community-dwelling older people over time.

METHOD

This is a population-based and household-based study, with a longitudinal, prospective and analytical design, with non-institutionalized older people living in the urban area of Montes Claros, a medium-sized municipality in the north of Minas Gerais, located in the Southeast of Brazil. The municipality represents the main regional urban center and has a population of approximately 400 thousand inhabitants. The planning and execution of the study was guided by the *Equator* guidelines, through the instrument *Strengthening the Reporting of Observational Studies in Epidemiology* (STROBE).

To define the sample size in the first phase of collection (baseline), the older people population contingent of 30,790 residents in the urban region was used, according to data from the Brazilian Institute of Geography and Statistics (IBGE). Sampling was defined in order to estimate the prevalence of each health outcome explored in the epidemiological survey. For the total number of older people allocated to the study at baseline, the following parameters were applied: 95% confidence level, 50% conservative prevalence for unknown outcomes and 5% sampling error. For sample planning, cluster sampling was adopted and therefore it was necessary to multiply the sample number identified by a correction factor and design effect (*deff*) of 1.5%. In order to mitigate possible losses and ensure the adequacy of the sample size, 15% was added to the final sample number. The sample size calculation defined 656 older people as the minimum number of people for the study[12].

The inclusion criteria adopted were: being 60 years of age or older, residing in the allocated

household and accepting to participate in the study. The residence of all older people interviewed in the base year (May and July 2013) was considered eligible for the new interview in the first wave of the study (between November 2016 and February 2017). People over 60 years of age who had not participated in the first data collection were excluded. All selected households were visited up to three times on different days and times. After that, older people who were not available for participation, even by appointment, were defined as losses. Other losses were: older people who changed residence and those who had died, in addition to older people whose caregivers/family members refused to participate in the study. Older people who changed their address were not contacted, as there was no information about their current address.

Baseline data collection was performed by interviewers who were trained and underwent a calibration process (Kappa 0.8). The calibration process consisted of training the interviewers who were undergraduate students in nursing and medicine. After the training, the data collection instruments were applied repeatedly to the same interviewees over a few weeks. The results of these interviews were compared in order to verify the agreement between the interviewers. The results of the calibration step were not included in the study data as they were part of the pilot study with the aim of improving the collection instruments and training the interviewers. The interviews took place from May to July 2013. As a data collection protocol, the interviewers started from a pre-stipulated point in each selected census sector. The households were visited alternately, when an older person was found, they were invited to participate in the study. In case there was more than one older person, the oldest was invited to participate. If no older person was found in the household, the route was followed by the criterion of switching households.

In the base year, between May and July 2013, 685 older people (age ≥60 years) were investigated. The first wave (second collection phase) of the study took place between November 2016 and February 2017, in order to continue the investigation. In this second phase, all homes of older people who participated in the study in the base year were visited again for the second data collection. The data collection instruments are validated and have been previously used[3,12]. The questions in the questionnaire were answered with the help of family members or companions for the older people who were unable to answer, following the guidelines of the data collection instruments.

The dependent variable was the transition to a worse state of self-rated health. This variable was measured by the question: "How would you rate your health status?", whose possible answers were "very good", "good", "regular", "bad" or "very bad". The results of the health classification of each older person were compared between the two moments of the study (first wave and baseline), thus defining the dependent variable. The dependent variable responses were dichotomized into two levels: worsening and non-worsening of self-perception of health.

The data to compose the independent variables were extracted from the first wave of the study (second collection phase). The variables were grouped into sociodemographic, related to health and use of health services. They were dichotomized as follows: sociodemographic: sex (male or female); age group (up to 79 years or ≥80 years); marital status (with a partner, which was composed of married and in a stable union, or without a partner, composed of single, widowed and divorced people); family arrangement (lives alone or with other people); time of education (up to four years or more than four years of study); reading (knows how to read or does not know how to read); religious practice (yes or no); has own income (yes or no); monthly family income (≤ minimum wage or > than one minimum wage). Health-related: existence of reported chronic diseases (systemic arterial hypertension, diabetes mellitus, acquired heart diseases (acute myocardial infarction, heart failure secondary to other chronic diseases. Congenital heart diseases were not considered), osteoarticular disease, asthma, neoplasia, cerebrovascular accident; polypharmacy, defined as the use of five or more medications (yes or no); self-reported weight loss (yes or no); presence of caregiver (yes or no); fall in the last 12 months (yes or no) and the levels of frailty measured by the *Edmonton Frail Scale* (EFS)[13,14]. Use of health services: medical consultation in the last 12 months (yes or

no); hospitalization in the last 12 months (yes or no), the perception of difficulty in using the most sought after health service (yes or no) was also evaluated. The diseases assessed were identified through the report of the older person and/or caregivers or family members. It was not possible to measure how long the older person had had the disease due to the difficulty in finding medical records and also the fragility of memory for such information.

The EFS allows an assessment of frailty through nine domains, from 11 items with a score from zero to 17. The values of the scores determine that between zero and four there is no presence of frailty; five and six indicate an apparent vulnerability; seven and eight suggest mild frailty; nine and ten, moderate frailty; and 11 or more, severe frailty[13,14]. Older people with a score ≥7 were considered frail.

Descriptive analyzes were performed to organize the data, followed by bivariate analyzes aimed at identifying factors associated with the dependent variable (worsening of self-perception of health). For this purpose, the chi-square test was used. The magnitude of the associations was estimated from the prevalence ratios (PR). Using Poisson regression, with robust variance, the adjusted PRs were calculated. The variables eligible for the elaboration of the final model were those that, in the bivariate analysis, were more strongly associated with the worsening of self-perception of health, up to a significance level of 20% ($p<0.20$). To define the final model, a significance level of 0.05 ($p<0.05$) was adopted.

The research project that gave rise to this study was approved by the Research Ethics Committee through opinion number 1,629,395. All participants were instructed on the research, had the opportunity to ask questions and presented their consent. All signed the free and informed consent form.

RESULTS

Among the 685 older people evaluated in the base year, 92 refused to participate in the second phase of the study, 78 older people changed their residence and were not located, 67 older people had their homes visited three times on different days and times but were not found and 54 older people had died. Therefore, 394 older people participated in this study.

In relation to self-perception of health, 21.1% of the older people progressed to worsening of the indicator, 26.7% showed improvement and 52.2% showed no change (Table 1).

Tables 2 and 3 present the results of bivariate analyzes between the dependent variable (worsening of self-perception of health) and the characteristics of the older people. No sociodemographic variable was associated with worsening self-perception of health.

In the final model, the covariates that remained statistically associated with worsening of self-rated health, after multiple analysis, were: asthma, systemic arterial hypertension and frailty (Table 4).

Table 1. Transition between levels of self-perception of health in older people from baseline to the first wave of the study in Montes Claros, Minas Gerais, Brazil, 2013–2017.

Base line	First wave				
Self-perception levels	Very good	Good	Regular	Bad	Very bad
	n (%)	n (%)	n (%)	n (%)	n (%)
Very good	15 (3.8)	2 (13.3)	6 (40.0)	5 (33.3)	1 (6.7)	1 (6.7)
Good	145 (36.8)	7 (4.8)	91 (62.8)	44 (30.3)	2 (1.4)	1 (0.7)
Regular	180 (45.7)	3 (1.7)	54 (30.0)	102 (56.7)	17 (9.4)	4 (2.2)
Bad	48 (12.2)	0 (0.0)	9 (18.8)	26 (54.2)	11(22.9)	2 (4.2)
Very bad	6 (1.5)	0 (0.0)	1 (16.7)	5 (83.3)	0 (0.0)	0 (0.0)

* The percentages indicate the proportion of each level of self-rated health in relation to the baseline.

Table 2. Bivariate analysis between the worsening of self-perception of health and sociodemographic variables of community-dwelling older people followed up in the first wave of the study in Montes Claros, MG, Brazil, 2013–2017.

Independent Variable	Sample	Worsening of Self-Perception		
		No	Yes	
	n%	n	n	*p-value*
Sex				0.916
Male	131 (33.2)	103 (78.6)	28 (21.4)	
Female	263 (66.8)	208 (79.1)	55 (20.9)	
Age group (average 73.9 ±7.9)				0.911
Up to 79 years	302 (76.6)	238 (78.8)	64 (21.2)	
≥ 80 years	92 (23.4)	73 (79.3)	19 (20.7)	
Marital status				0.820
With partner	195 (49.5)	153 (78.5)	42 (21.5)	
Without partner	199 (50.5)	158 (79.4)	41 (20.6)	
Family arrangement				0.586
Lives alone	50 (12.7)	38 (76.0)	12 (24.0)	
Does not live alone	344 (87.3)	273 (79.4)	71 (20.6)	
Education (in years)				0.167
Up to 4	99 (25.1)	228 (77.3)	67 (22.7)	
> 4	295 (74.9)	83 (83.8)	16 (16.2)	
Reading				
Can read	300 (76.1)	238 (79.3)	62 (20.7)	0.728
Cannot read	94 (23.9)	73 (77.7)	21 (22.3)	
Religious practice				
Yes	381 (96.7)	300 (78.7)	81 (21.3)	0.609
No	13 (3.3)	11 (84.6)	2 (15.4)	
Own income				0.359
Yes	355 (90.1)	278 (78.3)	77(21.7)	
No	39 (9.9)	33 (84.6)	6(15.4)	
Monthly family income				0.885
Up to 1 minimum wage	102 (25.9)	80 (78.4)	22 (21.6)	
> 1 minimum wage	292 (74.1)	231 (79.1)	61 (20.9)	

Table 3. Bivariate analysis between the worsening of self-rated health and variables related to health and the use of health services by community-dwelling older people followed in the first wave of the study in Montes Claros, Minas Gerais, Brazil, 2013–2017.

Independent Variable	Sample	Worsening of Self-Perception		
		No	Yes	
	n (%)	n (%)	n (%)	*p-value*
Arterial hypertension				0.033
Yes	281 (71.3)	214 (76.2)	67 (23.8)	
No	113 (28.7)	97 (85.8)	16 (14.2)	

to be continued

Continuation of Table 3

Independent Variable	Sample	Worsening of Self-Perception		
		No	Yes	
	n (%)	n (%)	n (%)	*p-value*
Diabetes *Mellitus*				0.234
Yes	90 (22.8)	67 (74.4)	83 (21.1)	
No	304 (77.2)	244 (80.3)	60 (19.7)	
Heart disease				0.436
Yes	110 (27.9)	84 (76.4)	26 (23.6)	
No	284 (72.1)	227 (79.9)	57 (20.1)	
Osteoarticular Disease				0.431
Yes	189 (48.0)	146 (77.2)	43 (22.8)	
No	205 (52.0)	165 (80.5)	40 (19.5)	
Asthma				0.021
Yes	29 (7.4)	18 (62.1)	11 (37.9)	
No	365 (92.6)	293 (80.3)	72 (19.7)	
Neoplasia				
No	356 (90.4)	284 (79.8)	72 (20.2)	0.210
Yes	38 (9.6)	27 (71.1)	11 (28.9)	
Encephalic Vascular Accident				
No	365 (92.6)	288 (78.9)	77 (21.1)	0.959
Yes	29 (7.4)	23 (79.3)	6 (20.7)	
Polypharmacy				
No	287 (72.8)	234 (81.5)	53 (18.5)	0.038
Yes	107 (27.2)	77 (72.0)	30 (28.0)	
Self-reported weight loss				
No	335 (85)	267 (79.7)	68 (20.3)	0.373
Yes	59 (15)	44 (74.6)	15 (25.4)	
Presence of Caregiver				
Yes	348 (88.3)	276 (79.3)	72 (20.7)	0.614
No	46 (11.7)	35 (76.1)	11 (23.9)	
Fall in the last 12 months				
No	271 (68.8)	218 (80.4)	53 (19.6)	0.276
Yes	123 (31.2)	93 (75.6)	30 (24.4)	
Frailty				<0.001
Yes	111 (28.2)	100 (69.0)	45 (31.0)	
No	283 (71.8)	211 (84.7)	38 (15.3)	
Medical consultation in the last 12 months				
Yes	34 (8.6)	29 (85.3)	5 (14.7)	0.341
No	360 (91.4)	282 (78.3)	78 (21.7)	
Hospitalization in the last 12 months				0.080
Yes	57 (14.5)	40 (70.2)	17 (29.8)	
No	337 (85.5)	271 (80.4)	66 (19.6)	
Access Difficulty				0.140
Yes	130 (33.0)	97 (74.6)	33 (25.4)	
No	264 (67.0)	214 (81.1)	50 (18.9)	

Table 4. Factors associated with worsening of self-perception of health in community-dwelling older people in Montes Claros, Minas Gerais, Brazil, 2013–2017.

Independent Variable	PR *(adjusted)	**95% CI	p value
Frailty			< 0.001
Yes	1.147	1.063 - 1.236	
No	1		
Asthma			0.048
Yes	1.139	1.001 - 1.294	
No	1		
Arterial hypertension			0.049
Yes	1.020	1.001 - 1.130	
No	1		

*PR- Prevalence Ratio, ** 95%CI - Confidence Interval.

DISCUSSION

This study showed that there was variation between the different levels of self-perception of health of older people during the mean follow-up period (42 months). Chronic diseases and frailty showed a longitudinal association with the worsening of these levels of self-perception of health.

It is important to highlight that no significant differences were found for the main characteristics between the older people population followed up in the base year and the older people population considered as losses (57.5%) during the follow-up of this study. Therefore, it points to a non-differential loss[15].

The dynamic process of health self-perception of older people residing in the community, over time, was observed in this study. Just over half of the older people group maintained the pattern of the previous assessment, while about one-fifth showed worsening and approximately one-quarter showed improvement.

Factors associated with improved self-perception of health were not investigated in this study. This is due to the fact that variables such as diet, physical activity level, social support and autonomy were not considered, which according to the literature are capable of positively influencing self-perception of health[6,8].

The results of this study show a significant association between the worsening of self-perception of health status and frailty. Frail older people have physiological vulnerability to maintain or recover homeostasis after the occurrence of stressful events. This decompensation of homeostasis arises when acute physical, social or psychological events are capable of promoting an increase in deleterious effects on the different organic systems of frail older people. It is the decrease in energy reserves resulting from changes related to the aging process, composed of sarcopenia, neuroendocrine dysregulation and immune dysfunction[16-18]. Thus, the frailty syndrome with so many interferences in the functionality and autonomy of the older person is capable of negatively interfering over time in their health self-assessment.

The relationship between frailty in older people and negative self-perception of health has already been identified in cross-sectional studies[3,19,20]. However, no other study was found in the literature that evaluated the determinants of the worsening of self-perception of health in older people over time, which made it impossible to compare the results of the present study with other similar investigations.

A recent systematic review shows that frailty is highly prevalent in South American older people, with rates higher than those found in Europe and Asia[21]. These findings indicate the need for proposals capable of preventing the progression of both frailty and self-perception of health in older people towards negative health outcomes. This aspect is particularly important for health professionals who assist this

population. The Family Health Strategy teams should establish a closer relationship with these individuals, with the implementation of care protocols aimed at the necessary actions for healthy aging and quality of life, focusing on the promotion and prevention of the determinant aspects of frailty. This will bring benefits to the population with possible impacts on frailty and improvement in self-perception of health[2].

Worsening self-perception of health was also associated with asthma. Considered one of the main public health problems, asthma is a chronic obstructive inflammation of the bronchi with acute reversible exacerbations, caused by the increased reaction to various inhalational or food stimuli, causing constriction of the bronchial muscles, edema of its wall and hypersecretion of the mucous glands, leading to characteristic clinical picture: dyspnea, cough, wheezing[22].

Asthma has already been associated with negative self-perception of health among older people[19,20]. However, no other studies were found that showed a relationship between asthma and the worsening of self-perception over time. It is possible to establish a parallel between the possible severity of cases of the disease, which may even pose a risk of death[19] and its negative impacts on the worsening of self-perception of health. The clinical picture of asthma can vary from individual to individual, as well as in the same older person. There are times when the clinical picture may present exacerbated symptoms, requiring emergency care and hospitalization. Generally, older people with asthma also have other concomitant chronic non-communicable diseases that complicate and influence the treatment of asthma[19,20] and can also impact on the worsening of self-perception of health. Although there is no cure, there are treatments that greatly improve asthma symptoms and provide disease control[22,23]. Actions to prevent triggers related to asthma attacks should be part of the routine efforts of health professionals who accompany these older people in order to reduce the exacerbation of the disease and thus avoid worsening the indicator of worsening self-perception of health.

The worsening of self-perception of health was also associated with systemic arterial hypertension (SAH) in community-dwelling older people. Cross-sectional studies also identified this association[24,25]. Systemic arterial hypertension can negatively interfere in the self-perception of health in older people [26]. Hypertensive individuals are instructed to restrict certain foods, perform physical activity, and correctly use antihypertensive medications. Such changes in lifestyle can lead the older person to have a negative perception of their own health. Over time, the worsening of the condition of hypertension associated with the addition of medications can contribute to the worsening of the negative self-perception of health.

In this sense, health education is one of the main devices to enable and effect the health promotion of this population, as it strengthens the development of individual and collective responsibility for the prevention of diseases[26-28]. The establishment of partnerships between the Family Health Strategy teams and outdoor gym programs, multidisciplinary support teams, the older person and their caregivers is recommended for the development of health promotion actions and prevention of SAH complications. These are possibilities to develop lasting actions that generate in the older person the feeling of belonging to the health care group. Such actions are based on health literacy studies[29] and can favor prolonged adherence with very positive results also in the self-perception of health in the long term.

It is evident that the aspects found as determinants for a worsening of self-perception of health are associated with chronic diseases and frailty that can negatively impact the autonomy and independence of the older person. Old age with such limitations, in general, can interfere with the worsening of self-perception of health.

The present study has some limitations. The impossibility of evaluating the transitions in self-perception of health that occurred in time intervals shorter than the period elapsed between the baseline and the first wave of the study. It was also not possible to assess the factors associated with improved self-perception of health because variables that may be linked to a possible improvement were not investigated. In addition, some variables studied were self-reported. However, despite these limitations, this study has a random sample, with a significant

number of community-dwelling older people. In addition, this is an unprecedented study that shows what actually influences the worsening of the self-perception of health indicator. Also noteworthy is its potential for directing efforts that can improve self-perception of health among older people.

Understanding the factors that interfere with variations in self-perception of health is essential for the development of a care plan aimed at older people that seeks to intervene in the determinant aspects of self-perception over time. In the case of the older people in the municipality under study, efforts should be aimed at older people who have chronic diseases and those who have some level of frailty.

CONCLUSION

Self-perception of health was dynamic, with transition between levels of self-rated health during the follow-up period. Some health conditions were associated with worsening of self-perception of health in community-dwelling older people: chronic diseases and frailty. A significant portion of the older people showed improved self-perception of health. These results should be considered by health care teams in carrying out planned actions aimed at the health of the older person and aimed at improving the self-perception of health indicator.

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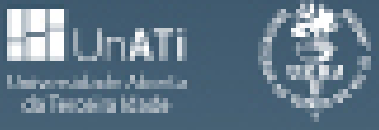
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