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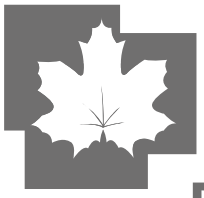

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Older adults living under social distancing: possibilities for tackling Covid-19

Since the beginning of the year, the world has been gripped by news emerging from China, after a local doctor announced an increase in the number of cases of an atypical respiratory syndrome caused by a new virus, before being forced into silence, then dying from the very same respiratory syndrome. It is vital that justice is done to the story of the first steps of what was to become a pandemic, and which was negligently handled. This was a different type of flu, which quickly evolved into severe pneumonia and death. Cases had been reported in the city of Wuhan, Hubei province, China since the end of 2019, and soon affected an alarming proportion of the population of that province and then the country as a whole. Soon, the outbreak became an epidemic across the entire region, based on the high number of reported cases and deaths.

Since the outbreak of the epidemic in China, many countries have made their public health emergency centers operational. Brazil has been no different, despite some skepticism on the part of both administrators and the population. The etiologic agent of the "new flu" was quickly identified (SARS-COV2), and the disease it causes became known as Covid-19. From then on, Covid-19 spread rapidly across every continent, and in early March, the World Health Organization decreed that we were living through a pandemic[1].

In Brazil, the Ministry of Health declared a Public Health Emergency of National Importance (or ESPIN) on February 3, 2020, before sanctioning law No. 13,979 dated 2/6/2020[2], which provides measures to deal with emergencies of national and international significance, resulting from Covid-19. In the following month, Brazil declared a situation of community transmission throughout the country, through Ordinance No. 454 dated 3/20/2020[3] and, with it, the implementation of more consistent quarantine, isolation and social distancing measures.

Despite these actions, the number of cases and deaths in Brazil has been growing and the "stay at home" instructions continued to be reinforced, with attention mainly focusing on the older population and those with chronic diseases.

Data from the latest bulletin from the Ministry of Health, dated April 4, 2020, revealed 10,278 cases and 431 deaths, with more than 80% of fatalities caused by the new coronavirus involving older people, and almost the same number having at least one risk factor constantly related to covid-19, with an emphasis on heart disease and diabetes[4]. This suggests that more comprehensive measures are needed to protect this population.

The ABRASCO Aging Working Group document[5] highlights the grave concerns over the various vulnerabilities that older adults are subject to and the countless failings in care related to these citizens, suggesting an age-related genocide (of those aged 60 years and over) if immediate measures are not taken.

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Measures of prevention and protection must be effectively advocated to reduce the various forms of contagion everywhere older adults find themselves, whether in the context of their homes, cared for by caregivers and family members, through social isolation, or for residents of long-term care facilities (LTCFs), contributing to a reduction in the mortality rate of those aged 60 or over.

In light of this worrying situation, a group of researchers linked to the Universidade Federal do Rio Grande do Norte (Rio Grande do Norte Federal University - UFRN), working on the theme of aging and primary health care, has proposed a series of recommendations on how Primary Health Care can contribute to the implementation of the strategy for the protection of older adults living in their own homes and in the surveillance and monitoring of LTCFs (Long Term Care Facilities for Older Adults) in the region.

The establishment of viable health care actions in primary care in Brazil reinforces the importance and effectiveness of the Brazilian National Health Service (or SUS), the Family Health Strategy (or ESF) and the National Social Care System (or SUAS) from an articulated and integrated perspective, with dimensions that can guarantee protection for older adults in all their places of residence, including those in situations of greater vulnerability, such as residents of long-term care facilities, those living in the community, people on low-incomes, homeless people, refugees and nomads, as well as through the implementation of emergency public policies, aimed at reducing hospitalizations, the need for intensive care treatment and, above all, avoiding deaths, as has been occurring both around the world and in Brazil[6].

It is essential, therefore, that sectoral and intersectoral actions adopt an integrated approach, involving all the relevant sectors and incorporating the scientific guidelines that underpin the work of health teams across the country, and extend throughout local territories where competencies and skills that incorporate new and varied technologies in their practices are applied.

Based on this perspective, the group proposes a tool for monitoring essential home care for the health of older adults, in the context of covid-19, to be applied to families, health teams from Primary Health Care (PHC) and managers operating in both health and intersectoral actions.

The tool will allow the mapping of strengths and weaknesses in the management of elderly care and can guide PHC actions, providing essential monitoring for avoiding hospitalizations and deaths[6] and, based on the assumption of a greater than ever need for the comprehensive and efficient coverage of this vulnerable group, can be implemented through training to monitor the protection of older adults, applied by caregivers in cases where Family Health Strategy coverage is scarce or non-existent.

Therefore, the concerns of the group must be disseminated among all parties who debate issues related to the older population that receives treatment through primary health care, allowing them to provide guaranteed care for this population during the pandemic caused by the new coronavirus, and contributing to a new approach to the care model for this age group in Brazil.

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Influence of physical rehabilitation on functional aspects in individuals submitted to total hip arthroplasty: a systematic review

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Silvio Assis de Oliveira-Junior[1,2]
Paula Felippe Martinez[1,2]

Abstract

Objective: by performing a systematic review, the present study aimed to evaluate the influence of physical rehabilitation on functionality, range of motion and musculoskeletal strength in patients submitted to total hip arthroplasty due to osteoarthritis. *Methods:* a systematic search for randomized and non-randomized controlled trials was conducted using the PubMed, Web of Science, PEDro, Cochrane, Clinical Trials and SciELO electronic databases, using the search strategies recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). *Results:* in general, protocols supervised by physiotherapists associated with performing active exercises of the hip periarticular muscles and knee extensors have provided effective functional prognosis. High intensity resistance exercises (dynamic and isometric) are more effective in improving functionality. Dynamic exercises with three to five sets of eight to twelve low and high intensity repetitions promoted more pronounced increases in muscle strength and range of motion than other therapeutic modalities. *Conclusions:* the techniques and protocols used for physical therapy treatment after THA are wide-ranging and their clinical efficacy is demonstrated in literature.

Keywords: Arthroplasty, Replacement, Hip. Osteoarthritis. Exercise. Aging.

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The authors declare there are no conflicts of interest in relation to the present study.

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INTRODUCTION

Population aging is a phenomenon found in several countries[1], hugely impacting the organization of health systems, as older adults are more likely to be affected by chronic diseases[2].

In this scenario, osteoarthritis (OA) is one of the main causes of functional disability in older adults worldwide[3]. The condition is characterized by structural changes, ranging from mild to severe, of the cartilage in the synovial joints[3], which occur due to biomechanical, sex, genetic, obesity, ageing, and metabolic factors[4]. Clinically, subjects with OA may experience pain, short-term stiffness, crackling, reduced joint function and deformities[3].

Weight-bearing joints, such as the knee and hip, are often affected by OA[3], and hip osteoarthritis is one of the most disabling forms of the disease[4]. Currently, surgical treatment is recommended for patients with OA who have not achieved satisfactory results with a more conservative treatment approach, and who present pain, loss of functionality, and the inability to perform activities of daily living[5].

In this sense, OA represents the clinical condition for which total hip arthroplasty (THA) is most frequently recommended. Although it is a radical procedure, THA improves quality of life and provides an early return to activities of daily living[5]. Considering the clinical and functional repercussions of OA and THA, physiotherapy becomes extremely important for patients, as it aims to increase range of motion, minimize complications resulting from the surgical procedure, provide an early return to routine activities, and improve pain and functional deficits[6,7].

Studies have shown that patients who participate in physical therapy treatment after THA exhibit a greater recovery of physical function and an earlier improvement in quality of life than those who do not[6,8-18]. Although physical therapy presents many therapeutic techniques for the post-surgical rehabilitation of these individuals, information on the efficacy of treatment protocols remains incipient.

Therefore, it is necessary to systematize the scientific evidence of adequate physiotherapy methods for the functional rehabilitation of patients undergoing THA. Based on the existing literature, the purpose of the present study is to describe the effects of physical rehabilitation on functionality, muscle strength, and range of motion in patients undergoing THA due to OA.

METHODS

This study is a systematic review which applied the following inclusion criteria: randomized and non-randomized clinical trials that evaluated protocols with physical exercises and/or electrotherapy for the treatment of subjects (female and male) undergoing THA due to osteoarthritis, compared to other forms of intervention or to a control group, and which were published in scientific journals between January 1980 and December 2019. The exclusion criteria were: studies that did not meet the inclusion criteria, systematic reviews, case studies, case series, retrospective studies, observational studies, pilot studies and experimental animal model studies.

The systematic search for randomized and non-randomized controlled trials was performed using the PubMed, Web of Science, PEDro, Cochrane, Clinical Trials and SciELO electronic databases, based on the search strategies recommended by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). The search was also performed by screening the citations of the studies included in the review. The research used the following Medical Subject Headings Terms (MeSH) combined descriptors: Exercise, Hip and Arthroplasty; Physical Therapy, Hip and Arthroplasty; Physical Activity, Hip and Arthroplasty; Exercise Therapy, Hip and Arthroplasty.

The research was carried out in December of 2019. First, the titles and abstracts of all the articles identified with the search strategy were evaluated independently and in duplicate by two reviewers. All abstracts that did not provide enough information on the inclusion and exclusion criteria were selected for reading in their entirety. In the second step, the same reviewers evaluated the complete manuscripts, independently and in duplicate, to select those that

complied with the eligibility criteria. Differences between reviewers were resolved by consensus among all the researchers involved.

The evaluators performed data extraction independently, using standardized forms, which included information on the authors, year of publication, participants (number of individuals, age and sex), study design, evaluation scale, duration of the study, and intervention results. In case of inconsistency, the original documents were retrieved and investigated together for consensual definition. The outcomes of interest were: muscular strength; range of motion (ROM); functionality.

The risk of bias in the evaluation and methodology was analyzed by the same independent reviewers and in duplicate, using the JADAD bias risk scale[24]. For each specific outcome, the quality of the evidence was based on five factors: 1-described as randomized, 2-described as double-blind, 3-description of sample losses, 4-appropriate randomization, and 5-appropriate masking. The JADAD scale results are divided into two levels of evidence that classify the study as low (score 0 to 2) or high quality (score 3 to 5)[19].

RESULTS

A total of 5702 studies were found by electronic search; 5264 of which were excluded as neither pre-established eligibility nor inclusion criteria were matched. Therefore, 438 were selected for detailed analysis, beginning with the titles; 321 were excluded due to being duplicates. Thus, 117 abstracts were evaluated, 57 of which were selected for reading in their entirety. After the evaluation of the full text, 26 articles were excluded as they did not comply with the eligibility criteria. Thus, 31 studies were included in the systematic review. Subsequently, the studies cited by the 31 papers included in the review were analysed, with one study which had not been identified being included in the present review. Therefore, 32 studies made up this systematic review.

Figure 1 shows the steps of the selection process of the studies and the reasons for exclusion.

Table 1 shows the characteristics of the studies included in this review, exhibiting the following items: author, year of publication, study design, study subjects, division of groups, analyzed variables and results.

Risks of bias

Regarding the risk of bias in the studies included in this systematic review, 29 (90.62%) studies were submitted to randomization, only two studies (6.25%) were double-blind and 29 (90.62%) reported sample losses (Table 2).

According to the JADAD score, only one study[20] received a maximum score and two articles did not score the minimum[21,22]. The classifications of the other studies are described in Table 2.

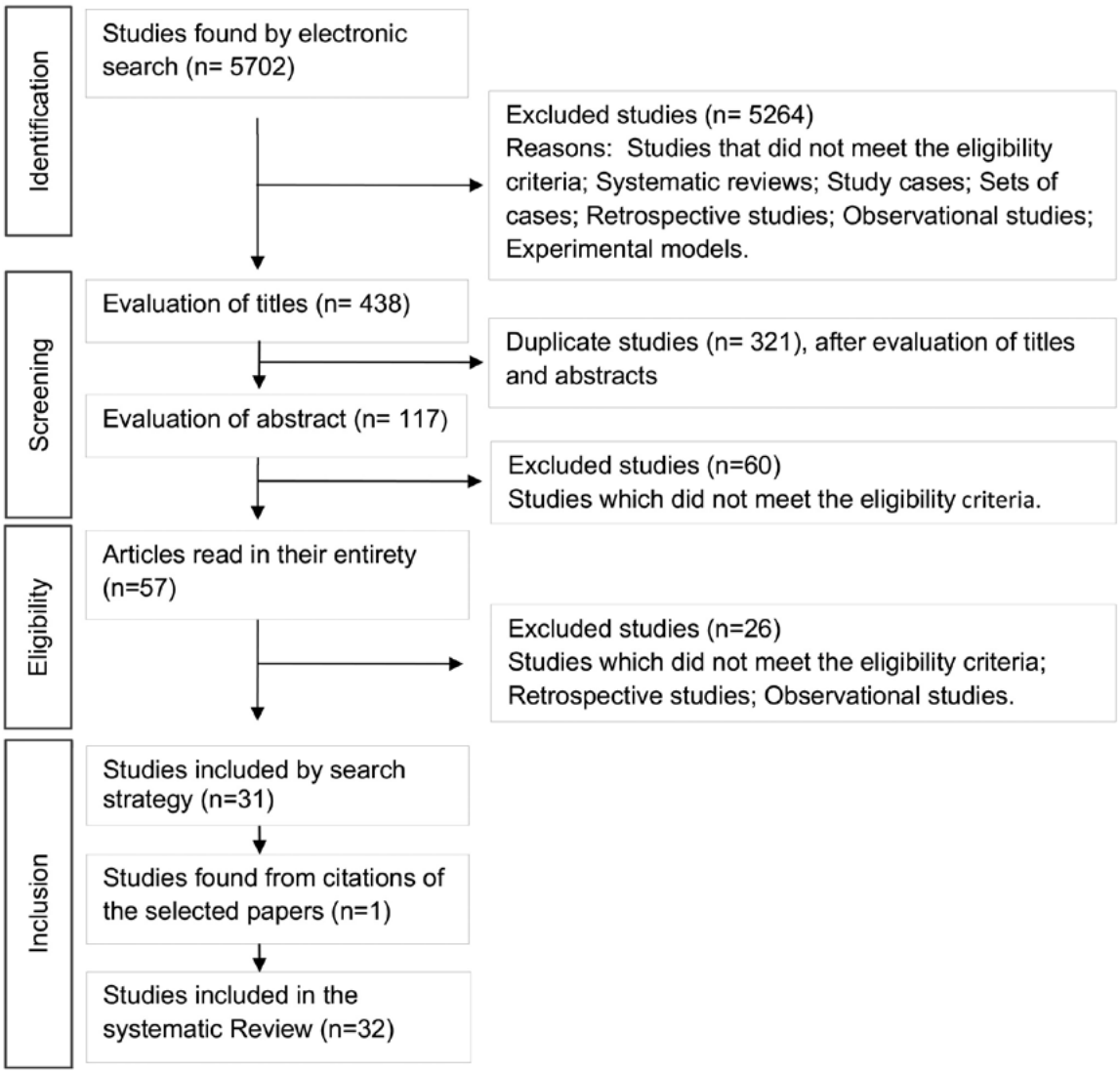

Figure 1. Flowchart of the search process, selection steps and reasons for exclusion of studies included in the systematic review. Campo Grande, Mato Grosso do Sul, 2019.

Table 1. Characteristics and results of randomized and nonrandomized clinical trials included in the systematic review. Campo Grande, Mato Grosso do Sul, 2019.

Author, year	Design and Subjects	Intervention Group (IG)	Control Group (CG)	Analyzed variables	Results
Gremeaux et al., 2008[8]	Randomized Clinical Trial n=29	LFEMS Group (Low frequency electric muscle stimulation and Physical Therapy) (n=16)	Physical Therapy Only (n=13)	Maximum isometric muscular strength of knee extensors (*isokinetic dynamometer)* and functionality (*FIM*).	The IG showed better knee extensor strength (p<0.05) and functionality (p<0.05) results than the control group.
Liebs et al., 2012[13]	Multicenter Randomized Clinical Trial n=271	THA early group (Early aquatic therapy starting on 6th postoperative day) (n=129)	THA group (Aquatic therapy after healing) (n=142)	Functionality (*WOMAC* and *Lequesne*).	The IG achieved better results for functionality (p=0.01).

to be continued

Continuation of Table 1

Author, year	Design and Subjects	Intervention Group (IG)	Control Group (CG)	Analyzed variables	Results
Hesse et al., 2003[14]	Randomized Clinical Trial n=79	Treatment group (conventional physical therapy and treadmill training) (n=39)	Conventional physical therapy alone (n=40)	Functionality (*HHS*) and hip abductor strength (*MRC*).	The IG had better results for functionality (p<0.0001) and hip abductors strength (p<0.001) than the CG.
Husby et al., 2010[41]	Randomized Clinical Trial n=24	STG group (Maximal strength training and conventional rehabilitation program) (n=12)	CRG group conventional rehabilitation (n=12)	Knee extensors strength (*1RM*), hip abductors strength (*1RM*), and functionality (*Merle d'Aubigné and Postel*).	STG group showed a significant increase in quadricep (p<0.002) and hip abductor (p<0.002) strength than the CG.
Heiberg et al., 2012[10]	Clinical Trial Randomized n=68	Walking skill training group (n=35)	CG(n=33)	Functionality (*FIM* and *HHS*), hip flexion, extension, and abduction ROM (Goniometer)	The IG achieved significant improvement in hip extension ROM (p=0.02) and functionality (p=0.001) when compared to the CG.
Jan et al., 2004[17]	Clinical Trial n=53	Exercise-high (Conventional exercises at home - group with high adherence) (n=13) Exercise-low (Conventional exercises at home - group with low adherence) (n=13)	CG(n=27)	Hip flexors and extensors strength (*isokinetic dynamometer*) and functionality (*HHS*).	The Exercise-high group showed improvement (p<0.05) of hip muscles strength bilaterally and functionality.
Trudelle-Jackson and Smith, 2004[11]	Randomized Clinical trial n=34	Experimental group (strength and postural stability exercises). (n=18)	Isometric and active range of motion exercises (n=16)	Functionality (*12-Item Hip Questionnaire*) and muscular strength of knee extensors and flexors, and hip extensors, flexors and abductors (*platform of strength with software BEP*).	There was significant improvement in functionality (p<0.01), hip flexors, extensors and abductors muscles strength (p<0.05), and knee extensors for the IG . There were no significant differences for the control group.
Stockton and Mengersen, . 2009[6]	Clinical trial n=57	Treatment Group (twice a day conventional physiotherapy and functional exercises) (n=30)	Once a day of conventional physiotherapy (n=27)	Functionality (*Iowa Level of Assistance hip score Oxford*).	There was no difference between groups.
Sashika et al.,1996[9]	Non-Randomized Clinical Trial n=23	Group A (ROM and isometric exercises) (n=8) Group B (ROM, isometric and eccentric exercises) (n=8)	CG(n=7)	Knee extensors and hip flexors strength (*MMT*), maximum isometric strength of hip abduction (isokinetic dynamometer) and ROM (*JOA hip score*).	The maximum isometric hip abduction torque increased in the three groups in the hip submitted to THA (Group A: p<0.01; Group B: p<0.01; and Control: p<0.05). However, there was no difference between the groups.

to be continued

Continuation of Table 1

Author, year	Design and Subjects	Intervention Group (IG)	Control Group (CG)	Analyzed variables	Results
Giaquinto et al., 2010[16]	Prospective Interventional Cohort Study n=64	HTG (hydrotherapy group) (n=31)	NHTG (no-hydrotherapy group = conventional exercise) (n=33)	Functionality (*WOMAC*).	HTG had better result for functionality (p<0.01) than the NHTG group.
Galea et al., 2008[18]	Clinical Trial n=23	Unsupervised exercise (n=12) Supervised exercise (n=11)	-	Functionality (*WOMAC*).	There was no significant difference between the groups.
Tsukagoshi et al., 2014[30]	Randomized controlled trial n=65	WB group (Weight-bearing) (n=22) NWB group (Non-weight-bearing) (n=21)	CG(n=22)	Functionality (*HHS*) and isometric muscular strength of knee extensors, and hip abductors, flexors and extensors (hand dynamometer)	There was significant improvement in functionality (p<0.01) for WB group compared to the CG. There were no significant differences between the WB and NWB groups.
Barker et al., 2013[31]	Randomized controlled trial n=80	Treatment group (Tailored Protocol) (n=40)	Traditional Protocol (n=40)	ROM of hip flexion, extension and abduction (Goniometer), muscle strength of hip flexors, extensors and abductors (hand dynamometer), and Functionality (*UCLA, OHS, HOOS, EuroQol*)	There was a significant improvement in functionality (p<0.011) for the treatment group than the CG. There was also a significant improvement in flexion, extension (p<0.0005) and abduction (p<0.004) hip ROM in the IG than the CG.
Rahmann et al., 2009[35]	Randomized controlled trial n=54	Aquatic exercise Physiotherapy Program (Aquatic exercise - (fast pacemetronome 80–88bpm) (n=18) Aquatic exercise Program (Aquatic exercise - slow pacemetronome 50–58bpm) (n=19)	Ward Exercise program (conventional exercise during hospitalization) (n=17)	Hip abductors and knee extensors strength (hand dynamometer), ROM of knee flexion (Goniometer), and functionality (*WOMAC*).	Hip abductor strength was significantly greater after aquatic physiotherapy intervention (fast pacemetronome 80–88bpm) than ward exercise program (p=0.001) or water exercise program (slow pacemetronome 50–58bpm) (p=0.011)
Unlu et al., 2007[42]	Randomized controlled trial n=26	Home exercise program (Conventional exercise) (n=9) Exercised under physiotherapist supervision in hospital (Conventional exercise) (n=8)	CG (n=9)	Hip abduction strength (isokinetic dynamometer).	Maximal isometric hip abduction torque improved significantly in the supervised (p=0.012) and home therapy (p=0.018) groups. The supervised group showed the best improvement for abduction torque (p=0.006).

to be continued

Continuation of Table 1

Author, year	Design and Subjects	Intervention Group (IG)	Control Group (CG)	Analyzed variables	Results
Jogi et al., 2015[33]	Clinical Trial n=30	THA Exercise (Conventional exercise) + Balance (n=13)	THA Exercise alone (Conventional exercise) (n=17)	Functionality (*WOMAC*).	There was a significant improvement in functionality in both groups (p<0.01). There was no difference between groups for functionality.
Husby et al., 2009[10]	Randomized controlled trial n=24	Maximum strength + conventional treatment (STG) (n=12)	Conventional rehabilitation group (CRG) (n=12)	1RM leg press; Hip abductors strength (1RM) and functionality (*Merle d'Aubigné and Postel*)	No significant difference was observed for functionality in the STG than the CRG. 1RM Leg press for the healthy leg was significantly improved in the STG (p=0.044) than the CRG. From 6 to 12 months, hip abduction in the healthy limb improved in the CRG (p=0.031).
Temfemo et al., 2008[22]	Clinical Trial n=81	Standard rehabilitation and isometric exercises with electromyographic feedback (n=40)	CG (Standard rehabilitation alone) (n=41)	Maximum voluntary isometric hip strength (isokinetic dynamometer).	The addition of exercises with electromyographic feedback provides increased strength of the operated *gluteus medius* seven days after surgery (p<0.001).
Umpierres et al., 2014[7]	Randomized controlled trial n=106	Exercise and instructions (THAPCP) (n=54)	Only instructions (THAP) (n=52)	Functionality (*Merle d'Aubigné and Postel*), hip flexion, extension, adduction, abduction, and internal and external rotation ROM (Goniometer), muscle strength of knee flexion and extension, and hip flexion, extension, adduction, abduction, and internal and external rotation (*Kendall test*).	The THAPCP group obtained better results for flexion, extension (p<0.001), adduction (p=0.003), abduction (p=0.002), internal rotation and external rotation strength and functionality (p<0.001)
Wójcik et al., 2012[21]	Clinical Trial n=35	Experimental group (conventional therapeutic exercises, and fascial relaxation) (n=25)	CG (conventional therapeutic exercises) (n=10)	ROM of hip flexion, extension, abduction, adduction, internal and external rotation (Goniometer).	The IG had a significant increase in abduction (p=0.04), adduction (p=0.01) and internal rotation (p=0.03) hip ROM than the CG.
Liebs et al., 2010[25]	Randomized controlled trial n=203	Ergometer Cycling and conventional treatment (n=99)	CG (conventional treatment) THA (n=104)	Functionality (*WOMAC*).	The IG had a significant improvement in functionality (p=0.046) than the CG.
Suetta et al., 2004[20]	Randomized controlled trial n=36	Electrical stimulation (n=11) Resistance training (n=13)	Home Exercise (n=12)	Knee extensor isokinetic strength (isokinetic dynamometer)	The resistance training group obtained better results for knee extensor strength (p<0.05).

to be continued

Continuation of Table 1

Author, year	Design and Subjects	Intervention Group (IG)	Control Group (CG)	Analyzed variables	Results
Suetta et al., 2008[38]	Randomized controlled trial n=36	Resistance training (n=13) Electrical stimulation (n=12)	Standard rehabilitationn (n=11)	Knee extensor muscle isokinetic strength (isokinetic dynamometer)	The resistance training group obtained better results for dynamic extensor muscle strength (p<0.05).
Suetta et al., 2004[37]	Clinical Trial n=30	Standard rehabilitation and strength training (n=11) Standard rehabilitation and neuromuscular electrical stimulation (n=10)	Standard rehabilitation (n=9)	Knee extensor muscle maximum isometric strength (isokinetic dynamometer).	The resistance training group obtained better results for knee extensor muscle isometric strength (p<0.01).
Mikkelsen et al., 2014[44]	Randomized controlled trial n=62	Intervention group (home-based exercise and progressive resistance training) (n=32)	CG (home-based exercise) (n=30)	Hip abductor and flexor strength (hand dynamometer) and functionality (*HOOS*).	There was no difference between groups for all outcome measures.
Nankaku et al., 2016[43]	Clinical Trial n=28	Exercise group (Conventional rehabilitation and exercise external rotator) (n = 14)	GC (Conventional rehabilitation) (n = 14)	Hip flexion and abduction ROM (Goniometer), knee extensor and hip external rotator and abductor strength (hand dynamometer).	Hip abductor strength (p<0.05) improved significantly in the IG after the intervention.
Monticone et al., 2014[24]	Randomized controlled trial n=100	Experimental group (task-oriented exercises and abandoning of any support for walking) (n=50)	CG (open chain kinetic exercises, partial weight-bearing and support walking after surgery) (n = 50)	Functionality (*WOMAC*)	There was a significant improvement in functionality (p<0.001) in the IG.
Pohl et al., 2015[32]	Clinical Trial n=58	Sensorimotor training 6 times a week (n=23) Sensorimotor training 4 times a week (n=15) Sensorimotor training twice a week (n=20)	-	Functionality (Lequesne).	There was significant improvement in functionality over the time (p< 0.001), but this did not differ between groups.

to be continued

Continuation of Table 1

Author, year	Design and Subjects	Intervention Group (IG)	Control Group (CG)	Analyzed variables	Results
Smith et al., 2008[29]	Randomized Clinical Trial n=60	Gait re-education and Bed Exercise (n=30)	Only gait re-education (n=30)	Functionality (*ILOA*).	There was no difference between groups for all outcome measures.
Matheis and Stöggl, 2018[50]	Controlled trial n=39	Intervention group (mobilization and strength training) (n=20)	CG (n=19)	Hip flexion, abduction, and extension ROM (Goniometer), functionality *(Merle d'Aubigné, HHS* and *WOMAC*).	The IG showed significant improvement in hip flexion (p<0.01), extension (p<0.001) and abduction (p<0.01) ROM.
Winther et al., 2018[39]	Randomized controlled trial n=60	Conventional physiotherapy (n=29)	Maximal strength training (n=31)	Functionality (*HOOS* and *HHS*) and abductor strength (pulling apparatus)	The IG showed significant improvement in abductor strength ($p \leq 0.002$)
Monaghan et al., 2017[26]	Randomized controlled trial n=63	Exercise and usual care group (n=32)	Control group (usual care only) (n=31)	Functionality (*WOMAC*) and hip abductors strength (dynamometer.	The IG had a significant improvement in functionality (p<0.01).

Abbreviations: THA: Total Hip or Knee Arthroplasty; ROM: Range of motion; HHS: Harris Hip Score; FIM: Functional Independence Measure; WOMAC: Western Ontario and McMaster Universities; MRC: Medical Research Council; MMT: Manual Muscular Testing; ILOA: Iowa Level of Assistance Scale; OHS: Oxford Hip Score; HOOS: Hip Disability and Osteoarthritis Outcome Score; UCLA: UCLA Activity Score, 1RM: One-Maximum Repetition.

Table 2. Jadad scale-based classification of risk of bias for the studies included in the systematic review. Campo Grande, Mato Grosso do Sul, 2019.

Author, year	Randomized	Suitable randomization?	Double blind	Suitable double blind?	Sample losses	Punctuation	Quality
Gremeaux et al., 2008[8]	Yes	Yes	No	-	Yes	3	High Quality
Liebs et al., 2012[13]	Yes	Yes	No	-	Yes	3	High Quality
Hesse et al., 2003[14]	Yes	Yes	No	-	Yes	3	High Quality
Husby et al., 2009[41]	Yes	Yes	No	-	Yes	3	High Quality
Heiberg et al., 2012[10]	Yes	Yes	No	-	Yes	3	High Quality
Jan et al., 2004[17]	Yes	No	No	-	Yes	1	Low Quality
Trudelle Jackson and Smith, 2004[11]	Yes	Yes	No	-	Yes	3	High Quality
Stockton and Mengersen al., 2009[6]	Yes	No	No	-	Yes	1	Low Quality

to be continued

Continuation of Table 2

Author, year	Randomized	Suitable randomization?	Double blind	Suitable double blind?	Sample losses	Punctuation	Quality
Sashika et al.,1996[9]	No	-	No	-	Yes	1	Low Quality
Giaquinto et al., 2010[16]	Yes	No	No	-	Yes	1	Low Quality
Galea et al., 2008[18]	Yes	No	No	-	Yes	1	Low Quality
Tsukagoshi et al., 2014[30]	Yes	Yes	No	-	Yes	3	High Quality
Barker et al., 2013[31]	Yes	Yes	No	-	Yes	3	High Quality
Rahmann et al.,2009[35]	Yes	Yes	No	-	Yes	3	High Quality
Unlu et al., 2007[42]	Yes	Yes	No	-	Yes	3	High Quality
Jogi et al., 2015[33]	Yes	No	No	-	Yes	1	Low Quality
Husby et al., 2010[10]	Yes	Yes	No	-	Yes	3	High Quality
Temfemo et al., 2008[22]	No	-	No	-	No	0	Low Quality
Umpierres et al., 2014[7]	Yes	Yes	Yes	Yes	No	4	High Quality
Wójcik et al., 2012[21]	No	-	No	-	No	0	Low Quality
Liebs et al., 2010[25]	Yes	Yes	No	-	Yes	3	High Quality
Suetta et al., 2004[20]	Yes	Yes	Yes	Yes	Yes	5	High Quality
Suetta et al., 2008[38]	Yes	Yes	No	-	Yes	3	High Quality
Suetta et al., 2004[37]	Yes	No	No	-	Yes	1	Low Quality
Mikkelsen et al., 2014[44]	Yes	Yes	No	-	Yes	3	High Quality
Nankaku et al., 2016[43]	Yes	No	No	-	Yes	1	Low Quality
Monticone et al., 2014[24]	Yes	Yes	No	-	Yes	3	High Quality
Pohl et al., 2015[32]	Yes	No	No	-	Yes	1	Low Quality
Smith et al., 2008[29]	Yes	Yes	No	-	Yes	3	High Quality
Matheis and Stöggl, 2018[50]	Yes	No	No	-	Yes	1	Low Quality
Winther et al., 2018[39]	Yes	yes	No	-	Yes	3	High Quality
Monaghan et al., 2017[26]	Yes	yes	No	-	Yes	3	High Quality

Evaluated Outcomes

Regarding the outcomes, 23 articles evaluated functionality, 21 studies evaluated muscular strength, and eight analyzed range of motion.

DISCUSSION

The present study proposed to describe the effects of physiotherapy on functionality, muscle strength, and range of motion in patients submitted to THA, following OA. In general, high intensity resistance exercises (dynamic and isometric) are more effective in improving functionality. Concerning muscle strength and range of motion, dynamic exercises with 3 to 5 sets of 8 to 12 repetitions, with low and high intensity, promoted more substantial gains than other therapeutic modalities.

Functionality

There is evidence that patients submitted to THA can present persistent functional deficits, associated with biomechanical limitations and changes in gait kinematics, derived from the surgical procedure and/or pain[23].

The results of three studies have shown that daily movement-based functional exercises can restore functionality in patients submitted to THA[10,18,24-26]. However, it should be reported that the functional exercises used by the cited authors were generally accompanied by cycling and walking[10,24,25].

Regarding resistance exercises, it is stated in scientific literature that this intervention modality is effective for functional gain in healthy older adults[27,28]. In this context, previous studies revealed that low[27] and moderate intensity[28] resistance exercise improved functional performance in this population. In our findings, a low-scoring study on the JADAD scale showed that low intensity resistance exercise protocols promoted positive functionality results in patients submitted to THA[18]. However, two high quality studies, according to the JADAD scale, showed that low intensity resistance exercises did not modify functionality[8,15]. In addition, a study considered to be of high quality showed that exercises without external resistance are not effective in achieving significant gains in functionality[29]. Therefore, the potential of resistance exercise protocols is not fully established, considering the effects of different exercise loads on the functionality of patients with THA. For this reason, further studies are needed to elucidate the influence of resistance exercise on the functional recovery of THA.

Moreover, studies have documented that dynamic and isometric exercises, used as part of the physiotherapeutic treatment of THA, resulted in significant functional benefits[7,8,11,14,17,29-33]. When these exercises are accompanied by balance exercises, the functional outcomes are even more positive for these patients[32,33]. Therefore, resistance exercise can improve functionality as it enhances muscle strength, which is required to execute most activities of daily living, as strength is a predictor of functional capacity[34].

The studies cited in the present review present inconclusive results about the efficacy of aquatic physiotherapy on the functionality of patients with THA. According to the studies by Husby et al.[15] and Rahmann et al.[35], which were considered to be high quality, compared the effects of water- and land-based exercises and observed that both therapies promoted increased functionality; however, they found no significant differences between the two therapeutic modalities. In the studies by Stockton et al.[6] and Giaquinto et al.[16], which were classified as low quality by the JADAD scale, hydrotherapy presented better results than land-based exercises for functionality. Furthermore, according to Liebs et al.[25], hydrotherapy is effective for functionality, but only if performed after suture removal. Therefore, the positive scientific evidence for hydrotherapy is weak, due to the methodological quality of the identified studies. More studies should be performed to better clarify the role of hydrotherapy as a therapeutic method in THA.

Muscle strength

Classically, the chronic condition of osteoarthritis contributes to a decline in muscle strength. In addition, surgical procedures further increase this

reduction[36]. Therefore, muscle strengthening should be part of rehabilitation goals after THA. The studies included in this review contributed to the prescription of muscle strengthening protocols after THA.

In relation to dynamic exercises, the prescription of a protocol with two sets of 10 repetitions is recommended to increase muscle strength in untrained individuals[37]. Among our findings, only eight studies showed the number of series and repetitions used in dynamic exercise protocols[7,9,17,20,29,37-39].

For the quadriceps muscle, the prescription of 3 to 5 sets of 8 to 10 repetitions was found to enhance muscle strength for subjects undergoing total hip arthroplasty[20,37,38]. In the study by Umpierres et al.[7], three sets with 12 repetitions improved the muscle strength of the extensors, abductors, adductors and rotators of the hips, and the knee flexors and extensors. Tsukagoshi et al.[30] observed that three sets of 15 repetitions resulted in increased knee extensor strength, as well as hip abductor, extensor and flexor strength. According to Sashika et al.[9] and Jan et al.[17], two sets of ten repetitions each increased hip abduction, flexion and extension muscle strength. These data show that protocols with 2 to 3 sets of 8 to 12 repetitions appear to be safe not only for healthy individuals, but also for patients with total hip arthroplasty.

It is also important to discuss the safe load to achieve significant gains in muscle strength. Load prescriptions of 60% to 70% of 1-repetition maximum (1RM) are indicated to increase muscle strength in healthy older adults[40]. This review shows significant results for strength improvement in patients submitted to THA with moderate to high intensity prescriptions, using 50%, 65%, 70%, 80%, 85, 90% 1RM[15,20,37-39,41]. However, muscle strength was also increased when low intensity exercises (10%, 30% and 40% 1RM) were used[13, 29,49,50].

Load prescription, whether low or high intensity, is very important. Five studies included in this review compared groups of patients submitted to THA who performed load exercises with groups without load. In these studies, the groups submitted to resistance exercises showed better muscle strength performance than the groups without load[20,30,37,38,44].

Regarding the effectiveness of the isometric exercises, the results on the strength gains of subjects submitted to THA are unclear. In six studies, isometric exercise was used as the treatment protocol[11,22,30,31,35,42]. In three of these, the authors observed increased strength for the hip abductors, flexors and extensors, and for the knee extensors[22,30,42]. However, one of these studies received a low score on the JADAD scale[22]. Three studies considered to be of high quality did not detect an improvement in strength in the group that performed isometry against gravitational resistance only[11,31,43].

Most of the included studies did not report the prescribed exercise in detail, making comparisons and conclusions on the type of prescription required to achieve a strength gain with isometric exercise difficult. There is evidence that isometric exercises produce strength gains when 6 repetitions held for 30 to 40 seconds are performed in healthy older adults[45]. In this review, quadriceps strength gain was achieved with prescriptions of three repetitions sustained for 20 seconds in patients undergoing THA[30]. Although isometric exercise is effective for achieving strength gain, more studies are needed to clarify the type of prescription appropriate for subjects with THA.

In turn, strength improvement due to hydrotherapy intervention is reported in literature, especially when associated with equipment that increases resistance. In addition, this modality that can be prescribed safely, in order to potentiate muscular conditioning and reduce the risk of exercise-associated injuries[46]. In this sense, three studies observed the effects of hydrotherapy on muscle strength in patients submitted to THA[15,35,41]. In general, hydrotherapy seems to present better strength improvement results than isometric exercises[44]. However, when compared to high-intensity exercises, hydrotherapy does not present significant strength improvement results, even if combined with exercises performed on land[15,41]. Regardless, hydrotherapy can be used in the early stages, when patients are unable to perform ground-based exercises, or are unable to fully or partially support their body mass[47].

Another treatment technique reported in the studies was biphasic electrotherapy with a frequency of 40 Hz[20,37,38] or 10 Hz[8]. The results showed that

the use of electrotherapy alone does not increase the strength[8,20,37,38]. However, electrotherapy seems to increase the potential effects of resistance exercise on quadricep muscle strength[8]. These results are similar to those found by Hauger et al.[48], in which neuromuscular electrostimulation combined with exercise further enhanced quadriceps strength in patients with another condition. Therefore, electrotherapy can be effective as a coadjutant to physiotherapeutic treatment, when combined with resistance exercise.

Regard the influence of the presence of the physiotherapist during exercise, one study concluded that patients who performed exercises with supervision exhibited more significant and positive results for the improvement of hip abduction strength, when compared to groups without supervision[42]. Considering this issue, Kuru et al.[49] studied the effect of a supervised physiotherapy program on older adults with knee osteoarthritis. The sample was divided into two groups that performed the same protocol for 6-weeks; however, only one group under supervision. According to the results, strength gains were greater for the group that performed exercise with supervision. These results suggest that supervision affects the results of muscle strength gain and functionality, most probably because the professional controls speed of execution, rest intervals, load adjustment, and other important variables to make the performance more efficient and obtain better results.

Range of motion

In relation to hip range of motion, this review found that exercises performed in three sets, from eight to 12 repetitions, for the gluteal and thigh muscles, are effective to increase the range of motion (ROM) of the flexion, extension, abduction, adduction, and internal and external rotation of this joint[8,41]. When a prescription with fewer sets and repetitions (two sets of ten repetitions) was performed, these positive results were not maintained[9].

Isometric exercises, when combined with another exercise modality, were also effective for increasing the ROM of the hip flexion, extension, abduction, and internal and external rotation in patients submitted to THA[21,31]. In relation to the studies included in this review, isometric exercises were combined with unloaded active exercises, gait training[21], stretching, and functional exercises[31]. Furthermore, the association between isometric exercises and myofascial release techniques promoted an even more satisfactory improvement in hip ROM[21].

Most of the studies included in this review used resistance exercise to increase ROM. The study by Fatouros et al.[40] reinforces these results, since these authors observed greater flexibility in older adults who performed resistance training with three sets, using 40% (low intensity), 60% (medium intensity) and 80% (high intensity) 1RM. The authors concluded that resistance training improves flexibility in older adults; however, better results are obtained using 60% 1RM (moderate intensity)[40]. In addition, when passive and active mobilization is added to the resistance exercise protocol, joint ROM seems to increase more rapidly[50]. The data also showed that the positive effect on ROM gain is greater when a physical therapist performs orientation exercise execution[7,10].

CONCLUSION

In conclusion, the physiotherapy techniques and protocols used for THA rehabilitation are varied and have important proven clinical efficacy in literature. The analyzed clinical trials showed significant improvement in the experimental groups compared to the control groups for all the outcomes evaluated (functionality, muscle strength, ROM). In general, protocols with active exercises for the hip periarticular muscles and knee extensors, and which were supervised, provided a better functional prognosis. However, although most of the studies were rated as high quality by the JADAD scale, the results should be analyzed with caution, since several protocols with different combinations of therapies were observed.

Considering the importance of evidence-based practice in clinical decision making, it is suggested

that randomized clinical trials are carried out, which specify the training methods (such as the type and speed of muscle contraction, and the frequency and intensity of the exercises), so that suitable, safe therapies may be prescribed for the post-surgical rehabilitation process of total hip arthroplasty.

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Validity and accuracy of the Guedes Tool for the evaluation of informal social support for older adults

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Abstract

The objective of the present study was to confirm the validity of the Guedes Tool, an instrument for assessing informal social support (ISS) for older adults, and to estimate its accuracy. Confirmatory factor analysis (CFA) was performed with the CFI and RMSEA indexes and the chi-square relationship (X2) with degrees of freedom (gl). For the analysis of accuracy, the area under the ROC curve, sensitivity (S) and specificity (SP) values, positive predictive value (PV+), negative predictive value (PV-) and the Younder's J Index (J) were verified to confirm the best cut-off point. Data collection was carried out with older adults from Natal and metropolitan region in 2018. The inclusion criteria were: be 60 years old or older, with preserved cognitive levels. Two hundred and six older adults participated in the CFA study and 197 participated in the accuracy analysis. The estimates of the indexes evaluated in the CFA were: X2/gl =1.33, RMSEA=0.04 (95% CI 0.025-0.054) and CFI=0.91. The ROC curve obtained an area of 0.78 (CI95: 0.72-0.85; p<0.001) for the determination of older adults with low ISS. The highest value J was 0.44 for a score ≤34, with an S value of 59.76% and an SP value of 84.96%. The instrument presented a well-adjusted model with four dimensions, according to CFA criteria. It had a good area under the ROC curve and good to moderate S and SP values for the cutoff value of 34 points or less, for the diagnosis of insufficient ISS. Good PV+ and PV- indicators confirmed the desirable levels of accuracy of the tool.

Keywords: Social Support. Health of the Elderly. Validation Study. Factor Analysis, Statistical. Data Accuracy.

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INTRODUCTION

The demographic profile of Brazil has been undergoing a transformation into a mainly urban society, with fewer children and a new structure for Brazilian families[1,2]. Nowadays a growing contingent of people aged 60 or over[2] has led to a high prevalence of chronic diseases or conditions[3]. Thus, with new demands for the care of older adults, more complex models of care are required, which take into account the assessment of social determinants as a support strategy for the management of comprehensive care for this segment of the population[4,5] .

Formal and informal social support are important determinants for healthy aging, representing the set of resources provided by other individuals, and reflecting the totality of the relationships that a person has at their disposal[4,6]. Insufficient social support is associated with several negative physical and mental health outcomes[7]. This social characteristic represents an intermediary between people's behavior and their living conditions[5], and is possibly the most significant external condition that the health professional deals with.

Informal support networks simultaneously include family, friends, neighbors, spiritual counselors, and social groups such as clubs, associations, churches, and play an important role in supporting older adults from a social, emotional and instrumental point of view, allowing them to resolve many health problems without the intervention of official or professional institutions. Older adults tend to resort to formal support only when the structures of informal support have been exhausted[8].

Considering the importance of informal social support in a more complex analysis of the health-disease process of older adults, there is a need to assess this type of support with suitable, accurate instruments, so that errors of judgment are avoided. Therefore, a new instrument with effective psychometric indicators, which corresponds to the socio-cultural characteristics of the older Brazilian population and which assesses informal social support, is necessary for an accurate assessment of these aspects of social support for this population segment. There is no instrument in the literature that specifically evaluates such aspects for older adults Brazilian population[8].

Understanding the validation of instruments as a process, confirmatory factor analysis (CFA) is a step used to test hypotheses regarding certain constructs[9]. In this case, the researcher, guided by previous theory, tests to what extent certain variables are representative of a certain concept or dimensions[10].

Accuracy analysis is another decisive tool in the questionnaire validation process, as it defines parameters for diagnosis/prognosis and proposes more reliable reference measures to identify true cases or exclude false cases (sensitivity and specificity, for example), thus making the diagnostic assessment process more assertive[11]. Other steps in the validity process for this instrument have been previously developed, and have demonstrated good indicators of content validity and in the response process of the target population[12], as well as internal validity of the factors and items chosen from the exploratory factor analysis[13].

In view of the above, the present study aims to verify the psychometric quality of the Guedes Tool, an instrument for assessing informal social support for older adults and to estimate its diagnostic accuracy, based on CFA and analysis of the ROC curve, of the indicators of sensitivity, specificity, and negative and positive predictive value.

METHOD

The present study is an evaluation of psychometric and diagnostic indicators, with an observational design. It is of the transversal and analytical type and adopted a quantitative approach. The study was performed from October to December 2018, as part of the project entitled "Construction and Validation of a Social Support Scale for Older Adults". This project included the stages of CFA and accuracy analysis.

The project was approved by the Research Ethics Committee of the Onofre Lopes University

Hospital, under opinion number 1,644,533. The present study complies with the recommendations of National Health Council Resolutions nº 196/96 and nº 466/2012.

The target population of the study was composed of older Brazilian adults residing in the community. The source population was older adults living in the city of Natal, Rio Grande do Norte, Brazil.

As a sample, a minimum total of 200 participants was established. To calculate the sample for CFA, the total number of respondents followed a minimum proportion of ten respondents for each variable included in the instrument, which had 20 items, following criteria guided by Hair et al.[10].

For the design of the diagnostic accuracy of the Guedes Tool, a type I (α) error of 5%, type II (β) error (test power) of 20%, and a minimum area under the curve of 0.7 were taken into account, along with a null hypothesis area of 0.50 and a negative/positive ratio of up to 3:1[14]. Thus, a minimum of 88 participants was required, with at least 22 positive cases and 66 negative cases.

The inclusion criteria of the study participants were an age of 60 (sixty) years old or older, with preserved cognitive levels (no report of a clinical diagnosis of cognitive deficit), capable of answering the proposed questions. These criteria were valid for both the CFA and accuracy stages. Only those who answered all the questions in the Guedes Tool were included in the CFA, while for the accuracy analysis only those who responded to the two questionnaires in their entirety, including the Social Support Scale (MOS-SSS), were included.

For both analyzes, data collection always took place in person, with a population aged 60 or over, from the city of Natal and its metropolitan region. Collection took place in an association for older adults, a public consultation center, a municipal park and through home visits in Natal, Rio Grande do Norte and metropolitan region (Santa Cruz, Macaíba, São Gonçalo do Amarante). All the participants signed an Informed Consent Form (ICF) before the interview.

The instruments were applied sequentially to each respondent, with the Guedes Tool being applied first. The average time for application of the two questionnaires was 25 minutes per respondent. Four interviewers, who were undergraduate students, were previously trained by one of the researchers who designed the instrument.

CFA was performed using the statistical program M PLUS Version 7®. This analysis was carried out to demonstrate how different indicators of informal social support can be reduced to represent four dimensions or factors, namely: x1, x2, x3 and x4. The technique of dimensional reduction by main factors was used, and oblique type goemin rotation was applied. Seven iteration points per dimension were used. All variables were treated as dichotomous categorical variables. Delta parameterization and the WLSMV estimator (weighted least square with diagonal weight matrix with standard errors and mean- and variance-adjusted chi-square test statistics) were used.

For validity purposes, the incremental index Comparative Fit Index (CFI) and the absolute indexes, Root Mean Square Error of Approximation (RMSEA), as well as the relationship between the chi-square value (X^2) and degrees of freedom (df), were used. The following reference values were considered: CFI> 0.90; RMSEA<0.05; $X^2/df<3.0$[10,15].

To assess accuracy, the data were analyzed descriptively and inferentially. The descriptive analysis obtained the summary and dispersion measures of the studied variables. Inferential analysis established the diagnostic validity of the Guedes Tool. The complete instrument with its items and the respective values assigned to them is shown in Table 1. The answers to this instrument were dichotomous, assigning the total value of the item when the answer was "yes", and zero when the answer was "no", for each question asked.

Table 1. Guedes Tool Questionnaire. Point values assigned to the items and the instrument. Natal, Rio Grande do Norte, Brazil.

Items and Factors (dimensions)	Value assigned to the item
COMPOSITION AND EXTENSION OF SOCIAL NETWORK	
1. Can you count on people close to you?	4
2. Do you have a friend you see often?	4
3. Do you have anyone in your family you can count on and who lives nearby?	4
4. Do you have a friend who lives nearby?	4
5. Do you have a neighbor who you can count on when needed?	4
INSTRUMENTAL SUPPORT AND AVAILABILITY	
6. Do you live with a lot of people?	2
7. Do you often have visitors?	2
8. Do you have someone to help with the housework?	2
9. Do you have someone to help you leave the house if you need to?	2
10. Do you have someone to help if you are in bed or sick?	2
11. If you have financial difficulties, do you have someone to help you?	2
12. Do you have a family member who helps with your care if you need it?	2
RECIPROCITY AND LONGITUDINALITY	
13. Do you participate in any family decisions?	2
14. Was the help you had or would have had in the past 30 days satisfactory?	2
15. Throughout your life, have you received adequate help from others?	2
EMOTIONAL SUPPORT AND SOCIAL PARTICIPATION	
16. Do you have anyone to talk to?	2
17. Do you participate in decisions among your friends?	2
18. Do you spend your leisure time with anyone?	2
19. Is your social contact with other people permanent?	2
20. When you are sad or miss someone, do you have someone to talk to about it?	2
Total value attributed to the instrument	50

Based on the responses of the respondents, the ROC (Receiver Operator Characteristics) curve, a diagnostic/prognostic validation technique, was developed, with the outcome of a low social support result of the dichotomous variable of the Social Support Scale (MOS-SSS). Values below 52 points were considered to be low social support for this instrument, which was taken as the gold standard[16]. The results of the gold standard test and the Guedes Tool were interpreted independently, without knowledge of the results of the other.

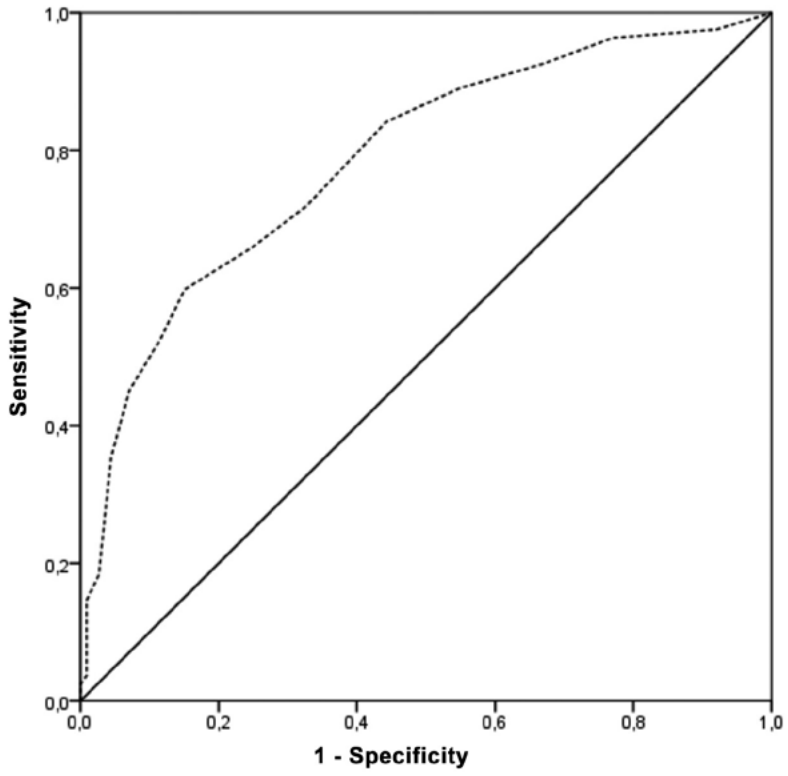
The area under the ROC curve was also calculated, as well as its 95% confidence interval (95% CI) and the associated probability (p-value). In addition, the accuracy of the Guedes Tool was obtained from the sensitivity (S) and specificity (SP) values, the positive predictive value (PV +) and the negative predictive value (PV-)[17].

To identify the best cutoff point for the Guedes Tool, Younder's J Index (J) was used, which summarizes the diagnostic test performance for the data of the study participants, and which also served for dimensioning of the accuracy sample. This statistic is obtained as follows: J = sensitivity + specificity-1, where values range from 0 to 1[18]. In all inferential analysis strategies, a significance level of ≤5% was adopted in an attempt to minimize the type I error. The analyzes were also stratified by gender and age group, in order to estimate different accuracy for these social conditions.

RESULTS

Two hundred and six older adults (112 from an older adults association, 42 from home visits, 30 from a public consultation center, and 22 from the Natal municipal park) participated in the study, with ages varying between 60-99 years and an average of 69.80 (± 7.63) years, and of whom 145 (70.7%) were women. The most common schooling level among participants was elementary (49.5%), followed by the illiterate (24.4%) and those with a high school education (20.5%). Of this total, nine older adults did not answer a question on the MOS-SSS social support scale and were excluded from the accuracy analysis, which therefore had a total of 197 respondents. The MOS-SSS instrument identified 82 (41.62%) older adults with low social support.

The estimates of the indexes evaluated in the CFA were as follows: X^2/ gl=1.33, RMSEA=0.04 (95% CI 0.025-0.054) and CFI=0.91. As shown in Figure 1, the analysis of the ROC curve revealed a good area, of 0.78 (CI95: 0.72-0.85; p<0.001), for the determination of older adults with low social support. The Younder's J Index with the highest value was 0.44 for the cutoff ≤34 in the Guedes Tool, which has a sensitivity of 59.76% and specificity of 84.96% (Table 2). However, other cut off points can be used depending on the purpose of their application, as shown in Table 2.



Axis (x) presents 1 - Specificity and axis (y) Sensitivity.

Figure 1. Analysis of the ROC curve area to determine the low social support of the Guedes Tool, with the MOS-SSS Social Support Scale as a reference. Natal, Rio Grande do Norte, Brazil, 2018.

Table 2. Cutoff points of the *Guedes Tool* and its parameters of sensitivity (Sen), specificity (Spec), and positive (PV +) and negative (PV-) predictive values for older adults. Natal, Rio Grande do Norte, Brazil, 2018.

Criterion	Sen	95%CI	Spec	95%CI	PV+	95%CI	PV-	95%CI
<10	0	0.0 - 4.4	100	96.8 - 100.0			1	1.0 - 1.0
≤10	2.44	0.3 - 8.5	100	96.8 - 100.0			0.98	0.9 - 1.0
≤12	3.66	0.8 - 10.3	99.12	95.2 - 100.0	4.13	0.4 - 39.0	0.97	0.9 - 1.0
≤14	4.88	1.3 - 12.0	99.12	95.2 - 100.0	5.51	0.6 - 48.4	0.96	0.9 - 1.0
≤16	6.1	2.0 - 13.7	99.12	95.2 - 100.0	6.89	0.8 - 57.9	0.95	0.9 - 1.0
≤18	7.32	2.7 - 15.2	99.12	95.2 - 100.0	8.27	1.0 - 67.4	0.94	0.9 - 1.0
≤20	9.76	4.3 - 18.3	99.12	95.2 - 100.0	11.02	1.4 - 86.4	0.91	0.8 - 1.0
≤22	14.63	7.8 - 24.2	99.12	95.2 - 100.0	16.54	2.2 -124.7	0.86	0.8 - 0.9
≤24	18.29	10.6 - 28.4	97.35	92.4 - 99.4	6.89	2.1 - 23.0	0.84	0.8 - 0.9
≤26	26.83	17.6 - 37.8	96.46	91.2 - 99.0	7.58	2.7 - 21.2	0.76	0.7 - 0.9
≤28	35.37	25.1 - 46.7	95.58	90.0 - 98.5	7.99	3.2 - 19.8	0.68	0.6 - 0.8
≤30	45.12	34.1 - 56.5	92.92	86.5 - 96.9	6.37	3.1 - 13.0	0.59	0.5 - 0.7
≤32	52.44	41.1 - 63.6	88.5	81.1 - 93.7	4.56	2.6 - 7.9	0.54	0.4 - 0.7
≤34*	**59.76**	**48.3 - 70.4**	**84.96**	**77.0 - 91.0**	**3.97**	**2.5 - 6.4**	**0.47**	**0.4 - 0.6**
≤36	65.85	54.6 - 76.0	75.22	66.2 - 82.9	2.66	1.9 - 3.8	0.45	0.3 - 0.6
≤38	71.95	60.9 - 81.3	67.26	57.8 - 75.8	2.2	1.6 - 3.0	0.42	0.3 - 0.6
≤40	84.15	74.4 - 91.3	55.75	46.1 - 65.1	1.9	1.5 - 2.4	0.28	0.2 - 0.5
≤42	89.02	80.2 - 94.9	45.13	35.8 - 54.8	1.62	1.4 - 1.9	0.24	0.1 - 0.5
≤44	92.68	84.8 - 97.3	32.74	24.2 - 42.2	1.38	1.2 - 1.6	0.22	0.1- 0.5
≤46	96.34	89.7 - 99.2	23.01	15.6 - 31.9	1.25	1.1 - 1.4	0.16	0.05-0.5
≤48	97.56	91.5 - 99.7	7.96	3.7 - 14.6	1.06	1.0 - 1.1	0.31	0.07-1.4
≤50	100	95.6 -100.0	0	0.0 - 3.2	1	1.0 - 1.0		

* suggested cutoff point for the diagnosis of low social support for the total sample of older adults evaluated.

When stratifying the ROC curve according to gender, it was observed that the area under the curve barely changed in comparison with the area of the total population evaluated, being 0.79 (95% CI: 0.68-0.91) for men and 0.79 (95% CI: 0.72-0.87) for women. The best cutoff point for men would be ≤40 with a Younder's J Index of 0.50 (S=78.12%; SP=72.00%). For women, the best cutoff point is ≤34, with a Younder's J Index of 0.46 (S=62.00%; SP=84.09%).

When we stratified the sample by age group, we identified an area under the ROC curve of 0.74 (95%CI: 0.64-0.84) for older adults aged up to 69 years (cut≤34; J=0.44; S=83.33%; SP=60.71%), 0.85 (95%CI:0.76-0.94) for those between 70 and 79 years (cut-off≤30; J=0.61; S=64.52%; SP=97.22%) and 0.72 (95%CI: 0.45-0.98) for ages over 80 years (cut-off≤36; J=0.51; S=66.67%; SP=85.71%).

DISCUSSION

The steps covered in this research were based on the previous stages of the construction of this instrument, among them, the proposition of items based on literature review[8], content-based validity, validity based on the response process[17] and exploratory factor analysis[18].

All the estimates of the absolute and incremental indexes demonstrated the adequate fit of the model with 20 items and four dimensions. The RMSEA obtained was within the desirable range. This

absolute indicator assesses how well the model fits the population, while the goodness of fit values for this criterion indicate that the model has a good fit, and correct internal structure[10].

Regarding the second absolute indicator estimated, the chi-square analyzed in isolation demonstrated excellent results for this study. Variance, which depends on the sample size, was stable, and represents another important absolute indicator in determining the quality of fit of the model[11,16].

The CFI assessed is an incremental indicator that measures the relative improvement of the model in relation to a standard model. This standard model is typically considered to have a variance between variables equal to zero, with the closer to 1 (one) the CFI, the better the quality of the adjustment. The CFI value obtained for this instrument (0.91) was adequate.

The latent dimensions confirmed in the present study are the subject of discussions in scientific literature, and should therefore be justified in the present discussion, with a theoretical model provided for each one. Our decision to choose such domains is also based on previous studies regarding this instrument[12,13].

Studies have pointed out the importance of the composition and extension of the social network of individuals, such as having someone close on whom one can count, whether a family member, friend or neighbor[19-22], as well as how these structures are arranged and thus, how they can influence the physical and mental health of older adults[23]. This was the first dimension presented in the instrument, and the score attributed to its items has a greater weight than the score of the items in the other dimensions. The justification for this greater weighting of items can be verified in a previous study of this instrument[13].

The solicitude and support provided during the performance of activities, addressed in the dimension of instrumental support and availability, is important for the maintenance of adequate informal social support, and can be a fundamental tool in the promotion of self-care for older adults and, consequently, a support mechanism for such individuals and public and private health services[24].

Informal social support, when considered as a two way street, can generate a feeling of appreciation for both the older adults and the other social actors involved[25,26]. The perception of adequate social involvement throughout life, on the other hand, may be associated with a better quality of life for older adults, with positive repercussions on their health and independence[27]. These aspects were addressed in the reciprocity and longitudinality dimension.

Emotional support and social participation are important requirements for the informal social support of older adults. The feeling of positive insertion in a social context can generate important feelings of welcome and appreciation for older adults and those who participate in their social network[25]. Insufficient levels in these aspects of informal social support can lead to significant psychological damage to older adults[20,28].

Regarding the analysis of accuracy, the choice of the social support scale (*MOS-SSS*) as the gold standard is justified, as this instrument has good psychometric construct validity indicators for the Brazilian population[29]. The instrument also underwent recent standardization of its cutoff points[14]. Although in both the studies cited, the sample was not exclusively limited to older adults, this instrument was originally designed for an older population, and contains items relevant for the assessment of social support among older adults[30].

Considering the results of the total sample of this research, a score of 34 points or less for considering the informal social support for older adults as insufficient provided good specificity and moderate sensitivity, as well as good indicators for the positive and negative predictive values.[17]. In addition, the area on the ROC curve obtained was desirable, demonstrating an acceptable degree of accuracy at this cutoff point for this population[11].

Other cutoff points may be applicable, depending on the objective and priorities of the observer. If the option is for a higher sensitivity or if the priority is for greater specificity, this reference can be adjusted, according to the results obtained in this study.

When stratifying the sample for both sex and age groups, the ROC curve did not undergo major

changes. Thus, the use of this cutoff point for the overall older population is correct. However, in specific research cases, the observer may select, for example, cutoff points to diagnose insufficient informal social support for men (40 points or less) or women (34 points or less), as the patterns of perception of social support may differ between men and women[7].

When stratifying for age groups, in all groups the area of the ROC curve was desirable. However, the group of older adults aged 80 and over did not exhibit statistically significant indicators, and their cut-off point should be used with caution. We therefore suggest that the value obtained for the overall sample be considered eligible, regardless of the age group. Thus, we consider that the accuracy of this instrument does not depend on the stratification of age for the older adult group.

This instrument was designed with the diagnosis of insufficient informal social support for the older population in mind. However, the positive accuracy indicators related to the MOS-SSS scale for the diagnosis of social support for the overall population, emphasizes that the application of the Guedes Tool for other populations cannot be ruled out. Its broad approach in other dimensions which are common to several vulnerable groups, not just older adults, should also be considered

The sample was representative for both stages of this study (confirmatory factor analysis and accuracy). Data collection in various environments minimized errors in relation to selection bias. A considerable number of participants of both sexes, with different ages and varying levels of education, resulted in a desirable heterogeneity of the sample, considering that the instrument is being developed for the overall older population. The prior calibration of the interviewers reduced the chances of errors relating to the observer during the interviews (information bias)[11].

Considering the aforementioned aspects, this instrument is an important tool for epidemiological screening to diagnose insufficient informal social support among older adults, and can be applied in various health services and levels of health care, especially in primary care, to provide a more complex assessment perspective that contemplates the demands of an expanded concept in health[4,5].

Regarding the limitations of the study, it should be mentioned that, despite having respondents from a range of environments, the sample was convenience based and concentrated in only one region of Brazil. For a country of continental size, with a population with a wide range of socio-cultural and economic aspects, studies in other locations are important. Previous steps in the development of this instrument have taken a broader approach, with respondents from the five regions of Brazil[13].

Another relevant question refers to the failure to carry out a direct assessment of the cognitive capacity of the respondents, which increases the risk of older adults with cognitive deficits answering the questionnaire, impairing the analysis and interpretation of the data, as this exclusion criterion was assessed from the self-reporting of the interviewees.

The "information" dimension for assessing social support is discussed in scientific literature[16] and was not addressed in this instrument. Addressing all the aspects of a complex construct such as social support, is a great challenge, and could lead to the creation of an excessively extensive instrument. Therefore, in professional practice, the evaluator should apply care in relation this aspect when evaluating older adults.

Considering the obtaining of evidence of the validity of instruments as a process of constant improvement, it is important to emphasize that other steps, in different population groups should be carried out, such as, for example, cross-cultural adaptations to other languages, and confirmatory factor analysis for other vulnerable groups.

CONCLUSIONS

The Guedes Tool instrument presented a well-adjusted model with four dimensions, according to criteria obtained by confirmatory factor analysis. This indicates an internal structure with items and dimensions of good psychometric quality.

The Guedes Tool exhibited a good area under the ROC curve and good specificity and moderate sensitivity for the cutoff value of 34 points or less for the diagnosis of insufficient informal social support, in relation to the total sample of older adults evaluated. The good indicators of positive and negative predictive values for this reference cut-off point reinforce the desirable accuracy of the instrument. Other steps for improving the process of obtaining evidence of validity are important.

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Care and the impact of aesthetic appearance on the social perception on a group of elderly women

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Abstract

Objectives: Describe and explore the care and impact of the aesthetic appearance of a group of elderly women. Method: Exploratory and descriptive study, of a qualitative nature, carried out through a sociodemographic questionnaire and a semi-structured interview, with 11 elderly women, participants in a social group. What emerged from the speeches composed the material for thematic content analysis. Results: The extraction in thematic units allowed the elaboration of two categories that intertwine and complement each other: Feeling good is the key word and Care for appearance. Conclusion: in the participants' perceptions, care and appearance is related to body, facial and capillary aesthetics, generating self-esteem, satisfaction, happiness, freedom, psychological well-being and social well-being and was conceived as an effective means of family, social, and professional integration, motivating them to face the existential vicissitudes. This finding is in line with the expression of freedom, dialogue, self-determination and self-knowledge, recognition and social insertion.

Keywords: Womem´s Health. Aesthetic. Freedom. Elderly Women.

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INTRODUTION

In recent decades, at a global level, there has been a change in people's lifestyles. There is a criticism of the traditional values of patriarchy, religions and morals and there is a search for values that aspire to the subject's autonomy, regardless of his economic, social and professional condition and education level. This revolution in the world of life also features elderly women, who are rebuilding their existential values, especially in the face of changes in new family configurations, social and sexual roles, the labor market, etc., mainly due to the influence of social groups. These groups provide spaces for the strengthening of their subjectivities, channeling and expressing a new way of being and acting, such as self-care[1]. This attitude of social insertion is capable of "letting life enjoy the invention of singular ways of existence"[2]. Thus, the groups promote leisure activities, study, travel, exchanges, volunteering, a spirit of welcome and team, spirituality, as well as physical and psychological well-being, extolling the art of living well and happy with autonomy, confidence, citizenship, self-esteem, dignity, that is, an aesthetic of existence[3,4].

Michel Foucault (1926-1984) conceives the aesthetics or art of existence and self-care as "subject's self-perfection and self-affirmation"[5], through rational and voluntary practices and a set of rules of conduct attributed to oneself by the subject, with the purpose of transforming oneself into a singular being, bearer of "certain aesthetic values and that corresponds to certain style criteria"[6]. Still, it is centered on the individual's way of being and taking care of himself as part of a society, as a free citizen, with the opportunity to progress morally and intellectually, capable of achieving his personal, social and civic freedom.[7,8].

From the historical and careful analysis of Greek and Roman ethics, such as stoicism, cynicism and epicureanism, Foucault extracted a philosophical ensemble focused on self-care and, consequently, on an aesthetics of existence or self-care. Even though it is an autonomous mode of existence aimed at privileged citizens of the ancient world[2], to which Foucault received harsh criticism, mainly from Charles Taylor, Pierre Hadot and Richard Rorty, the aesthetics of existence can be extended to all contemporary people, from liberal societies, through their secular, immanent and historical morals. These morals enhance freedom, fraternity, equality, autonomy, happiness, beauty, physical and aesthetic beauty, in short, subjectivity. "They are modes of subjectivity, as Foucault understands them, [and] it is a production of ethical subjects"[2].

The aesthetics of existence is a form of subjectification, a work of art centered on asceticism, purification, spirituality, self-control that transcends the codes of conduct presented by society. It is not a way of being heteronomous, compulsory, metaphysical and strictly extrinsic, shaped by transcendent, rigid, dogmatic values, but intrinsic, deliberate, subject to choice and determination of oneself, as a rational subject to insert oneself consciously in the world, as a practice of self, "Conceived as a permanent combat. It is not simply a matter of forming a man of value for the future. It is necessary to give the individual the weapons and the courage that will allow him to fight his whole life"[9]. In other words, the person has the possibility to assign existential rules different from the standard, traditional and conventional, often market, consumer and alienated, sculpting, molding and taking care of oneself. It is taking care of oneself and then going back and inserting oneself into society as a modern citizen. It is not a selfish and narcissistic way of living, but shared by "individuals of different age, social status and activity"[6].

The aesthetics of existence is anchored in self-care. From the Greek *epimeleia heautou*, this care is structured in the ethical dimension of the subject, of the *ethos*, that is, in the art of living well and happily, in the practice of freedom, autonomy and in the cultivation of the values of the soul, of the self, through a lifestyle with an attitude of self-government and autarchy. It is a way of being, thinking and acting in the world and caring for others[10-13].

And this way of being and existing has awakened the care with the body aesthetics of elderly women. Feelings of freedom, security, satisfaction with life and happiness are conditions desired by the human being, as well as the possibility to choose and maintain a desirable aesthetic appearance[2,4,6,7].

Considering that the human aging process generates anatomical-physiological, psychological and social changes, and, consequently, of care with body aesthetics, image and self-esteem, there is a need to expand studies on the theme, identifying perceptions of satisfaction with physical appearance, life, acceptance and adaptation with the body and age, social, family and social contact[2,8].

The aim of the article was to describe and explore the care and the impact of aesthetic appearance on the social perception of a group of elderly women.

METHOD

It is a study of qualitative approach, exploratory and descriptive, through the application of a sociodemographic questionnaire and a semi-structured interview, with 11 elderly women, participants in a coexistence group of the Elderly Care Coordination (DATI), constituted by women, carried out from August to October 2018, linked to the integrated research project *Aging, Education and Health*, developed in a stricto sensu Human Aging Program, in a municipality in southern Brazil.

The selection of participants was by convenience and the definition of the sample size determined by data saturation.

With the authorization of the group's management and prior contact, the meetings were scheduled, with date and time, according to the preference of the participants, in a reserved environment in the space where the group meetings take place. The inclusion criteria were being 60 years old or older, to attend the coexistence group and be available to participate in the research and exclusion, not being present at the time of data collection. The interviews were conducted individually and lasted 30 minutes each, with the following guiding questions: What is aesthetics or beauty for you? What are your usual cares with appearance? Does the opinion of others about your appearance interfere with your participation in the social group? Does caring for your appearance influence the social and emotional aspects of your life?

The information was analyzed qualitatively, using Bardin's content analysis [14], through fluctuating reading in pre-analysis, exploration of the content and interpretation, "trying to discover what is hidden under the selected documents, in search of understanding the phenomenon investigated". Then, it was synthesized, by inference, into units of significance, considering the completeness, representativeness, relevance and homogeneity and elaboration of thematic categories, based on semantic criteria based on the objective of the study.

To preserve the identity of the participants in the excerpts of their reports, E (elderly) and the Arabic number indicating the sequence of the interview were used. The project was approved by the Research Ethics Committee of the University, with under opinion number 2,628,706.

RESULTS AND DISCUSSION

The participants are between 60 and 83 years old, with an average age of 72. Most are retired, with personal income between one and three minimum wages. Six have up to three children, four have more than three and one does not. Ten elderly women live with family members and one lives alone. Five have 5 to 8 years of study and six, with more than 8 years. Six are widows, four are married and one is separated. From what emerged from the participants' speeches, it was possible to construct two categories: Feeling good is the keyword and Care for appearance.

Feeling good is the keyword

The participants mentioned that body aesthetics provided self-esteem and confidence, making them feel good, with encouragement to seek happiness from the inside to the outside, with physical beauty as the means, the path, and not the main objective, according to the lines:

> "I feel confident, happy, even to come to class I feel better, praised" (E 3).

> "It is important for every woman. There are days when we feel good, feel happy, beautiful" (E 9).

"Appearance is from the inside out" (E 10).

"We are happier, we feel better" (E 11).

In Goldenberg's view [15], old age reveals itself, more and more in the last decades, as a time to take care of yourself, health, friendships and grandchildren, to laugh, dance, travel, study, date, it is not necessary to "answer, desperately, to the expectations of others". With aging, there is a change of purpose, of focus, where the elderly person starts to take more care of themselves, creating spaces for the development of autonomy and freedom, a theory corroborated by the statements above. In the same sense, for Foucault [10], when a person manages to develop his own style, investing and producing in self-care, he becomes an artisan of his beauty, making, in his way of being, a work of art. Thus, the ethics of the Greek and Roman world had as principles that the citizen did not submit to the power of the authorities, nor was he a slave, a foreigner, much less, let passions be dominated, which should be rationalized through exercises, such as meditation, contemplation, examination of conscience and exchange of correspondence, and seek happiness as a greater, supreme good, taking care of life as a whole[6,9-11]. To achieve a balance between the body, the soul, relationships with the other (otherness) and divinity, it was necessary to occupy oneself with the practice of asceticism (*askésis*), by modifying and extolling his subjectivity, in relation to the body , thought and conduct, to become a moral subject.

The perceptions of elderly women in relation to physical and aesthetic appearance are associated with the daily care of beauty and vanity and this way of being significantly influences self-care, relationship and behavior. They conceived aesthetics related to daily life, capable of contributing to family, social and professional adaptation and integration, improving confidence and self-esteem. However, a person does not agree with appearance to be used for ethnic discrimination and social status:

"I already noticed that people make a difference between treating people who look better or not, which I think is sad" (E 9).

"We are happier, we feel better, we are often treated well. [...]. I'm not ashamed to be with someone better dressed than me" (E 11).

"It all depends on your self-esteem. If you are well dressed, sometimes you go to a place, but the clothes are not in accordance with the location, it depends on whether you got it right or not" (E 5).

"When people meet me and say I look fine, I'm happy" (E 8).

"If I am not feeling well with my appearance, I am feeling kind of left out" (E 1).

For Cerqueira[16], when old age becomes a natural and welcome stage, appearance, despite being important and promoting physical and psychological well-being, does not need to obey and follow the standard of beauty required by society. In this sense, a study carried out with elderly women, who attend a social group linked to a Basic Health Unit, in southern Brazil, showed that, with advancing age and the natural marks of aging, the elderly do not feel intimidated because they dress and act pleasantly with the intention of feeling satisfied with their body image[17].

Self-practices, such as self-care and the aesthetics of existence, are linked to the rules of the social environment. If the subject breaks abruptly and builds a way of being independent of these norms, he feels out of touch with his outside world. Therefore, it is up to the person to seek a balance in social relations, maintaining their autonomy and adapting what is convenient in a society "associated with knowledge and power relations"[10]. Foucault stresses the value of uniqueness and the degree of independence achieved by the individual in the sphere of private relations to which the subject belonged in the Greek and Roman world, such as family, domestic activities and "patrimonial interests". This aesthetics of existence made it possible to intensify relationships with oneself, as an object of knowledge and a field of "action to transform, correct oneself, purify oneself, and promote one's salvation"[10]. Well, the time spent by the participants of this study in self-care, through appearance, highlights this uniqueness.

Still, in relation to the influence of appearance in the daily lives of the interviewees, they reported that they take the time to care for and maintain their body beauty, such as going to the hairdresser, the manicure, to dress well, because there is a concern with the vanity to feel elegant, sensual and beautiful. Thus, there is an aesthetic perception in the aging process aimed at self-care, acting in a positive way, with self-esteem, to live and face existential vicissitudes:

> "I always take time to take care of myself, go to the hairdresser, the manicure, because women need it" (E 1).
>
> "It positively influences" (E 7).
>
> "I think this care is important, because you feel good" (E 2).
>
> "If you see that you look fine, your day is nice" (E 5).
>
> "If you look at yourself and like yourself, the day is different. Self-esteem is everything for the person" (E 6).
>
> "When we don't feel well, we don't feel beautiful" (E 11).

According to Goldenberg [15], in Brazil, the cult of the young and slim body is considered "true capital", as an asset to be managed, preserved and cared for. It is a means of achieving freedom and happiness and maintaining a social identity. Still, in the question what do you most envy in other women, "they answered: body, beauty, youth, thinness and sensuality. The body envied by them is young, thin and sensual". Goldenberg praises the time that Brazilian women use to take care of themselves and an emancipation from the "old sexual, procreative and clothing easements", however, always accompanied by anxiety, due to the imperative aesthetic constraints coming from society.

Care for appearance as aesthetics of existence

The care that the participants reported is related to physical appearance and body aesthetics, with an association between health and beauty. This relationship is initially linked to physical well-being, such as maintaining weight, adequate and balanced nutrition, physical exercises through walking, gymnastics and pilates classes, but with repercussions on psychological well-being, self-esteem, confidence and satisfaction and social well-being. Here are some lines:

> "But when someone talks about how thin or fat you are, I don't like it, I feel bad" (E 8).
>
> "It is well worth taking care of myself, taking care of my appearance. I always took care of myself, in food [...], especially after the age of 60. I don't like to put on weight, I demand to be well" (E 5).
>
> "When I get a little fat, I already start cutting the carbohydrate [...]. For me, feeling good is important, more than the appearance (E 1).
>
> "It is not about appearance. I'm like this. Anyone who likes me has to like me as I am" (E 4).

Foucault[10], paraphrasing Socrates, considered by the Greek and Roman tradition as the master of self-care and the aesthetics of existence, highlights that care for the body and physical appearance, as well as wealth, external goods and money, is something healthy and essential condition to satisfy biological and material needs. However, based on these conditions and care, we seek to achieve and develop the values of the soul, "of taking care of oneself", in "a form of an attitude, a way of behaving". This way of living requires reflection, improvement and practice and has repercussions on intersubjective relationships, promoting social well-being. If, on the one hand, there was a concern for self-care, on the other, there were strong local and family connections "of clientele and friendship relationships"[10].

In a similar sense, Fin et al.[18] ensure that beauty in old age is perceived as a process that demands care for oneself and social relationships. It consists of a thoughtful look at the body and the soul, which follows rules, behaviors and principles, such as exercising, maintaining a good mood, dancing, getting a lot of movement, looking for a doctor when you feel unwell and, even, occupying yourself with social causes.

Most elderly women said that, among the usual care with appearance, are the haircut, followed by coloring and manicure. This self-care with aesthetics brings a feeling of youthfulness to the woman, as well as the enhancement of her physical beauty and aesthetic care. This dedication and looking at themselves are anchored in capillary, facial and body aesthetics, elaborated from tastes and everyday experiences, as shown in the statements below:

> "If the hair is no longer straightening up, then, I go there, schedule the cut, do the highlights, try to change, change the cut and the clothes that don't look right, I discard." (E 2).

> "I care about how I look, because I can meet someone and look sloppy. Only when I go to an event, I take longer" (E 8).

> "I always try to be in order, hair, nail, a little makeup, get dressed, take care of the whole" (E 3).

According to Goldenberg [19], nowadays and in an increasingly accentuated way, it is possible to live old age with beauty, autonomy, happiness and freedom, because "aging is a verb, action, continuity. [...] We were different in the past and we will be different in the future". A study carried out with ten elderly women demonstrated that there is a concern with body aesthetics and being healthy, with skin, hair and nail care, always accompanied by physical activity, in view of freedom and autonomy and as social recognition[20].

Regarding the opinion of people of the same age about their aesthetic appearance, the elderly women reported that they feel, on the one hand, uncomfortable and challenged, especially when they look in the mirror, and, on the other hand, motivated, with self-confidence and self-esteem. For them, aesthetic care is linked to thoughts, feelings and perceptions, derived from their experiences, and socio-cultural influences of the environment in which they are inserted:

> "Feeling that my appearance is pleasing does me good" (E 10).

> "It's everything, it's my self-esteem" (E 6).

> " It's important! I like to always be kind of matching colors" (E 7).

> "Somewhere more important that we go, I look [referring to the other elderly women], but not that I feel inferior. It's just an assessment. I usually assess myself in the mirror [...]. Especially before leaving" (E 4).

> "I have to look in the mirror and I have to like myself. I will not dress for you or anyone. I dress for myself" (E 2).

> "I don't care much about looks. But I notice that on a party day when I dress nicer, I feel better" (E 11).

Foucault[10] emphasizes the need for the person to examine oneself, their own conscience, as a judge of oneself before the acts and customs performed and what others say and think. This aesthetics of existence does not aim to investigate culpability and generate remorse over self-wits, but to encourage the person to progress morally, intellectually and achieve "wise conduct", similar to the perceptions of care and the aesthetic appearance of elderly women. Thus, the process of thinking about oneself, also called by Foucault as a culture of oneself, has the function of effecting a "permanent filtering of representations: examining, controlling and sorting them"[10]. Still, starting from the exterior beauty, the participants showed concern to enhance the interior beauty, improving their identities, autonomies and social roles.

The study by Marinho and Reis [21], with 10 long-lived elderly women, aged 80 and over, showed and synthesized that the words most used by the participants were "I feel young, wonderful, eighty, I am beautiful, hair, tidy, beautiful, cream, lipstick and care". Among the findings, elderly women considered themselves to be cheerful long-lived, aging in a healthy way, in good health, in good mood, "autonomy, independence, conserving the young spirit". Foucault[10] calls this aesthetics of existence as a "conversion of the self", a practice of self towards the cultivation of identity and happiness, results of a long journey of knowledge, self-knowledge and self-care.

Research by Elfving-Hwang [22], in South Korea, with twenty elderly women, from the metropolitan area of Seoul, with the aim of exploring the aesthetic

appearance, demonstrated that body care is a daily concern, capable of generating self-esteem, autonomy and social engagement. Another study, by Cameron et al.[23], by systematic review, in order to identify women's perspectives on aging, health and body image, highlighted that there is a constant concern with the body and the aging process, such as the loss of beauty, youthfulness and identity. Most women reported dissatisfaction with their body image and this perception generates emotional suffering and social isolation.

Finally, the aging process is also a period of life to conquer and praise freedom, security, charm, recognition [24], respect, independence, pleasure, "self-knowledge and much more"[13]. Foucault[10] conceives this improvement and politeness of the subject of aesthetics of existence, which is the search for freedom, self-esteem and self-affirmation reported by the participants of this study. In view of the above, it is suggested to improve the methodology with focus group discussions and establish connections based on self-care and body aesthetics with subjective well-being and quality of life.

CONCLUSION

The participants reported that the care for body, facial and hair aesthetics provided self-esteem, confidence, satisfaction, happiness, freedom, psychological well-being, and social well-being. Still, a good body appearance was conceived as a means, an effective path of family, social and professional integration and capable of generating motivation to face existential vicissitudes, because it is intrinsically linked to thoughts, feelings and perceptions, arising from their experiences, and socio-cultural influences.

According to the statements of elderly women, the expressions and perceptions that emerged highlighted the search for self-care, with an emphasis on caring for physical appearance as an expression of freedom, dialogue, self-determination and self-knowledge, recognition and social inclusion . All these expressions of care for physical appearance demonstrated a fruitful dialogue between elderly women with themselves and with each other.

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Reasons for the adherence of older adults to Gyms for Seniors

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Abstract

Objective: to verify the reasons behind the adherence (entry and permanence) of older adults to Gyms for Seniors (GFSs) in the city of Rio de Janeiro. *Method:* a total of 396 men and women over the age of 60 were interviewed for this study. The subjects frequented 58 different GFSs from all the administrative regions of the city of Rio de Janeiro. The data was collected with a validated questionnaire and analyzed through descriptive statistics. *Results:* the results indicated that the main reasons which explain the older population entering the GFSs are to do with health (Avoiding health problems: 26%; Doctor's orders: 16%) while their permanence is more associated with social factors (I like the teacher and It makes me feel good, both with 100%) and their perception of the benefits of exercise (It is a healthy physical activity: 100%). *Conclusion:* although health reasons are important for the older adults who enter the program, they mostly remain due to how much they like the activities.

Keywords: Aging. Physical Exercise. Public Health Policy. Health of the Elderly.

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INTRODUCTION

Due to the growth of the older population in Brazil[1], there is an obvious need for public policies aimed at this group[2]. For Harris et al.[2], alternatives include assistance programs aimed at older people, including those related to the need to stimulate active lifestyles, as regular exercise has been proven to be an important tool for controlling chronic disease and maintaining the functional autonomy and quality of life of older adults[3].

Thus, free physical exercise programs offered to the general community in public locations have become more common, offering support to groups that normally find it difficult to reach the minimum recommended amount of physical activity, such as older men and women[2,3].

One public policy alternative which offers free physical exercise in the city of Rio de Janeiro (RJ), Brazil, is the Rio Ar Livre, or Rio Open Air (RAL) project, which includes a program known as Gyms for Seniors (GFSs)[4]. The GFSs program consists of gyms with exercise equipment installed in public locations, allowing people to practice physical activity with the help of Physical Education professionals[5].

Considering the importance of regular physical activities for one's health[3,6], this program is especially valuable in the field of health promotion for this population, as it is both supervised and free, potentially facilitating access for older adults who have difficulty adhering to a program of this nature[7], which is important if they are to benefit from this practice[2,3].

Considering the differences between the characteristics of GFSs and programs developed in traditional gyms with more sophisticated environments and equipment[5], as well as their status as a public policy for health promotion, understanding what facilitates the adherence of older population groups to this program is relevant, and the motives found by the study can be used as parameters for the evaluation and restructuring of the programme in order to increase its quality and impact.

Therefore, the main objective of the present study was to investigate the reasons behind the adherence of the older population to GFSs in the city of Rio de Janeiro, with adherence in this case including both entrance into and permanence in the program.

METHODS

A cross-sectional descriptive field study was performed, which sought to describe the naturally occurring distribution of the characteristics of older adults participating in the GFSs program in the city of Rio de Janeiro.

The GFSs are gyms linked to the RAL project, consisting of gym equipment installed in public locations, allowing people to practice physical activity with the supervision and help of Physical Education professionals[5]. Although the gyms are not exclusively used by the older segments of the population, such a group is the target audience of the GFSs. The program requests that any participants get permission from their doctor before joining[5].

The city of Rio de Janeiro is highly heterogeneous, with varying degrees of development. To facilitate its management, and reduce inequality in the distribution and use of available resources, it has been divided into five planning areas which are subdivided into ten Programmatic Areas (PAs). Each of these areas contains neighborhoods with similar sociodemographic characteristics[8]. In order to guarantee the adequate representation of different sociodemographic profiles, the sample contains gyms from all of the PAs in the city.

The amount of gyms visited per AP was determined with the help of a sample calculator[9], with the entire sample comprised of 58 GFSs distributed throughout all PAs in the city (Reference year: 2017). The data collection locations were determined through the drawing of numbers[10] from an address list provided by the RAL administrators.

For inclusion in the study, volunteers needed to be enrolled in and have participated in the GFSs for at least six months, and be 60 years of age or older. The sample sizing based on the eligible subjects was conducted according to guidelines provided by Barrow & McGee[11]. For GFSs with up to 50 participants, we interviewed 20% of subjects who

were aged 60 years old or more; in GFSs with 50-100 participants, 15% were included and, finally, in GFSs with more than 100 participants, 10% of the eligible subjects were included. After the draw was completed, a total of 396 volunteers of both sexes (aged 60-91 years) participated in the study. All participants signed an Informed Consent Form (ICF) in accordance with the determination of Resolution 466/12 of the National Health Council[12]. The study was approved by the Pedro Ernesto University Hospital Ethics Committee (number 1.514.233).

To determine the reasons for the adherence of the participants to the program, we used the questionnaire developed and validated by Castro[13,14], adapted slightly to the public in question and the physical activities available at the GFSs, since the original version of the questionnaire focused on different populations and activities.

The data collection instrument contains three parts which identify: 1) the subject's socioeconomic profile; 2) the reasons which justify their entry into the program; and 3) the reasons behind their permanence in said program. Furthermore, we included questions regarding the health of the participants. In the portion which identified the reasons for entry, the volunteers pointed to each item, identifying whether it was the first, second or third most important reason for entering the programme; while in the portion dealing with permanence, they indicated the level of importance of each factor as very important, quite important or not very important.

The questionnaires were administered between February and June 2017 at each GFSs location during class time by three properly trained researchers. In order to avoid difficulties for the participants, the questionnaires were completed by the researchers.

The answer frequency was determined by percentages. For reasons for permanence, which were determined through an opinion scale, levels of 80% were taken as an agreement, which according to Bellack's formula is the minimum acceptable percentage needed to deem observations as trustworthy.

RESULTS

Table 1 shows the distribution of the participants among each of the Rio de Janeiro city PAs, as well as their ages and sexes. Only one person was interviewed in PA 5.3 due to the lack of participants who fit the inclusion criteria. Thus, the data from that region was incorporated into the data from the neighboring region (5.2). The total sample reflects the profile of all the PAs, in that it mostly consisted of women, and the majority of the participants were older adults from the youngest age group, with a gradual reduction in participation in the project as age increases.

Since no major variations were found among the PAs, we opted to present the socioeconomic and health profile pertaining to the entire sample, and comment on the few differences that exist in the discussion section. This approach was also applied to the subjects' reasons for adhering to the program.

Table 2 presents the socioeconomic profile of the sample and indicates that the majority of participants have low monthly earnings, adhere strongly to the project and possess a history of regular exercise, especially concerning fitness related activities. Furthermore, most participants do not depend on third parties to get to the project and see the proximity of the GFSs gym to their homes as an important reason for their participation.

Table 3 presents the main reasons behind the participants' entry into the GFSs program. We opted to show only reasons that obtained an agreement of over 10%. The two main motivation factors were health-related, such as "To avoid health problems" and "Doctor's orders".

Table 4 shows the reasons which lead to the participants remaining in the GFSs program. We opted to show only those reasons that reached an agreement level greater than or equal to 80%. It is noteworthy that there was 100% agreement with the following reasons: "It is a healthy physical activity", "I like my teacher" and "It makes me feel good".

Table 1. Distribution by sex and age group of the Gyms for Seniors users (n=396; Male=58; Female=338). Rio de Janeiro, RJ, 2017.

	Programmatic Area 1	Programmatic Area 2.1	Programmatic Area 2.2	Programmatic Area 3.1	Programmatic Area 3.2	Programmatic Area 3.3	Programmatic Area 4	Programmatic Area 5.1	Programmatic Area 5.2
Variables	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)	n (%)
Sex									
Female	27 (82)	78 (87)	34 (85)	37 (86)	20 (91)	84 (88)	27 (90)	15 (68)	16 (80)
Male	6 (18)	12 (13)	6 (15)	6 (14)	2 (9)	12 (13)	3 (10)	7 (32)	4 (20)
Age Group (Years)									
60-65	12 (36)	33 (37)	18 (45)	15 (35)	09 (41)	32 (33)	10 (33)	12 (55)	08 (40)
66-70	06 (18)	13 (14)	06 (15)	05 (12)	08 (36)	20 (21)	10 (33)	04 (18)	05 (25)
71-75	10 (30)	18 (20)	06 (15)	05 (12)	02 (9)	23 (24)	03 (10)	01 (5)	03 (15)
76-80	02 (6)	18 (20)	04 (10)	10 (23)	02 (9)	11 (11)	04 (13	02 (9)	04 (20)
81-85	02 (6)	05 (6)	05 (13)	07 (16)	01 (5)	09 (9)	02 (7)	02 (9)	00 (0)
86-90	01 (3)	03 (3)	01 (3)	00 (0)	00 (0)	01 (1)	01 (3)	01 (5)	00 (0)
91-95	00 (0)	00 (0)	00 (0)	01 (2)	00 (0)	00 (0)	00 (0)	00 (0)	00 (0)

Source: The author, 2017. n: number of sample subjects

Table 2. Socioeconomic and health profiles pertaining to entire sample (n=396; Male= 58; Female= 338). Rio de Janeiro, RJ, 2017.

Variables	n (%)
Personal Earnings (in Minimum Wage units)	
≤1	249 (62.9)
1 – 3	145 (36.6)
3 – 5	49 (12.4)
≥ 5	34 (8.6)
Did not answer	26 (6.6)
Time participating in GFSs (Years)	
6 months – 1 year	69 (17.4)
1 – 2	73 (18.4)
>2	254 (64.1)
Weekly participation frequency (Days per week)	
1	02 (0.5)
2	19 (4.8)
3	68 (17.2)
>3	308 (77.8)
Practice of physical activity before entering GFSs	
Regularly	242 (61.1)
Sometimes	17 (4.3)
None	137 (34.6)
Practice of physical activity other than at GFSs	
Regularly	135 (34.1)
Sometimes	11 (2.8)
None	250 (63.1)
Activities involved	
Fitness activities	120 (30.3)
Sports	16 (4)
Dance	04 (5.6)
Help required to get to the GFSs	
Yes	02 (0.5)
No	394 (99.5)
Distance between GFSs and residence	
Very far	05 (1.2)
Far	30 (7.6)
Near	260 (65.7)
Very near	101 (25.5)
Age of entry into the GFSs program* (Years)	
56-60	88 (22.2)
61-65	99 (25)
66-70	76 (19.2)
71-75	51 (12.9)
76-80	48 (12.1)

to be continued

Continuation of Table 2

Variables	n (%)
Chronic illnesses	
Yes	313 (79)
No	83 (21)
Main chronic illnesses**	
Hypertension	216 (55)
Arthrosis	73 (18)
Diabetes	59 (15)
Perception of health after entering the GFSs program	
Much better	346 (87)
A little better	34 (9)
No difference	14 (4)
Worse	00 (0)

Source: The author, 2017. n: number of subjects in the sample; GFSs: Gyms for Seniors; *Higher and lower than those shown attained non-expressive percentages; ** Further illnesses cited by the participants attained non-expressive percentages; Minimum wage in 2017: BRL937.00 per month.

Table 3. Reasons behind the entry of older participants in the GFSs program. (n = 396; Male= 58; Female= 338). Rio de Janeiro, RJ, 2017.

Reasons	Order of importance		
	1	2	3
	n (%)	n (%)	n (%)
To feel physically and mentally good	51 (13)	55 (14)	71 (18)
To have the company of friends and make new ones.	31 (8)	68 (17)	89 (23)
To improve physical condition	59 (15)	68 (17)	33 (8)
Doctor's orders	65 (16)	17 (4)	22 (6)
To avoid health problems	101 (26)	82 (21)	44 (11)

Source: The author, 2017.

Table 4. Reasons behind older people's permanence in the GFSs program. (n = 396; Male= 58; Female= 338). Rio de Janeiro, RJ, 2017.

Reasons	Level of Importance		
	Very important %	Quite important %	Not very important %
The space is pleasant	90	10	0
The activities are well organized	93	7	0
It challenges me	84	7	9
It is a healthy physical activity	100	0	0
I really like fitness activities	87	10	2
I become stronger, more resistant and agile	97	3	0
The resources and materials I use during the classes are good	82	12	6
It helps to prevent illnesses	97	2	1

to be continued

Continuation of Table 3

Reasons	Level of Importance		
	Very important %	Quite important %	Not very important %
It helps to prevent back, heart and respiratory problems	95	3	2
I like to make new friends	96	3	1
I like my teacher	100	0	0
It gives me lots of energy	88	2	0
It gives me satisfaction	99	1	0
I have fun	99	1	0
It makes me feel good	100	0	0
Class time does not interfere with my other activities.	91	5	4
The gym is located near my house	92	7	1
The gym is easy to access	99	1	0
The teacher is always creating something new and teaching different things	92	6	2
My friends support me	90	4	6
It is a pleasurable pastime	98	2	0
I am frequently praised for taking up this physical activity	90	6	4
There are lots of nice people	99	1	0

Source: The author, 2017.

DISCUSSION

It is important to note that AP 2.1 (South Zone) is the area with the highest Human Development Index (IDH) and per capita income in the city[8]. It is also the area with the second largest number of older adults who participate in this program, which is public and free. While this may seem incongruous, as a high IDH indicates that the older population in this area could easily pay to exercise in private facilities, most of the interviewees' income remains less than or equal to three minimum wages, which demonstrates that there are low income communities in all of the city's PAs, including those which are considered prime real-estate. The participants' income is actually quite low, especially if their expenditure on housing, food and health is taken into consideration[15], thus justifying their need to participate in free exercise programs. In contrast, region 3.3 (North Zone) possesses the lowest per capita income rates[8], which explains why it is also the area with the largest number of program participants. This data demonstrates that the project mostly serves older people who have a legitimate need for free exercise programs.

Although there are small differences in percentages among the regions, the majority of the sample consists of female participants. This data is in accordance with the findings of other studies which have already been conducted on the adherence of older people to exercise programs, such as those by Gilette et al.[16] and Lemos et al.[17]. Goggin and Morrow Junior[18] commented that there is a greater probability of women being a part of supervised exercise programs, due to their tendency to give more value to group work. Regarding the low levels of male participation, Mello et al.[19] stated that men tend to consider fitness classes as a typically feminine activity and, due to this stereotype, feel ashamed to participate alongside women, as they feel this will be prejudicial to their reputations. An interesting point brought up by Santos et al.[20] is that often men who join group activities do so thanks to the influence of their wives and family members. Thus, it is possible that older men who live by themselves are less likely to adhere to this type of program. Another factor which may explain the mostly female presence in programs such as this is a phenomenon known as the feminization of old age[21], which occurs due to

the difference in life expectancy for both sexes. In Brazil, women live on average seven years more than men[22].

In terms of the ages of the participants, younger age groups had the greatest rate of adherence to the project, both in terms of entry and permanence. As age increases, the adherence rate incrementally declines. The prevalence of entry between the ages of 56 and 70 can be explained by the average retirement age in Brazil, which in 2014 was 60 for men and 55 for women[23]. Once retired, older men and women find themselves with more time to dedicate to other activities such as, for instance, regular exercise[17], a positive factor as such activity can help to minimize the progressive biological, psychological and social decline that stems from the aging process[3,7].

The low rate of entry among older age groups is possibly linked to the natural aging process, which brings about physical, psychological and social alterations, and also to the increased presence of chronic-degenerative diseases[24]. However, these alterations and diseases are not necessarily a deterrent to regular and planned exercise, which has been proven to bring about benefits that can help combat said diseases[3]. However, we must also take into account the fact that the older a person is, the greater are their chances of having their health impaired and their physical capacity reduced, both of which are factors that potentially hamper the search for exercise programs in those belonging to the more advanced age groups, not to mention their permanence in said programs[7,24]. Another explanation for these results has to do with the lower number of individuals in higher age groups. Thus, the lower number of participants from such groups is proportional to the lower number of people they contain[1].

In terms of weekly exercise frequency and time spent exercising, most of the study participants have participated in the GFSs program for more than two years, with an average participation frequency of three days per week. According to Prochaska and Velicer[25], a person can only be considered to have truly adopted a certain behavior when they practice it consistently for at least six months, since the stages of behavioral change which these authors cite take approximately this length of time to run their course. The stages in question are pre-contemplation, contemplation, preparation, action, maintenance and completion.

Regarding weekly exercise time, as each class lasts for one hour, most participants exercise for three hours or more per week, complying with the recommendations set by Piercy et al.[6]. Overall, there appears to be a high rate of adherence to the activities proposed by the GFSs program in the city of Rio de Janeiro.

Another aspect brought to light by the present study has to do with the GFSs participants' level of autonomy. Most arrive at the gym locations on foot, which corroborates the percentage that considers it very important that the project locations are either close or very close to their homes. Very few of the participants require public or private transportation to arrive at the gyms and those that do are usually, for some reason, travelling to one that is located in a different neighborhood than that in which they live. These data corroborate the results from other studies such as that conducted by Lopes et al.[7] and Nakamura et al.[26], which indicate that the proximity of the exercise program influences adherence. This shows how important it is for the GFSs to be located in various strategic neighborhoods.

Only two people reported that they needed help to reach the GFSs locations. This, along with the fact that most participants arrive on foot, indicates that the older people who participate in the program have maintained their functional autonomy. Since most have been going to the GFSs gyms for two years or more, it can be inferred that the program has contributed to the maintenance of said autonomy. The positive results stemming from the work carried out in these spaces can also be reinforced by the fact that many participants abandoned the facilities where they previously exercised in order to fully dedicate themselves to this program. However, it is important to note that some of the population may not be adequately served regarding access to exercise programs, due to the city's accessibility issues, such as poor sidewalk maintenance conditions, the lack of ramps to facilitate transit and inadequate public safety, among other issues.

Regarding their physical and sporting culture, most participants already exercised before joining the GFSs project. Taking this into consideration, it is possible to link the previous practice of exercise to adherence to the project. Machado et al.[27] state that in old age, people tend to choose a similar lifestyle to that which they adopted when they were young and middle-aged, including regular exercising. Our results corroborate this statement, since there is greater interest in the GFSs among old people with an established physical and sportive culture. As for current practices, most of the older adults stated that they do not participate in activities other than those offered by the GFSs, which apparently shows that they believe their needs are fulfilled by this program, although the possibility of financial hardship, which would make paying for another activity difficult, should not be discounted. Whatever the reason, this highlights the importance of these gyms for the older population of the city of Rio de Janeiro.

Participants who simultaneously practiced physical activities other than those offered by the GFSs are generally enrolled in another fitness program. Since most of the sample is female, this was to be expected, since other studies of gender and leisure exercise practices, such as that conducted by Silva et al.[28], have already shown this preference among women.

Adherence, which is the central object of this study, is considered to be the entry and permanence of an individual in an activity for a period of over six months[13,14]. In this study, the reasons for entry and permanence in the GFSs program were evaluated separately.

One way to analyze the reasons for entry in exercise programs is by using the values assigned to this behavior by the participants. According to Lovisolo[29], there are usually three reasons behind human actions: norms, the action's usefulness to an individual and/or the pleasure/happiness the action causes. As explained by the author, norms have to do with rules, social impositions or conventions. Regarding usefulness, the action is performed as a means to an end, with a specific goal or level of prestige in mind. Both of these cases are extrinsic. As for pleasure or happiness, the action is primarily motivated and performed due to the pleasure it provokes within the subject (intrinsic motivation). These three reasons can converge or diverge in the execution of an activity, just as they can all be present at the same time. We have opted to use this viewpoint in order to analyze and discuss the reasons for entry given by the interviewees.

Regarding their entry in the GFSs project, the reasons given by the participants were mostly related to the prevention and/or treatment of health problems, which strongly indicates that their conduct was motivated by the usefulness of exercise in influencing their health. It is important to note that 16% of the subjects mentioned medical advice as the most important factor, which is related to rule-guided behavior. This result confirms the findings contained in the systematic review conducted by Harris et al.[2], where the authors found that health-related reasons tend to be the main determinants behind the entry of older people in exercise programs. The relevance of this result cannot be denied, as it shows that old people are extremely worried about their health. It has already been amply determined in literature that regular exercise can contribute to a healthier life in old age[5]. Nonetheless, to choose exercise merely for reasons related to norms and usefulness may not in itself favor the adherence process.

The possibility of spending time with friends and making new ones, both of which are related to pleasure, appeared only as a third option, chosen by 23% of the interviewees. Equally, the reason "to feel good physically and mentally", which is related partly to pleasure but also to usefulness, was chosen by only 18% of the sample, also as a third option. However, despite only appearing as a third option, these reasons cannot be discarded as forming part of the initial factors behind GFSs adherence, since socialization is a fundamental part of quality of life for older people[30]. The other reasons did not achieve significant support.

Unlike the main reasons behind entry to the project, the reasons chosen by the participants as "very important" for them to continue exercising in these spaces, and which obtained 100% agreement among the respondents were mostly pleasure-related, such as "I like my teacher" and "It makes me feel

good". Among these reasons, only one related to usefulness ("It is a healthy physical activity") obtained significant support. Also related to pleasure are the following reasons linked to satisfaction, fun and good relationships among classmates: "It satisfies me", "I have fun" and "There are lots of nice people there". These reasons obtained 99% agreement and "I like to make new friends" achieved 96%. Among the reasons with 99% agreement, was "The gym is easy to access", which has to do with usefulness and reinforces the importance of proximity if older people are to adhere to exercise programs.

Unlike the reasons which motivate old people to enter exercise programs, those linked to intrinsic motivation and the pleasure obtained through exercise are the main factors behind their maintenance of this conduct. This was also found in the studies that were included and analyzed in the systematic review conducted by Harris et al.[2], as well as in studies developed by Castro[13,14] with different populations. This is important as it shows that the quality of the program must be good in order to stimulate its users' permanence. The teacher's performance in stimulating the practitioners and creating strategies to encourage their integration seems to be a central element in the adherence of older population groups, along with the ease of access to class locations.

We further highlight that the reason "I have to recover from an injury/illness" which is related to the usefulness of exercise for health, was considered to be "not very important" by most of the interviewees, which indicates that these individuals do not seek out the GFSs to help them recover from acute injuries or illnesses, unlike with chronic illnesses, where the participants considered this to be a "very important" aspect of the GFSs program.

The most common illness in the sample group was hypertension, which is to be expected since, according to the Brazilian Society of Cardiology, hypertension is a highly prevalent illness among older people and is also one of the largest cost generators for Brazil's public health system[31]. Also common are diabetes and arthrosis, which are equally prevalent in this age group[32,33].

Other important points have to do with the changes in health observed by the participants after their entry in the program. Most of the interviewees consider that their health has improved a lot since they entered the program. None reported a decline in health and only 4% of the sample did not notice any changes. These results suggest that the work carried out at these gyms is important for the participants' healthcare and may lead to cost reduction in primary, or even secondary health care, since regular exercise is a way to control one of the greatest risk factors for chronic illnesses, sedentarism. Exercise is also one of the non-medicinal measures recommended for the treatment of illnesses such as hypertension[31] and diabetes[33]. Thus, a public exercise program supervised by physical education teachers has the potential to become a powerful tool for combating chronic illnesses, at least for older adults, improving health and quality of life for this growing segment of the population.

Finally, while it does not diminish the importance of the results obtained, this study may be limited by the fact that no association analysis was conducted among the investigated variables, something that would provide a better understanding of the importance of each variable to the adherence of older adults to the GFSs program.

CONCLUSION

Regarding this study's central object, it can be concluded that although health-related reasons are seen as an important reason for older adults entering the GFSs program, their permanence in said program depends on whether or not they like the activities and the exercise environment. Thus, the teachers and the technical team should pay close attention to lesson quality, the physical environment of the gyms and the social interaction which occurs in these locations.

Furthermore, a high rate of adherence to the program was identified, which means the exercises carried out are more likely to positively influence the health and quality of life of users, as well as their perception of improvement in these factors, making

the GFSs an effective tool for improving the health of the population.

The results suggest that the GFSs program is an example of public policy that is valuable to society, especially as most of the participants are low income older adults who have difficulty accessing private programs.

Thus, the present study has the potential for practical application as it provides information that can contribute to planning and reformulating the project investigated, as well as similar projects, in order to boost the adherence of older people to regular exercise habits.

As for the relevance of these results, one important gap is the lack of information regarding the withdrawal of older adults from programs such as this. We suggest that future studies delve deeper into the reasons behind such withdrawal, as they should also be considered in the evaluations and possible restructuring of projects of this nature, in order to contribute to a reduction in withdrawal rates.

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Expenditure on hospitalization of the elderly in intensive care units in private hospitals in a capital of the Brazilian northeast

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Abstract

Objective: Analyze the association between demographic variables, morbidity and relative to the conditions of hospitalization with the expenses resulting from the admission of elderly people in intensive care units (ICU) of private hospitals in a capital of northeastern Brazil. *Method:* This is an epidemiological, analytical and sectional study, with a quantitative approach, in which data were collected regarding 312 hospitalizations of elderly people in the ICU of all private hospitals in Natal (RN), Brazil. The dependent variable was the cost of hospitalization and the independent variables related to the characterization of individuals in terms of socio-demographic profile, morbid condition and characteristics of hospitalization. Data were analyzed using descriptive statistics, Chi-square test, t test and multiple logistic regression with prevalence ratios (PR). *Results:* The average cost per hospitalization was R$ 4.266,05±3.322,50 for the low cost group and R$ 39.753,162±4.929,12 for the high cost group. It was found that hospitalization due to clinical (PR=1,81; 95%CI=1,06-3,09) and respiratory conditions (PR=2,48; 95CI%=1,48-5,24), the need for mechanical ventilation (PR=2,33; 95%CI=1,43-3,78) and complete or partial disorientation at the time of admission (PR=1,81; 95%CI=1,15-2,84) were associated with higher expenditure on hospitalizations in the multiple statistical model. *Conclusion:* The knowledge produced by the study may serve as a subsidy for the implementation of actions capable of promoting better health conditions for the elderly, reducing expenses related to their hospitalization in highly specialized sectors. In addition, the research raises evidence that the construction of protocols and lines of care guiding the work process in the intensive care sector, specifically created for the elderly, may be relevant in reducing the expenses resulting from hospitalization of the elderly.

Keywords: Intensive Care Units. Health of the Elderly. Health Expenditures.

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INTRODUCTION

In most units of the federation, the gradual and proportional increase in the number of elderly people has been consolidated and brought significant social demands, also related to the change in the epidemiological profile resulting from the population aging. Such changes are associated with the advances in quality of life achieved by the population, however, on the other hand, they also imply social and economic consequences to some extent predictable, but that Brazilian states are not yet fully prepared to face them[1,2].

Due to demographic and epidemiological transitions, there has been an increase in the demand for health services. This perspective stems from the fact that the elderly have multiple chronic pathologies, require long-term care, have a higher frequency of hospital admissions when compared to other age groups, in addition to needing continuous interventions and being associated with a greater demand for beds in the Intensive Care Unit (ICU)[3,4]. It appears that 42% to 52% of ICU admissions are for the elderly, who consume about 60% of the daily rates available[4].

From the point of view of the budgetary impact, the increased demand for health services and medical-technological development promote the expansion of financial expenditures in health. When analyzing the costs per hospitalization according to the age profile of the population, a greater proportional expenditure is identified among the elderly in relation to younger patients[5].

The magnitude of this difference was evidenced in a nationwide study, which analyzed hospitalization expenditures between the years 2002 and 2011 and shows an eight-fold higher hospitalization spending ratio in the elderly male population in relation to the adult age group, and 2.5 times more expensive when comparing elderly women over 80 with adult women[5]. As a result, the debate on health spending and efficiency in resource allocation has been playing an important role in the discussion of public policies related to the financing of health services, in view of the aging population[6].

In Brazil, there is a total of 45,848 adult ICU beds, 23,004 of which belong to the private sector[7]. Considering the total number of adult ICU beds and their per capita distribution in the Brazilian macro-regions, it is observed that the Southeast has the highest absolute number of beds and also the best per capita distribution, while the North region has the lowest number of beds and the worst inhabitants / bed ratio. In turn, the Northeast region has the second largest number of beds for intensive adult care, but it has the second worst relationship between inhabitants and available beds[8].

While the Unified Health System (SUS) seeks to distribute its ICU beds according to a regionalized and hierarchical health care network, in an attempt to respond to population demands, the private hospital sector does not act in a complementary way to SUS, as provided in the organic health laws, installing them where the population has financial conditions to afford the service. In addition, the segment offers intensive care in an unregulated manner, characterized by the multiplication of diagnostic and therapeutic acts, which is advantageous for service providers, but often does not bring real benefits to hospitalized patients[9].

A research of systematic literature review, carried out in the health databases, shows a greater volume of publications on the elderly with a focus on the themes of chronic diseases, geriatric syndromes, education and the prevention of aging in its biological aspect[10]. In fact, there is a shortage in the production of knowledge that seeks to understand the factors that permeate the aging population and the increase in health expenditures, especially when it comes to the private hospital system, as a complement to SUS, and that, therefore, needs to face the defence of the public health system in Brazil.

In addition, the object of study of this research materializes in the space of the determinants of health / life conditions of the elderly hospitalized in ICU, as well as, in the scope of the knowledge of the multiple facets of old age and the process of aging in Natal, capital of Rio Grande do Norte. This circumscribes a gap in the field of geriatric research that implies a fragility for care, since the health needs of a population group are directly related to their

social, demographic, economic characteristics and to the morbidity and mortality of individuals, as well as to the financial and operational capacity to meet these demands[11].

In this context, this work is included among the proposals that articulate with a necessary challenge to Public Health and the elderly in Brazil: to collaborate in budgetary discussions so that the allocation of health resources starts from the critique on the social and epidemiological reality, so they can, in the end, materialize in health actions consistent with an ethical and fair society, especially with regard to the quality of life and constitutional rights of the Brazilian elderly.

Given this perspective, the objective of the research was to analyze the association between demographic variables, morbidity and relative to the conditions of hospitalization with the expenses resulting from the admission of elderly people to the ICU of private hospitals in a capital of northeastern Brazil.

METHOD

This is an epidemiological, observational, analytical and sectional research, with a quantitative approach, carried out in the city of Natal, capital of Rio Grande do Norte. Demographic data showed that, in the past decade, 10% of the municipality's 803,739 inhabitants were elderly. In addition, the low coverage offered by primary health care services in the municipality contrasts with the growth of an elderly population in need and with difficulty in accessing services at all levels of complexity.[12].

The dependent variable of the study was the cost in Brazilian Real (R$) resulting from the elderly being admitted to the ICU. This data was initially expressed by a quantitative value, taken from the audited medical record invoice. This value refers only to what was assessed as an expense resulting from the elderly hospitalization in the ICU, disregarding the procedures charged in the hospitalization bill of other units of the Hospital.

In turn, the independent variables were divided into three groups (Chart 1): related to the characterization of individuals in terms of sociodemographic profile; referring to the morbid condition; and related to the characteristics of hospitalization. This information was obtained from medical records, more specifically from clinical records made by the medical and nursing staff.

In addition to the variables shown in the table above, information was collected on religion, ethnicity, income, marital status and occupation of the elderly. However, they presented a loss percentage >90%, due to the lack of filling in the medical records and were excluded so as not to harm the sample and the analyzes.

Chart 1. Summary chart of study variables. Natal (RN), 2019.

Spheres	Variables	Unit of measure and categories
Sociodemographic	Gender Age Age categorized Place of residence	Male Female Full years of life 60 to 79 years / 80 or more Metropolitan / Interior Region
Morbid condition	Main diagnosis pointed out as a reason for hospitalization Chronic diseases previously diagnosed Vulnerable elderly	Name of disease / condition Comorbidity + Disease Name Yes/No
Hospitalization	Length of hospital stay Categorized length of stay ICU daily rate Type of ICU Bed Reason for ICU admission Outcome of Hospitalization Total cost of ICU stay	Full days (24 hours) 1 to 9 days / 10 days or more Daily rate in Real Type I / II / III Clinical cause / Surgical recovery Discharge / Death Expenses in Real

Source: Prepared by the author, 2019.

The categorization of the age variable was based on the definition of long-lived elderly (≥80 years). The place of residence was divided between those who live in the capital and the metropolitan region and the elderly coming from the interior, as normally those who are transferred from their cities to Natal (RN) have conditions that demand complex therapeutic needs that health services in small towns lack the capacity to respond.

The length of stay was divided based on statistical criteria, which showed that the two groups behaved differently for different outcomes, such as a higher percentage of deaths in hospitalizations with 10 or more days, for example. The types of ICU beds are the same as those standardized by the Ministry of Health from Ordinance No. 3,432, of August 12, 1998. According to this legislation, ICU beds are classified into types I, II and III, in order of complexity and ascending daily price, according to the list of inputs, professionals and technologies available in the sector[13]. Finally, the elderly with significant cognitive deficits and / or with moderate or severe degrees of functional disability were classified as vulnerable.

To be included as a participant, it was necessary to be aged ≥60 years in the period of hospitalization, to have been admitted between the 1st of November 2013 and the 31st of January 2014 in the ICU of the participating institutions and to have hospitalizations paid for by users / families or by health plans. Of the 335 medical records evaluated, 23 were excluded because they were damaged or illegible. In view of these criteria, data were collected referring to 312 hospitalizations of elderly people in adult ICU beds from all five private hospitals in Natal (RN), which offer this service through a total of 54 ICU beds.

The time frame was chosen based on a pilot study, carried out in October 2013, as a way to previously dimension an estimate of cases that was consistent in relation to the objectives and methods of the study, theoretical prerequisites to be observed during the determination process of the time frame in sectional studies with a budget focus[14].

The collected data were treated using descriptive statistics and tables of absolute and percentage frequency.

The dependent variable was dichotomized by the 75 percentile (R $ 13,761.40), the values above that percentile were considered as a high-cost hospitalization. The categorical independent variables were submitted to the chi-square test and the quantitative ones were submitted to the Student's t test, with the dependent variable as a reference. The use of parametric tests was supported by the normal distribution of the data, assessed by the Kolmogorov-Smirnov test, where non-significant values ($p > 0.05$) indicate Gaussian distribution.

The variables that presented $p \leq 0.20$ were pre-selected to compose the multiple logistic regression model. In the model built by the variable insertion method (stepwise), the Odds Ratio (OR) values and their 95% confidence interval (95% CI) were transformed into Prevalence Ratio (PR) due to the study design. Sectional studies with a dichotomous outcome usually prioritize obtaining PR using Poisson, Cox and log-binomial regression methods. The main justification presented is that OR, obtained by the logistic regression method, overestimates the effects of variables on the outcome, especially in high prevalence events[15]. In order to reduce this type of bias and avoid inflated analyzes, it was obtained, through statistical formulas, the measurement of PR and its confidence intervals.

Before the field phase and the application of instruments for data collection, the research project was forwarded to the Research Ethics Committee CEP-HUOL, in accordance with the guidelines of resolution 466/12 that guides the conduct of research involving human beings in Brazil. The research project was approved by CEP-HUOL with CAAE N° 20578913.1.0000.5292.

RESULTS

Table 1 shows the sample characterization based on some sociodemographic variables and referring to the individuals' own hospitalization, in addition to a bivariate test of statistical association with the dependent variable.

Table 2 presents descriptive data for the independent variables and their bivariate analysis,

depending on the cost of ICU admission. It was possible to observe that the 312 hospitalizations resulted in an average expenditure of R $ 13,137.95 with a standard deviation of R $ 2,225.19 and 95% CI (15,363.13-10,912.76).

Table 3 shows the independent variables with an important association (p <0.20) with the dependent variable. The age variable, in its quantitative form, was not significant to enter the multiple model. In addition, the length of stay and the ICU daily rate were also excluded from the final model, as they are components of the formula that calculates all the expenditure spent and, if included, would account for the entire variance of the dependent variable.

Table 4 shows the final multiple logistic regression model. The following variables did not show p <0.20: acute myocardial infarction, angina, non-specific infectious conditions, hypertension, diabetes, heart disease, kidney disease, more than three chronic diseases, long-lived elderly and a history of smoking.

The regression model for hospitalizations in the private network presented four significant variables. As for the analysis of residues, there were five cases with residue values greater than 2 and a Hosmer and Lemeshow test of 0.82. From a statistical point of view, that of this test is not significant (p> 0.05) already indicates adjustment in the model. However, the closer to 1, the better the final adjustment is. Another criterion used to demonstrate the quality of the modeling is the analysis of residues that have values above 2. This highlights the cases that do not fit the precepts indicated in the model. What is expected is that the number of cases in this situation does not exceed 10% of the sample value[16]. Still in order to maintain an appropriate adjustment, all variables in the model were tested for collinearity and there was no significant association that could overestimate any of the values presented.

Table 1. Descriptive and bivariate analysis of sociodemographic and hospitalization variables. Natal (RN), 2019.

Variables	n (%)	Cost		*p* (χ^2)
		High n (%)	Low n (%)	
Gender				
Male	149 (47.8)	40 (51.3)	109 (46.6)	0.47
Female	163 (52.2)	38 (48.7)	125 (53.4)	
Age (years)				
Between 60 and 79	198 (63.5)	47 (60.3)	151 (64.5)	0.49
80 or more	114 (36.5)	31 (39.7)	83 (35.5)	
Residence				
Metropolitan region	290 (92.9)	73 (93.6)	217 (92.7)	0.79
Interior	22 (7.1)	5 (6.4)	17 (7.3)	
Length of Hospitalization (days)				
1 to 9	249 (79.8)	17 (21.8)	232 (99.1)	<0.001
10 or more	63 (20.2)	61 (68.2)	2 (0.9)	
Outcome				
Discharge	247 (79.2)	45 (57.7)	202 (86.3)	<0.001
Death	65 (20.8)	33 (42.3)	32 (13.7)	
Type of ICU bed				
I	110 (22.3)	18 (23.1)	92 (39.3)	<0.009
II	202 (64.2)	60 (76.9)	142 (60.7)	
III*	0 (0.0)	0 (0)	0 (0)	

Data collected for research, 2019.

*There were no type III beds registered during the data collection period.

Table 2. Descriptive and bivariate analysis of the study's quantitative variables. Natal (RN), 2019.

Variables	N	Average	Standard deviation	*p* value*
Age (years)				
High cost	78	76.21	9.83	0.58
Low cost	234	74.89	10.18	
Length of hospital stay (days)				
High cost	78	16.96	10.35	<0.001
Low cost	234	2.83	2.14	
ICU daily rate (R$)				
High cost	78	620.21	115.39	0.04
Low cost	234	624.75	134.67	
Expenditure on ICU admission (R$)				
High cost	78	39,753.16	24,929.12	<0.001
Low cost	234	4,266.05	3,322.50	

Source: Data collected for research, 2019.

*Student's t test.

Table 3. Variables selected for the multiple logistic regression analysis of intensive care admissions by the significance of the chi-square test. Natal (RN), 2019.

Variable		Low cost (%)	High cost (%)	PR* (95%CI)**	*p* (χ^2)
Pneumonia	No	216 (80.0)	54 (20.0)	2.85 (1.92 - 4.25)	<0.001
	Yes	18 (42.9)	24 (57.1)		
Mechanical ventilation	No	202 (79.2)	53 (20.8)	2.11 (1.41 - 3.15)	<0.001
	Yes	32 (56.1)	23 (43.9)		
Respiratory disease	No	185 (80.8)	44 (19.2)	2.13 (1.15 - 3.12)	<0.001
	Yes	49 (59.0)	34 (41.0)		
Unconscious	No	200 (79.4)	52 (20.6)	2.10 (1.41 - 3.13)	<0.001
	Yes	34 (56.7)	26 (43.3)		
Vulnerable	No	170 (80.6)	41 (19.4)	1.89 (1.29 - 2.75)	0.001
	Yes	64 (63.4)	37 (36.6)		
Sepsis	No	218 (77.9)	62 (22.1)	2.26 (1.42 - 3.59)	0.001
	Yes	16 (50.0)	16 (50.0)		
Hospitalization for clinical reason	No	93 (85.3)	16 (14.7)	2.07 (1.30 - 3.30)	0.002
	Yes	141 (69.5)	62 (30.5)		
Disoriented	No	187 (78.2)	52 (21.8)	1.63 (1.09 - 2.44)	0.017
	Yes	47 (64.4)	26 (35.6)		
Previous Stroke	No	205 (77.1)	61 (22.9)	1.61 (1.02 - 2.57)	0.043
	Yes	29 (63.0)	17 (37.0)		
Bedridden at home	No	201 (77.0)	60 (23.0)	1.53 (0.97 - 2.41)	0.063
	Yes	33 (64.7)	18 (35.3)		
Dementia Syndrome	No	205 (76.8)	62 (23.3)	1.53 (0.95 - 2.44)	0.077
	Yes	29 (64.4)	16 (35.6)		
Congestive heart failure	No	214 (76.4)	66 (23.6)	1.59 (0.93 - 2.70)	0.085
	Yes	20 (62.5)	12 (37.5)		
Cancer	No	199 (76.5)	61 (23.5)	1.39 (0.88 - 2.20)	0.161
	Yes	35 (67.3)	17 (32.7)		

Source: Data collected for research, 2019.

*Prevalence ratio; **95% Confidence Interval.

Table 4. Multiple Logistic Regression Model of hospitalizations in the private intensive care network[a]. Natal (RN), 2019.

Variables in the equation	B*	S.E.**	Wald	Df***	Sig[b]	PR[c] (95%CI)[d]
Respiratory disease	0.732	0.306	5.728	1	0.017	2.48 (1.48 - 5.24)
Mechanical ventilation	1.160	0.341	11.555	1	0.001	2.33 (1.43 - 3.78)
Hospitalization for clinical reason	0.724	0.332	4.748	1	0.029	1.81 (1.06 - 3.09)
Disoriented	0.801	0.314	6.488	1	0.011	1.81 (1.15 - 2.84)

Source: Data collected for research, 2019.

DISCUSSION

The most frequent diagnoses among the elderly hospitalized in intensive care were due to diseases related to the circulatory and respiratory systems, in addition to hypertensive crises. As for comorbidities, it is worth noting that most elderly people had three or more chronic diseases at the time of admission, the most common being hypertension, diabetes and heart problems. Nogueira et al.[17] and Fuchs et al.[18] found in their studies similar clinical profiles of elderly patients admitted to the ICU, with a high prevalence of respiratory and cardiovascular problems among the causes of hospitalization and a high percentage of chronic diseases secondary to the main diagnosis.

It is perceived that, in order to achieve better health conditions for these individuals, reduce the complications resulting from diseases that are sensitive to Primary Health Care (PHC), such as chronic diseases, maximize their quality of life and, consequently, reduce spending on hospitalizations in ICU, it would be important to consider the implementation of a longitudinal care management proposal for the elderly in high, medium and low complexity services. Thus, strategies for health promotion and disease prevention aimed at the elderly need to be thought of in a broad program, organized in hierarchical levels, with guarantee of interprofessional and comprehensive assistance, in which actions are thought of individually, considering the particularities of each individual[19].

It was possible to notice that the age between 60 and 79 or ≥80 years was not associated with a higher rate of hospitalization (Table 1). Other studies, however, recognize that hospitalization costs among long-lived elderly people were higher, demonstrated only in a bivariate analysis.[5,20]. One of them found that the cost / inhabitant ratio increases 1.85 times in the 60 to 69 age group, 2.65 in the 70 to 79 age group and 3.05 times in the ≥80 age group.[20]. This perspective demonstrates the need for further research, preferably with longitudinal designs, which can assess the variables associated with the high cost of hospitalization in the ICU, also taking into account the construction of multiple models of statistical analysis, as proposed in the present study.

One of the variables present in the multiple model of analysis of this study, as a prognosis for high cost of hospitalization, were diseases of the respiratory tract, which presented a frequency of 28% of total hospitalizations. A similar finding was identified by Piuvezam et al.[21], demonstrating that pulmonary infections, pulmonary and extrapulmonary tuberculosis showed a positive correlation with the expenses related to hospitalization of the elderly, confirming that diseases of the respiratory system significantly burden hospitalization.

Among respiratory diseases, it was identified that 57.1% of the total cases of infectious pneumonia were considered to be of high cost (Table 3). This disease appears as one of the main respiratory pathologies that affect the elderly population, in addition to being related to high morbidity and mortality and higher hospitalization expenses for the elderly.[22]. Ribeiro et al.[23], in a study analyzing the expenses related to the admission of elderly people to the ICU for three pathologies, pneumonia, coronary disease and stroke, in the cities of São Paulo, Rio de Janeiro and Belo Horizonte, identified that 53.7% of the total expenditure was related to hospitalization due to pneumonia. Thus, it is possible to evidence the association between infectious pneumonia

among the elderly and the increase in spending on hospitalization of the elderly in the ICU, even in regions with different climates, as is the case in the southeast and northeast of Brazil..

The high incidence of pneumonia and its relationship with the increase in expenses in the ICU occurs even in the face of systematic vaccination of the elderly, in campaigns promoted by the federal government across the country, annually[24]. Even in the face of this apparent contradiction, there is sufficient evidence in the scientific literature that influenza vaccination is associated with reduced mortality and lower hospitalization rates[25].

However, the admission of elderly people to the ICU for infectious respiratory causes must involve measures that go beyond vaccination against influenza and pneumonia. It is necessary to implement strategies for the management of chronic conditions that are more comprehensive and focused on the groups at greatest risk, such as, for example, the longest-living elderly and / or those who are bedridden. Since a significant part of these individuals have muscle weakness, inefficient cough and impaired ciliary function, favoring the accumulation of secretion in the airways and the appearance of infections in the respiratory tract[26].

Among hospitalizations of elderly people in the ICU, 17.6% of the individuals had a need for mechanical ventilation at the time of admission to the sector, being associated with higher hospitalization expenses in the multiple analysis. The scientific literature corroborates these findings and highlights mechanical ventilation as a factor related to a longer length of stay for the elderly in the ICU, increased mortality, higher expenses and lower cost-effectiveness ratio[18,27-30]. Therefore, once mechanical ventilation is instituted, it is important to establish monitoring and adequate management of respiratory function to identify any complications, constantly evaluate the response to treatment and perform ventilatory weaning as soon as possible.

In addition to the issue of clinical severity, the association of mechanical ventilation with higher expenses in the private intensive care network can also find explanatory elements in the way expenses are composed. The hospitalization is invoiced according to the number of daily stays in the ICU and, additionally, fees related to the use of artificial ventilation equipment, amounts related to the volume of oxygen and compressed air used over time, and expenses related to the need for specialized procedures, such as respiratory physiotherapy and pulmonologist evaluation.

The type of hospitalization, classified as clinical or surgical, was also associated with high expenditure in the multiple regression model. In these cases, patients who were hospitalized due to clinical conditions that had a higher expense for ICU admission. A survey of 22,710 elderly people found that patients who underwent surgical intervention remained less days in intensive care and had a lower cost of hospitalization compared to those hospitalized for clinical reasons.[31]. In addition, the study by Fuchs et al.[18] highlights that the clinical hospitalization of elderly people in the ICU is associated with greater severity, loss ratio and costs, when compared to surgical interventions.

However, in order to obtain more precise measures on this data, it is necessary to work with two potential confounding variables. First of all, it would be important to compare clinical admissions with emergency and elective surgeries, separately. The hypothesis raised here is that acute and unexpected interventions may explain the greater use of resources in the ICU, regardless of the type of hospitalization, since elective surgeries are usually preceded by risk assessments that include blood, cardiovascular and respiratory aspects that allow a prior planning, which cannot be done in emergency surgeries and clinical hospitalizations.

Complete or partial disorientation at the time of admission of the elderly person was also associated with a higher expenditure on hospitalizations. This finding corroborates the results obtained by Vasilevskis et al.[32], which identified, from a prospective cohort study, that disorientation is directly associated with the increase in expenses related to ICU admissions. The importance of the variable for the phenomenon studied is also confirmed by some of the main instruments used to assess the prognosis of an intensive care stay, such as the Acute Physiology and Chronic Health Evaluation (APACHE II), the Sequential Organ

Failure Assessment (SOFA) and the Logistic Organ Dysfunction System (LODS), which use the variable as a criterion in their scores[33].

Thus, the disorientation of hospitalized elderly patients is a challenge for the entire team of health professionals in a hospital. Firstly, because it is a common, highly prevalent event with which many professionals are not qualified to promote specialized care. In addition, the disorientation in the elderly makes work more stressful for the team, requires different management and a greater number of professionals available to provide due care[34].

In this regard, the relevance of building protocols and lines of care is perceived, taking into account the particularities of the elderly public, and the use of instruments to manage their clinical condition and assess their prognosis. For that, it is possible to use disease severity assessment tools, such as those already mentioned, APACHE II, SOFA and LODS, even though they are not created and validated specifically for the elderly.

Therefore, the creation of validated prognostic assessment tools for the elderly could improve health care provided in the ICU, the work process of intensive care professionals and, consequently, reduce hospitalization costs in the sector. It is based on the premise that properly conducting treatment and care for the elderly in intensive care, optimizing resources according to individual health needs, can directly influence the cost of hospitalization.

This narrows a knowledge gap that may be the North for further research. Therefore, it is suggested that longitudinal studies, with robust samples and that have the purpose of analyzing the increase in expenditure over the entire course of hospitalization in intensive care, depending on the use of clinical assessment instruments, may be conducted.

The limitations of the study refer mainly to its cross-sectional design, which cause and effect are measured in the same time interval, however, this methodological approach allowed the analysis of hospitalization costs for a greater number of patients outside large more traditional urban centers of the south / southeast Brazilian axis.

CONCLUSION

The present study observed that age equal to or greater than 80 years was not associated with a higher rate of hospitalization and that a considerable part of the hospitalizations of elderly people in intensive care was caused by clinical conditions, which were mostly due to diseases related to the circulatory and respiratory systems. In addition, when analyzing the factors associated with the high cost of hospitalization of the elderly in intensive care, it was found that hospitalization due to clinical and respiratory conditions, the need for mechanical ventilation and complete or partial disorientation at the time of admission were associated with higher spending on hospitalizations.

In view of the discussions inherent to the expenses resulting from hospitalizations of elderly people in intensive care and its association with demographic factors, morbidity and relative to the conditions of hospitalization, the knowledge produced by the study may serve as a subsidy for the formulation and implementation of actions capable of promoting better health conditions for the elderly, maximize their quality of life and reduce hospitalization-related expenses in highly specialized sectors.

During the course of hospitalization, the research raises evidence that the construction of protocols and lines of care guiding the work process in the intensive care sector, specifically created for the elderly, through the use of clinical management tools and prognostic assessment , can be important in reducing expenses resulting from hospitalization of the elderly.

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Prevalence of diagnosis and types of cancer in the elderly: data from National Health Survey 2013

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Abstract

Objective: Estimate the prevalence of medical diagnosis of cancer in the elderly, describe the types of cancer, limitations in daily activities, health self-assessment, and the relationship between cancer and chronic diseases/conditions. *Methods*: Cross-sectional population-based study using data from the elderly (n=11,177) who participated in the National Health Survey (PNS/2013). Prevalence and 95% confidence intervals were estimated. *Results*: The mean age was 69.8 years ($CI_{95\%}$:69.5-70.1) and 56.4% ($CI_{95\%}$:54.8-58.0) were women. The diagnosis of cancer was mentioned by 5.6% ($CI_{95\%}$:5.0-6.4) of the elderly, is higher for men (7.1%) than in woman (4.7%; p<0.001). The three main types of cancer were, in men: prostate (52.4%; $CI_{95\%}$:43.5-61.2), skin (13.9%; $CI_{95\%}$:9.1-20.6) and intestine (10.6%; $CI_{95\%}$:4.9-21.5); in women: breast (46.9%; $CI_{95\%}$:40.6-53.3), skin (17.3%; $CI_{95\%}$:14.2-20.8) and intestine (9.8%; $CI_{95\%}$:6.5-14.5). About 67% were diagnosed after age 60, 33.0% reported some limitations due to the disease and 16.8% ($CI_{95\%}$:12.4-22.4) rated their health as bad/very bad. The presence of limitation was about 31% higher in those with a more recent diagnosis and self-perceived health was worse in those with a diagnosis of fewer than 5 years. In the elderly with cancer, there was a higher prevalence of hypertension, heart disease, depression, and chronic respiratory diseases (p<0.05). *Conclusion:* The findings show the prevalence of cancer in the Brazilian elderly, with differences between genders, and the distribution of the main types and the age of the first diagnosis. The importance of hypertension, heart disease, depression, and respiratory diseases is highlighted, as well as other living and health conditions of the elderly in oncogeriatric care.

Keywords: Health of the Elderly. Neoplasms. Chronic Disease. Health Surveys. Prevalence. Brazil.

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INTRODUCTION

Cancer is a multicausal disease and its relationship with environmental, cultural, socioeconomic risk factors, lifestyles (mainly obesity, smoking, alcohol consumption, physical inactivity and unhealthy diet), in addition to genetic factors and population aging, is known[1-3].

Globally, demographic and epidemiological transitions signal the growing importance of cancer in the coming decades[1,4,5]. As a cause of death, in most countries[6], and in Brazil[7], it is supplanted only by cardiovascular diseases. It is estimated that in 2025, the cancer burden will increase by 50% due to an aging population and an increase in lifestyle risk factors[3].

Considering the distribution of deaths by type of cancer according to gender in the elderly, for the period 1996-2016, the main among men corresponded to malignant neoplasm of the prostate (18%), followed by malignant neoplasm of trachea, bronchi and lungs (12%). In women, malignant breast neoplasms accounted for 12% and trachea, bronchi and lungs accounted for 11%[7]. Estimates of cancer incidence in Brazil, carried out by the National Cancer Institute (INCA), point to a total of 625 thousand new cases for each year of the 2020-2022 triennium, with a higher incidence for non-melanoma skin cancer (177 thousand), followed by breast and prostate cancers (66 thousand each)[8].

Data from the National Household Sample Survey (PNAD) of 2008 showed that the prevalence of cancer in the ages between 60 and 69 years, 70 to 79 and 80 years or more, were 1.93%, 3.11% and 3.57%, respectively[9]. In addition to investments in prevention policies and the necessary assistance to cancer patients[3,10,11], with the aging of the population there is also a demand for the expansion of training for oncogeriatric care[12].

A previous study conducted with data from the National Health Survey (PNS 2013)[13] presented estimates for individuals diagnosed with cancer in Brazil (age ≥18 years), disaggregating the elderly population. However, in relation to the type of cancer and average age for the first diagnosis, the data refer to the group of adults[13]. Specific information for the elderly, and according to gender, would make it possible to better estimate the demand for care in this subgroup, since most elderly people have concomitant diseases that can hinder cancer treatment. Therefore, the aim of the present study was to estimate the prevalence of medical diagnosis of cancer in the elderly, describe the types of cancer, limitations in daily activities, self-perceived health and the relationship with chronic diseases / conditions.

METHODS

Cross-sectional population-based study, conducted with public domain data of elderly people (age ≥60 years) who participated in the National Health Survey (PNS), a survey conducted by the Ministry of Health in partnership with the Brazilian Institute of Geography and Statistics (IBGE) in 2013. The survey's micro data are available on the website: https://www.ibge.gov.br. PNS used cluster sampling in three stages, with census sectors as the primary unit, and households as secondary units. Households and residents were selected by simple random sampling[14].

The questionnaire applied by the PNS is divided into three parts: data on the household; information related to all residents, provided by a selected resident (proxy); and information about this resident, answered by himself (adults aged ≥18 years). Detailed descriptions of the sampling process and weightings are available in previous publications[14].

For the present study, all research participants aged ≥60 years who answered the question of interest for this study, from the block on chronic diseases, were selected: "*Has any doctor ever given you a diagnosis of cancer*?" (yes or no) (n = 11,177), according to gender (male, female) and age groups (60-69; 70-79 and ≥80). If so, the following question was asked: "*In the first cancer diagnosis, what type of cancer do you have or have you had?*" (lung, intestine, stomach, skin, breast and cervix - only for women, prostate - only for men, and others), their age at the time of diagnosis (used to estimate the time elapsed from the first diagnosis), and the limitation through the question: "*In general, to what degree does cancer or any problem caused by cancer limit your usual activities (such as working, doing household chores,*

etc.)?" (does not limit, a little, moderately, intensely and very intensely).

Health self-assessment (very good / good, regular, bad / very bad) and information regarding the presence of other chronic diseases / conditions were also considered, through medical diagnosis referred by the interviewee about: arterial hypertension, diabetes mellitus, heart disease, stroke, asthma, arthritis or rheumatism, chronic kidney failure, chronic back problem (such as chronic back or neck pain, low back pain, sciatica, vertebrae or disc problems), depression, lung disease or chronic obstructive pulmonary disease - COPD (pulmonary emphysema, chronic bronchitis or other). In particular, chronic back pain was self-reported and depression considered a previous diagnosis by a doctor / mental health professional (psychiatrist or psychologist).

The prevalence and the respective 95% confidence intervals were estimated, as well as the projection of the absolute number of cancer cases, by expanding the sample to the total of the elderly Brazilian population. The percentage distribution of the types of cancer was described by the relative point frequencies and by interval (weighted). Proportion comparison tests (Pearson's chi-square with Rao-Scott correction; significance level of 5%) were performed and prevalence ratios were estimated by Poisson regression, adjusted for gender and age.

All analyzes were performed on Stata 14.0 (StataCorp LP, College Station, USA). The PNS was approved by the National Commission of Ethics in Research for Human Beings, of the Ministry of Health, under opinion No. 328.159, of June 26, 2013.

RESULTS

The average age of the elderly was 69.8 years ($IC_{95\%}$: 69.5-70.1) and 56.4% ($CI_{95\%}$: 54.8-58.0) were women. The prevalence of cancer (in life) in the elderly population was 5.6% ($CI_{95\%}$:5.0-6.4), which corresponds, in absolute number, to approximately 1,473,727 elderly people in the Brazilian population. Among the elderly who reported a medical diagnosis of cancer, the prevalence limited to the time of diagnosis in the last 5 years was 45.2% ($CI_{95\%}$:38.9-51.5). For the group of elderly people who reported the disease, the mean age was 71.6 years ($CI_{95\%}$:70.6-72.5). There was a statistical difference between genders (7.1% in men and 4.7% in women; $p<0.001$).

Regarding the sociodemographic characteristics of the elderly who reported a diagnosis of cancer, the majority were male (54.3%), white (71.7%), lived with a spouse (58.0%), without education or with incomplete primary education (62.0%), did not have a health plan (54.7%), was diagnosed with the disease aged 60 or over (66.7%) and did not report any limitation in habitual activities resulting from the disease or related to it (67.0%). Only 16.8%($CI_{95\%}$:12.4-22.4) of the elderly considered their health poor or very bad at the time of the research. Among the elderly aged 60 to 69 years, 77.7% ($CI_{95\%}$:70.3-83.7) reported medical diagnosis of cancer before age 60. In those aged ≥ 70 years, 62.8% ($CI_{95\%}$:55.9-69.2) reported a diagnosis ≥ 60 years old ($p <0.001$) (Table 1).

In assessing the distribution of any cancer diagnosis according to gender and age group, a higher percentage was observed for men aged 80 years or older ($p <0.009$) (Figure 1).

Considering the specific types of cancer, in men, the three main ones were: prostate (52.4%; $CI_{95\%}$: 43.5-61.2), skin (13.9%; $CI_{95\%}$: 9.1- 20.6) and intestine (10.6%; $CI_{95\%}$: 4.9-21.5); in women, breast (46.9%; $CI_{95\%}$: 40.6-53.3), skin (17.3%; $CI_{95\%}$: 14.2-20.8) and intestine (9.8%; $CI_{95\%}$: 6.5-14.5) (Figure 2).

On average, cancer was identified 10.8 years ago ($CI_{95\%}$: 9.4-12.2) in women and 7.4 years ago ($CI_{95\%}$: 6.5-8.4) in men. For lung, bowel, stomach, skin and other cancers, there was no statistical difference according to gender ($p> 0.05$) (Figure 3).

Table 1. Distribution of sociodemographic and health-related characteristics of the elderly, according to age groups. National Health Survey, 2013.

Variables	Total (n=542) n (%)	60-69 years (n=260) % ($CI_{95\%}$)	≥70 years (n = 282) % ($CI_{95\%}$)	*p*
Gender				
Male	238 (54.3)	48.0 (39.6 - 56.5)	52.0 (43.4 - 60.4)	0.330
Female	304 (45.7)	53.8 (46.6 - 60.9)	46.2 (39.1 - 53.4)	
Color				
White	369 (71.7)	49.3 (42.2 - 56.5)	50.7 (43.5 - 57.8)	0.439
Not white	173 (28.3)	54.1 (44.9 - 63.0)	45.9 (37.0 - 55.1)	
Lives with spouse or partner*				
Yes	239 (58.0)	57.1 (48.2 - 65.5)	42.9 (34.4 - 51.8)	0.015
No	303 (42.0)	41.8 (34.9 - 49.1)	58.2 (50.9 - 65.1)	
Highest education level reached*				
Uneducated and Incomplete Elementary	298 (62.0)	43.3 (36.0 - 50.9)	56.7 (49.1 - 64.0)	0.001
Complete Elementary to Middle Complete / Higher Incomplete / Complete	244 (38.0)	62.7 (54.7 - 70.0)	37.3 (30.0 - 45.3)	
Health Plan				
No	252 (54.7)	50.6 (43.4 - 57.7)	49.4 (42.3 - 56.6)	0.980
Yes	290 (45.3)	50.8 (40.8 - 60.6)	49.2 (39.3 - 59.2)	
Age (years) at first diagnosis*				
Less than 60	190 (33.3)	77.7 (70.3 - 83.7)	22.3 (16.3 - 29.7)	<0.001
60 or more	352 (66.7)	37.2 (30.7 - 44.1)	62.8 (55.9 - 69.2)	
Health self-assessment				
Very good / good	220 (40.7)	51.5 (42.6 - 60.3)	48.5 (39.7 - 57.4)	0.894
Regular	235 (42.5)	51.1 (43.4 - 58.7)	48.9 (41.3 - 56.6)	
Bad / very bad	87 (16.8)	47.6 (32.4 - 63.2)	52.4 (36.8 - 67.6)	
Limitation of usual activities				
No	364 (67.0)	52.8 (45.0 - 60.5)	47.2 (39.5 - 54.9)	0.313
Yes	178 (33.0)	46.2 (37.7 - 55.0)	53.8 (45.0 - 62.3)	
Time (years) after the first diagnosis				
Up to 5	247 (45.2)	53.4 (44.3 - 62.2)	46.6 (37.7 - 55.6)	0.449
Six or more	295 (54.8)	48.4 (40.6 - 56.3)	51.6 (43.6 - 59.4)	

$CI_{95\%}$: Confidence Interval (α=0.05); *P values obtained by the Chi-square test (Rao-Scott);

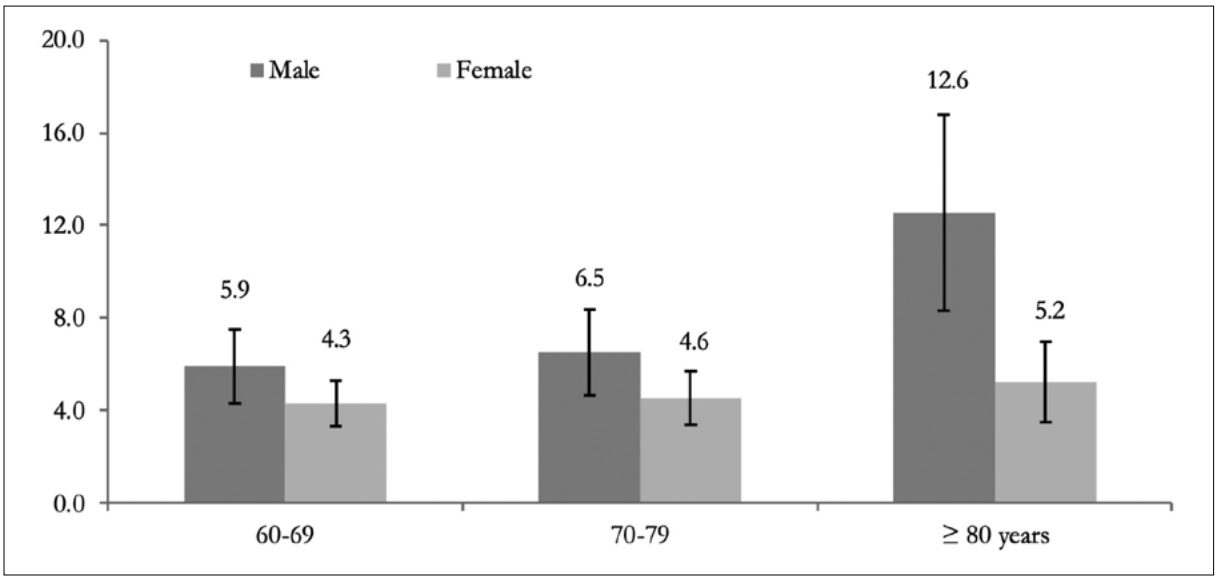


Figure 1. Distribution in age groups (proportion and 95% confidence interval) of the elderly who reported a medical diagnosis of cancer. National Health Survey, 2013.

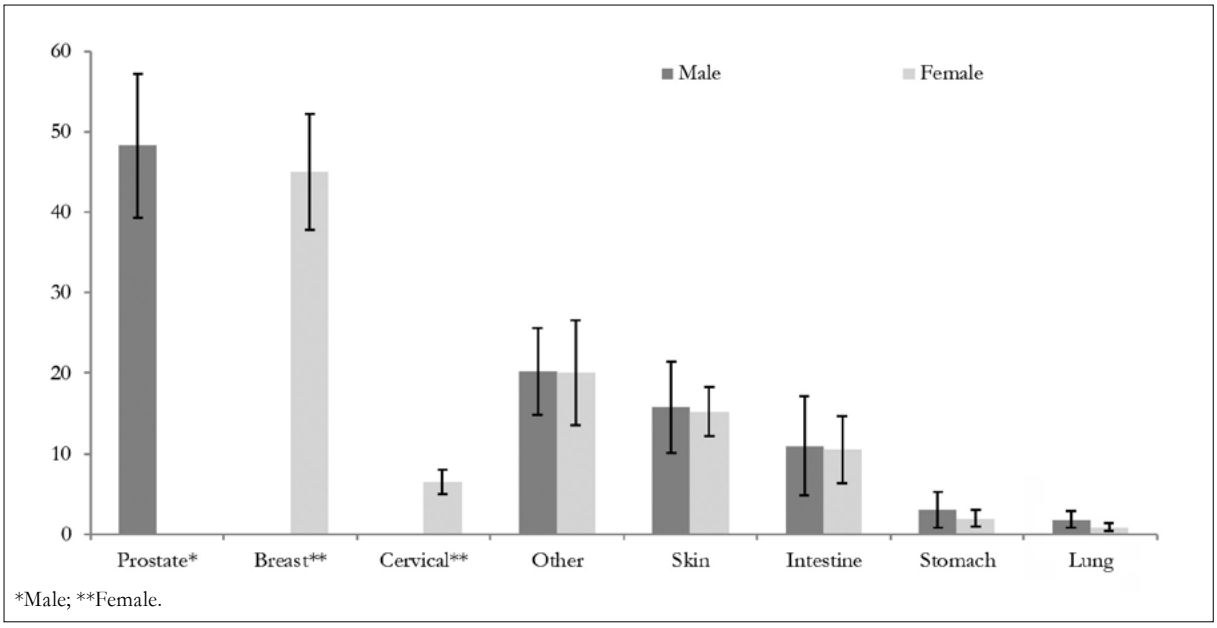
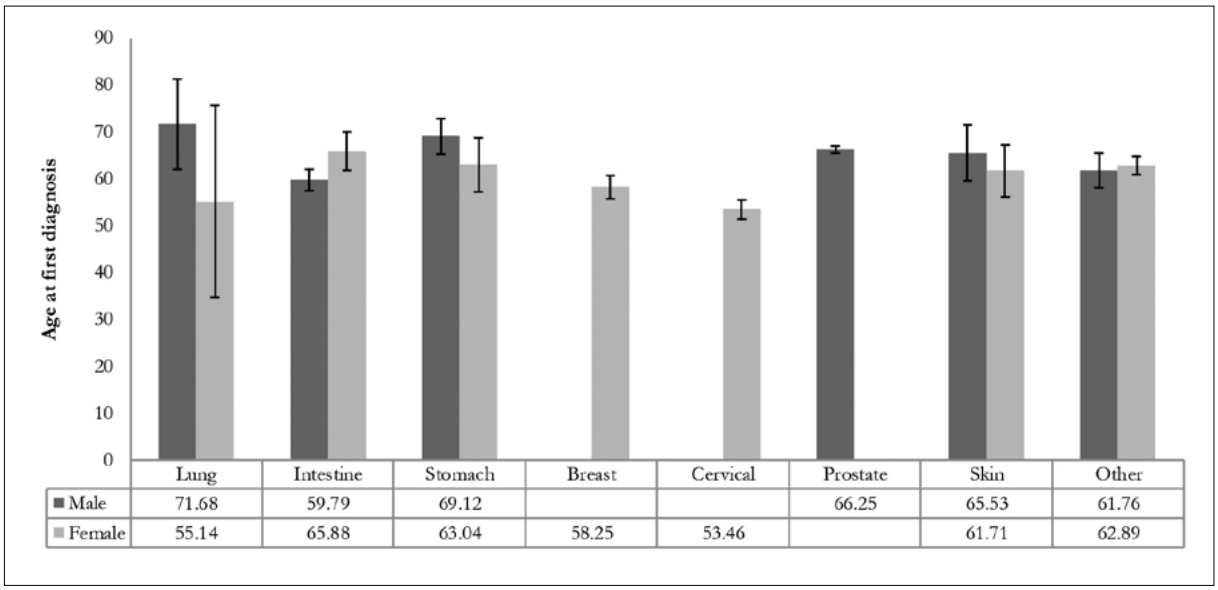


Figure 2. Distribution (proportion and indication of the 95% confidence interval) of the types of cancer reported by the elderly in the first diagnosis. National Health Survey, 2013.



	Lung	Intestine	Stomach	Breast	Cervical	Prostate	Skin	Other
Male	71.68	59.79	69.12			66.25	65.53	61.76
Female	55.14	65.88	63.04	58.25	53.46		61.71	62.89

Figure 3. Average age reported in the first cancer diagnosis, by type of cancer, according to gender. National Health Survey, 2013.

As for the limitation due to the disease or problem resulting from it for carrying out usual activities, 34.9% of men and 30.7% of women reported some limitation (p> 0.05). In the analysis stratified by the time elapsed from diagnosis (<5 years and ≥5 years) adjusted for gender, age and number of chronic diseases, the occurrence of some limitation was about 31% higher in those most recently diagnosed (RP=1,31; $IC_{95\%}$:1,02-1,70; *p*=0,037). Likewise, self-perceived health status was worse in the elderly with a diagnosis time of less than 5 years (PR = 1.65; $IC_{95\%}$: 1.13-2.41; p = 0.010), regardless of gender, age and the presence of other chronic diseases.

The prevalence of hypertension, heart disease (heart attack, angina, heart failure or other), depression and lung disease or Chronic Obstructive Pulmonary Disease-COPD (pulmonary emphysema, chronic bronchitis or other) was higher in the elderly diagnosed with cancer, even after adjusting for gender and age (Table 2).

Table 2. Chronic diseases and health conditions in the elderly, according to medical diagnosis of cancer (n=11,177). National Health Survey, 2013.

Chronic diseases	Cancer		*p*	$RP_{adjusted}$ ($CI_{95\%}$)
	Yes (n=542) % ($CI_{95\%}$)	No (n=10.635) % ($CI_{95\%}$)		
Arterial hypertension				
No	41.6 (35.5 - 47.8)	49.2 (47.4 - 50.9)	0.020	1.00
Yes	58.4 (52.2 - 64.4)	50.8 (49.1 - 52.6)		**1.16 (1.04 - 1.29)**
Diabetes				
No	81.7 (75.6 - 86.6)	80.9 (79.6 - 82.1)	0.762	1.00
Yes	18.3 (13.4 - 24.4)	19.1 (17.9 - 20.4)		0.96 (0.71 - 1.30)
High cholesterol				
No	72.2 (65.2 - 78.2)	74.2 (72.6 - 75.7)	0.550	1.00
Yes	27.8 (21.8 - 34.8)	25.8 (24.3 - 27.4)		1.17 (0.92 - 1.50)
Heart disease				
No	80.7 (74.6 - 85.6)	89.0 (87.8 - 90.1)	<0.001	1.00
Yes	19.3 (14.4 - 25.4)	10.9 (9.8 - 12.2)		1.69 (1.26 - 2.25)
Stroke				
No	92.6 (87.2 - 95.8)	95.2 (94.5 - 95.9)	0.139	1.00
Yes	7.4 (4.2 - 12.8)	4.8 (4.1 - 5.5)		1.36 (0.78 - 2.37)
Asthma (or asthmatic bronchitis)				
No	93.3 (88.5 - 96.2)	95.4 (94.6 - 96.0)	0.222	1.00
Yes	6.7 (3.8 - 11.5)	4.6 (4.0 - 5.4)		1.49 (0.83 - 2.66)
Arthritis or rheumatism				
No	82.9 (77.4 - 87.3)	83.6 (82.3 - 84.8)	0.785	1.00
Yes	17.1 (12.7 - 22.6)	16.4 (15.2 - 17.7)		1.11 (0.82 - 1.50)
Chronic spine problem**				
No	66.8 (59.9 - 73.1)	72.2 (70.6 - 73.7)	0.103	1.00
Yes	33.2 (26.9 - 40.1)	27.8 (26.3 - 29.4)		1.22 (1.00 - 1.50)
Depressão				
No	88.3 (83.9 - 91.7)	90.6 (89.5 - 91.6)	0.236	1.00
Yes	11.7 (8.3 - 16.1)	9.4 (8.42 - 10.5)		1.44 (1.02 - 2.03)
Lung disease or COPD***				
No	92.6 (87.8 - 95.6)	96.4 (95.6 - 97.0)	0.011	1.00
Yes	7.4 (4.4 - 12.2)	3.6 (3.0 - 4.4)		**1.93 (1.12 - 3.33)**
Chronic kidney failure				
No	94.2 (88.4 - 97.2)	97.4 (96.8 - 97.9)	0.035	1.00
Yes	5.8 (2.8 - 3.4)	2.6 (2.1 - 3.2)		2.05 (0.99 - 4.23)

$CI_{95\%}$: Confidence Interval ($\alpha = 0.05$); $RP_{adjusted}$: by gender and age; **Chronic spine problem: chronic back or neck pain, low back pain, sciatica, vertebrae or disc problems; ***COPD: Chronic Obstructive Pulmonary Disease (pulmonary emphysema, chronic bronchitis or other).

DISCUSSION

This study estimated the percentage of elderly Brazilians diagnosed with cancer and found a difference between genders. The diagnosis occurred mainly after the age of 60, and about 1/3 of the elderly referred to some limitation for daily activities. Worse subjective health assessment was associated with the most recent identification of the disease. The prevalence of arterial hypertension, cardiovascular disease, depression and lung disease were higher in the elderly with a previous diagnosis of cancer.

Cancer is a disease that mainly affects the elderly, as more than 60% of new cases occur above 60 years of age, as observed in this study. Of all cancer cases in the world, about 70% occur after age 65[1,5,10]. In Brasil, incidence[15] and prevalence[13] rates for all types of cancer are three or four times higher in the elderly compared to adults.

With the increase in the proportion of elderly people in the population, it is expected that a greater number of elderly individuals will be diagnosed with cancer[1,5.] It is noteworthy that both early detection and new forms of treatment increase the survival of people with this condition[4,16]. For the group of elderly Brazilians, on average, the identification of the disease occurred about nine years ago.

In this study, 33% of the elderly reported that cancer, or some problem caused by it, caused a limitation in their usual activities, such as working, doing household chores, among others. Systematic review and meta-analysis on inability to perform daily activities in adults with cancer, comprising 19,246 patients (mostly elderly), revealed that, in general, 36.7% and 54.6% of patients reported disability, respectively related to basic and instrumental activities of daily living[17]. A study on the relationship between disability and cancer factors in the oldest elderly (n = 290; mean age 80.6 years) with various types of cancer, participants in the prospective cohort study The Physical Frailty in Elderly Cancer (France), found prevalence of 67.6%. No oncological factors (location or extent of cancer) were associated with disability, however, mobility impairment (mobility), worse functional status, depressed mood, cognitive impairment and poly pharmacy were independently associated with disability[18].

It should be noted that, for the group of elderly Brazilians, Silva et al.[19] found a prevalence of 30.1% of functional limitation, attributed to any difficulty in performing at least one of the basic and instrumental activities considered. Other national population-based studies with representative samples of the elderly carried out in the South and Southeast regions of Brazil, in Pelotas (RS)[20] and Belo Horizonte (MG)[21], showed similar prevalences. In the present study, a higher prevalence of limitation was observed in those with more recent diagnosis, which may be due to treatment. A study carried out in the Northeast region of Brazil, in Recife (PE)[22], identified worsening of the physical performance of the elderly after starting chemotherapy, and for those with prostate cancer, there was a worsening of their general condition and quality of life.

Both the state of health and the subjective perception of health vary according to the time elapsed from diagnosis. Among elderly people who reported a diagnosis of cancer, about 17% considered their health bad or very bad at the time of the research, with a higher frequency observed in those with a diagnosis time of less than 5 years (23.5% versus 11.4%), regardless of gender, age and the presence of other chronic diseases. Self-rated health is an indicator that integrates the individual's biological, psychological and social perception, reflecting the presence of functional limitations and quality of life, in addition to being considered a predictor of mortality[23,24]. Still, it is considered an important indicator of the impact of the disease on individual well-being[24].

Estimates obtained by gender and age groups revealed a higher percentage of older men (age ≥80 years) with a diagnosis of cancer. Data from the National Health Survey indicated, for the Brazilian adult population (≥18 years old), that the average age of the first diagnosis of prostate and breast cancer was 65.7 and 49.0 years, showing the differences in terms of the age at which the highest incidence and prevalence of the main types that affect men and women, respectively[13]. Increased incidence rates of

prostate cancer have been observed in the country due to increased life expectancy, improved diagnostic methods and case records/notification, in addition to greater use of prostate specific antigen (PSA) and digital rectal examination for the diagnosis of neoplasia[15]. Such advances have resulted in a greater proportion of patients cured or surviving longer[25].

In the trend of age-adjusted prostate cancer mortality rates, Houston et al.[26] observed a rising curve similar to the incidence, but with a lower magnitude, going from 7.44 / 100 thousand men in 1980 to 14.06 / 100 thousand men in 2013. Also, the trend of the proportion of deaths among longest-lived elderly (age ≥ 80 years) has grown over the years. From 1996 to 2006, considering the elderly aged ≥60 years, the percentage of deaths that occurred in the longest-lived age group went from 33% to 46%. Among women, the behavior of this trend is quite different, as the longest-lived elderly women have the lowest percentage of deaths from malignant breast cancer.Over the period (1996 to 2016), for the elderly as a whole, the percentage of deaths in the oldest age group (≥80 years) increased from 20% to 28%[7].

It should be considered that the perception of health needs is related to sociodemographic characteristics - women use health services more[27] - as for behavioral, past experiences, perception of symptoms and severity of the disease, and access to services for diagnosis and treatment. Frequent use of services by women[27] makes them more exposed to actions of promotion and prevention, such as conducting screening tests, enabling an early diagnosis of cancer and better prognosis.

In this study, skin cancer was not the most reported, contrasting data on its incidence and prevalence (in life), as it is the most incident of all cancers[1,8]. It should be noted that the question asked by the National Health Survey to obtain information on the prevalence of skin cancer did not allow identifying, among the positive cases, whether they were melanoma or not melanoma. Thus, some hypotheses must be considered: (a) non-melanoma skin cancer has a high percentage of cure, when detected and treated early[28] and (b) the skin cancer may resemble a mole or spot and other benign lesions that are only recognized as cancer by a doctor, specialist or by exams[29]. Therefore, it is possible that many individuals do not perform medical evaluation for skin lesions because they neglect non-melanoma skin tumors as non-malignant. Furthermore, this type of cancer is not frequently monitored like other cancers - which makes it difficult to estimate - or even included in cancer statistics publications.[8,28]. Campaigns, informational materials and other strategies, aimed at health promotion and forms of disease prevention, have been used to expand early detection[30]. Therefore, the prevalence observed in this study can be explained, in part, by the use of self-reported information (yes or no). A cross-sectional study that assessed the prevalence and prevention habits of skin cancer in the elderly (n = 820) in rural Pelotas (RS), in the southern region of Brazil, found a prevalence of 4.8%[31], indicating the non-recognition of this condition, current or even past, by the elderly.

As for diseases and chronic health conditions, there was a higher prevalence of hypertension, heart disease, depression and lung disease in the elderly diagnosed with cancer. It is important to notice that a large part of the elderly population has comorbidities that can hinder cancer treatment, however, the implications and management become increasingly important, due to the aging population and the growing number of elderly people with cancer[32]. It is noteworthy that the temporal relationship of disease occurrence cannot be verified through this (cross-sectional) study, however, the use of health services by the elderly to treat other more frequent chronic conditions can favor the diagnosis of cancer.

In the capital of Pernambuco, arterial hypertension was the most frequent comorbidity in the elderly undergoing chemotherapy for cancer[22]. Between 80% and 90% of cancer cases are related to a set of modifiable risk factors that include changes caused by man himself in the environment, habits and lifestyle[2,3,33]. In Brazil, estimates of the fraction of risk attributable to 25 types of cancer due to exposure to modifiable risk factors (inadequate diet, overweight and obesity, smoking, alcohol consumption, physical inactivity, environmental and occupational agents, among others) pointed out that they would account for 34% and 35% of cancer cases in men and women in 2020, respectively, and 46% of deaths in men and 39% in women[2].

With regard to the question used for the outcome considered in this study, the research investigated the report of some medical diagnosis of cancer (in life). The prevalence of cancer therefore represents the proportion of people alive at any given time, who have already had a diagnosis of the disease[34], regardless of how long ago the diagnosis was made, whether the patient is still on treatment, or whether he is "cured"[16,34]. Therefore, "survivor" is understood not only to an individual who has lived for a long period of time after treatment, but also those newly diagnosed, as well as those who are undergoing treatment, have completed treatment or are in remission. In this study, the prevalence limited to the time of diagnosis in the last 5 years was 45.1% among the elderly. It is noteworthy that early diagnosis can provide a better prognosis and increase the likelihood of cure, and the improvement of the treatment offered to cancer patients has increased the frequency of prevalent cases, resulting in an increased demand for medium and high complexity health services.

Among the limitations of the study, it should be considered that the percentage of elderly people with some diagnosis of cancer may be underestimated, since the PNS is a household-based survey that comprised residents of private households, not including those living in special census sectors (barracks, military bases, lodgings, camps, boats, penitentiaries, penal colonies, prisons, jails, asylums, convents and hospitals)[14] and, especially in the elderly population, the percentage of hospitalized individuals and residents in long-term care facilities is higher than in other age groups. Also, the information was reported by the elderly and the specification of the type of cancer, referred to as "other types", was not available for detailed verification in the database. As for the time elapsed from diagnosis, as it is a disease with a high social and family impact, which requires treatment for a long period of time and frequent evaluations, it can be assumed that the memory bias is negligible, considering the totality of cases.

It is also noteworthy that, the question about a cancer diagnosis (had or has) did not allow to assess the current condition of the elderly in relation to the disease, therefore, the studied population included the "survivors", as previously defined. Thus, it is possible that there is a selective survival bias, in which the prevalent cases (sick and cured) may be atypical as to the evolution of the disease or present attenuated risk factors.

In Brazil, with the increase in the elderly population, a greater occurrence of cancer and other chronic diseases is also observed in this subgroup[5,33]. A study carried out in Ibero-America (Spain, Portugal and Spanish-speaking or Portuguese-speaking countries in America) pointed out that the services are not yet adequately prepared to serve the elderly with cancer, mainly due to the lack of resources and geriatric training for health professionals[10]. Comprehensive geriatric assessment[12] becomes increasingly important, as it can contribute to the early identification of elderly people with cancer, promote individual assessment and in its multiple dimensions - considering, among other aspects, comorbidities, functional state, fragility and physiological factors of senescence - to elaborate , in an interdisciplinary way, the best therapeutic care[35] and in a timely manner for the improvement of the quality of life and greater survival.

CONCLUSION

The findings show that the prevalence of cancer in elderly Brazilians differs between genders, as well as the distribution of the main types and the age of the first diagnosis. The importance of arterial hypertension, heart disease, depression and respiratory diseases is highlighted, in addition to other conditions of life and health of the elderly that must be considered, both in clinical practices and in the formulation of public policies, to ensure the diagnosis and timely treatment, and expanded care aimed at the quality of life of the elderly.

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Fall risk prevalence and associated factors in community-dwelling old people

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Abstract

Objective: To estimate the fall risk prevalence and associated factors. *Method:* Cross-sectional study with 339 community-dwelling old people in Juiz de Fora, MG, Brazil. The fall risk was assessed by the Timed Up and Go Test categorized as low (<10 seconds), moderate (11-20 seconds), and high (>20 seconds). The symptoms of anxiety and depression, fear of falling, functional capacity for instrumental activities of daily living and handgrip strength were assessed by the Patient Health Questionnaire, Falls Efficacy Scale - International - Brazil, Lawton and Brody scale and JAMAR hand dynamometer, respectively. A theoretical model of determination with three hierarchical blocks was built. The variables with those with a $p \leq 0.05$ remaining in the final model. *Results*: The prevalence of low, moderate, and high fall risk was 36%, 43.7%, and 20.3%, respectively. The variables associated with a moderate fall risk were female gender, age between 71-80 years, and over 80 years. Over 80 years of age were associated with high risk, negative self-perception of general health, need for help to walk through an auxiliary device, and human assistance and fear of falling. *Conclusion:* The study showed a high prevalence of moderate and high fall risk. Except for advanced age, the factors associated with moderate and high risk were different. These results can be considered in the approach of the old people at risk to enable the choice of the most appropriate intervention and it calls us to think about strategies and public policies that guarantee the prevention of falls and healthy aging.

Keywords: Health of the elderly. Accidental Falls. Risk factors. Prevalence. Cross-sectional studies.

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INTRODUCTION

Falls are the second most common cause of death among old people in the world[1,2]. They represent a complex geriatric syndrome, multifactorial, preventable and associated with morbidity and mortality, which makes it a major public health problem[1-4]. In Brazil, about a third of people over 60 fall at least once a year[2,3]. Prevalence increases to 50% after age 80[1-3]. Old people who have already suffered a fall have a risk of between 60 and 70% of falling again in the following year and 20% of these old people will die within one year[3,5].

The Unified Health System (SUS) has increasing expenses with hospitalization, treatment and rehabilitation of old people victims of falls[6,7]. Since these expenses represent only a small portion of the real value, when considering the underreported cases and the indirect impacts of this event on the old people, their caregivers and family members.

The magnitude of the fall event is widely described in the literature[4-8]. However, there are few studies devoted to investigating the risk of falling and the associated factors in old people community members. As it is a multifactorial condition, the increased risk of falling in this population includes factors related to the individual, lifestyle, environment and socioeconomic conditions[5-7,9]. The identification of the profile of old people who are at increased risk of falling is extremely important for public health, since it can assist managers and health professionals in planning preventive and health promotion actions, reducing the morbidity and mortality associated with the fall event and consequently improving the quality of life of this population[4,5,9,10]. Therefore, the aim of the present study was to estimate the prevalence of risk of falls in the old people and to analyze the associated factors.

METHOD

This study is part of a broader research project, called *Health Survey of the Old People Population of Juiz de Fora (ISPI-JF),* operationalized by means of two waves (2010/2011 and 2014/2015)[4,8]. And the present study is a cross-section of the second wave of collection, which included a sample of old people aged 60 and over, of both genders, living in the community, in the city of Juiz de Fora, Minas Gerais, Brazil.

For the second wave of the ISPI-JF, the calculation of the sample size was estimated from the 2010 sample and the IBGE data from the last census for the population of the delimited area, at the level of disaggregation of the census sector, in order to allow the resizing of the representative probabilistic sample based on stratification and conglomeration. To neutralize the exit of panel members, the "oversample" method was used, which allows the initial sampling to be respected, provided that the initial population is known and that the statistical treatment and weight assignment are different between the groups that make up each panel output situation[11]. Age, gender and education level were selected variables to guide the entry of new subjects. In total, 423 old people were eligible for the study. Individuals who presented results on the Mini Mental State Examination (MMSE) suggestive of cognitive decline (score <25 for old people with four years or more of education or <18 for old people with education <4 years)[12] and who were not accompanied by family members and / or caregivers were excluded (n=23). The total sample of the second wave of the ISPI-JF was 400 old people.

The risk of falling, a dependent variable of this research, was operationalized by the Timed Up and Go Test (TUG). It is a performance test, easy and quick to apply, safe, low cost, in addition to being in the public domain[9,10,13]. Despite being widely used in scientific research and in clinical practice, there is no consensus in the literature regarding cutoff points for determining the risk of falling. At ISPI-JF, the Edmonton Fragility Scale (EFE) was used[14], in which the functional performance domain is evaluated by TUG. The cognitive domain, represented by the Draw-a-Clock test (DAC), is the first domain for the evaluation of EFE and determines which old people will be evaluated in the other domains. Old people who have results suggestive of cognitive decline in DAC and who do not have another respondent are excluded. Of the 400 old people who made up the ISPI-JF sample, 61 were excluded from the present study because they did not meet the criteria proposed in the EFE, leaving 339 old people (Figure 1).

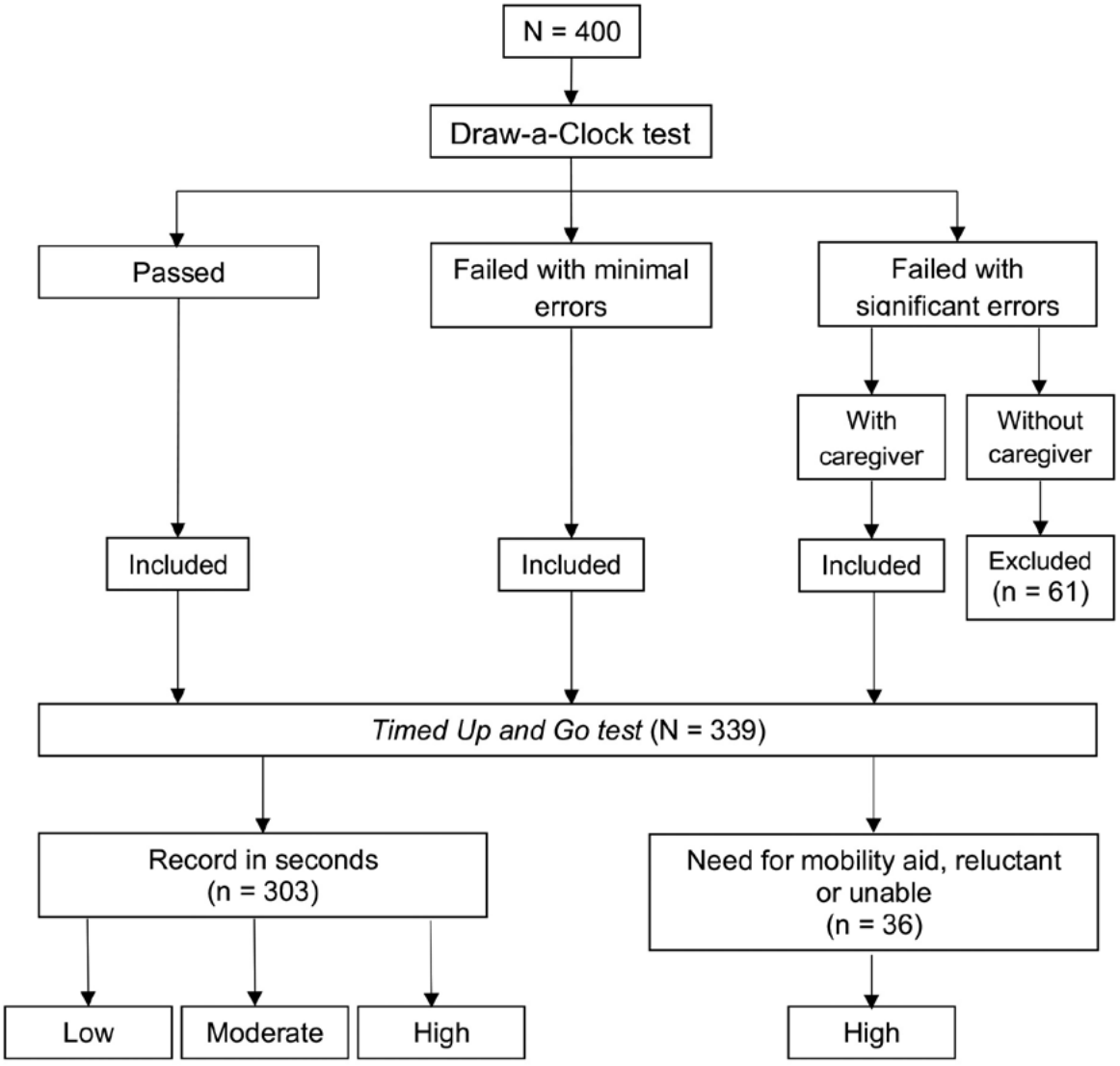

Figure 1. Flowchart of the sample of old people residents in the community. Juiz de Fora, MG, 2015.

EFE guidelines were followed[14] for TUG evaluation. The cutoff points used classified the individuals as: low (<10 seconds), moderate (between 11-20 seconds) and high risk of falling (>20 seconds). To perform the test, the old person was given the following command: "I would like you to sit on this chair with your back and arms supported. When I say "GO", please stand and walk to the mark on the floor (three meters away), go back to the chair and sit again". To record time, a digital stopwatch (Technos, YP2151) was used. Old people who needed assistance with mobility, were reluctant or incapable were classified as having a high risk of falling[14].

The questionnaire used to identify the sociodemographic profile and health issues was designed, standardized and previously tested by the researchers. The presence of anxiety and depression symptoms was assessed by the Patient Health Questionnaire (PHQ) anxiety and depression subscales and dichotomized as yes (score ≥3) or no (score <3)[15]. The fear of falling was verified through the Falls Efficacy Scale - International - Brazil (FES-I-BRASIL), adapted and validated for the Brazilian population[16]. The score ranges from 16 (with no concern for falling) to 64 (with extreme concern). The cut-off point 23 was adopted to classify the

fear of falling[17,18]. The variable History of fall was self-reported and the need for help with walking was also assessed.

Functional capacity to perform instrumental activities of daily living (IADL) was assessed by the Lawton and Brody Scale[19]. The score ranges from 9 (total dependence) to 27 (total independence). For analysis purposes, we dichotomize in independence (score>18) or dependence (score ≤18)[4].

For the measurement of handgrip strength (HGS), a manual hydraulic dynamometer (JAMAR, SH5001) was used and the test was performed and standardized following the recommendations of the American Society of Hand Therapists (ASHT)[20]. The evaluation was made with the individual seated, in the dominant limb with adducted shoulder, elbow flexed at 90º, forearm in neutral position and the wrist between 0 to 30º of extension. Participants were encouraged to develop maximum strength for six seconds. The procedure was performed three times with an interval of one minute between each repetition. The average value of the three measurements, obtained in kilogram/force (kgf), was considered. The HGS variable was dichotomized into low and adequate after adjustment for sex and age group by the median value[17].

The software Statistical Package for Social Sciences (SPSS) version 15.0 was used for statistical analysis. Absolute and relative frequencies were described, as well as the prevalence of the outcome. The chi-square test was used to verify the association between the dependent variable and the independent ones. To estimate the adjusted odds ratios and the 95% confidence interval (95% CI), the multinomial logistic regression model was adopted with robust adjustment of the variance to analyze the independent variables associated with the outcome of interest, controlled by possible confounding factors[4,21]. The hierarchical theoretical approach[21] was used in order to adapt to the proposed theoretical model (Figure 2).

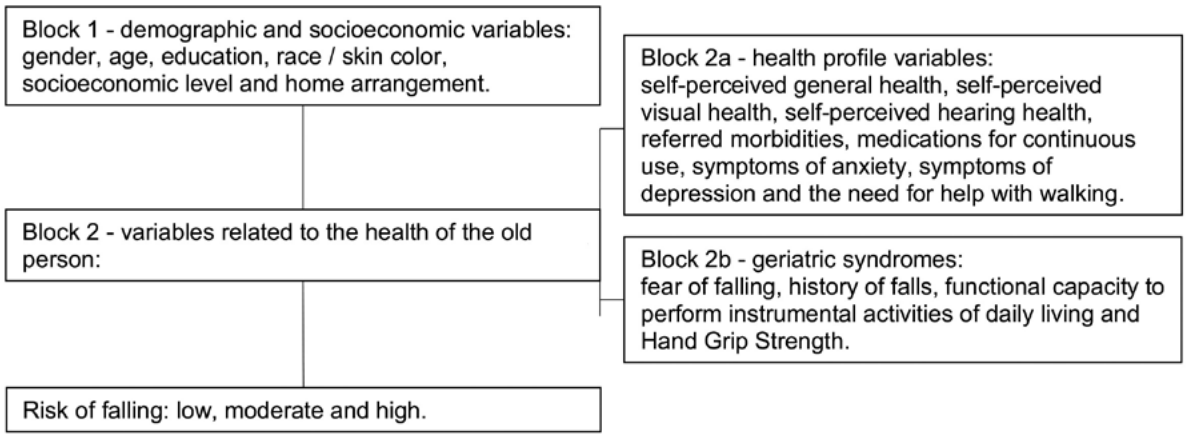

Figure 2. Theoretical investigation model of the association of independent variables with the dependent variable risk of falling in hierarchical blocks. Juiz de Fora, MG, 2015.

The independent variables were adjusted to each other within each block, those that reached a level of significance ≤0.2 were included in the model and adjusted by variables of the same level and higher. The technique of gradual removal of variables was used, remaining in the final model those that maintained a value of p≤0.05[4,21].

The Regulatory Guidelines and Norms for Research Involving Human Beings were obeyed, according to Resolution 466 of the National Health Council. The Ethics Committee of the Federal University of Juiz de Fora approved the study (Opinion 771/916). The recommendations of the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) were followed[22].

RESULTS

The characteristics of the sample are shown in Table 1. Old people who needed assistance with mobility, were reluctant or incapable and were classified as having a high risk of falling (n = 36). The others (n = 303) performed the TUG and were classified according to their performance on the test. The prevalence of low, moderate and high risk of falling was 36%, 43.7% and 20.3%, respectively.

The independent variables associated with the moderate risk of falling in the multinomial logistic regression analysis by hierarchical blocks were female, age between 71-80 years and over 80 years, fear of falling and low HGS. The variables associated with a high risk of falling were female gender, age between 71-80 years and over 80 years, negative self-perceived general health, need of help to walk through an auxiliary device and human assistance, fear of falling and dependence to perform IADL (Table 2).

After adjusting for the final model in the multinomial logistic regression between hierarchical blocks, the variables that remained associated with the moderate risk of falling were females and age between 71-80 years and over 80 years. Over 80 years of age, associated with high risk of falling, negative self-perceived general health, need help to walk through an auxiliary device, human assistance and fear of falling remained (Table 3).

Table 1. Main characteristics of old people resident in the community (n=339). Juiz de Fora, MG, 2015.

Variables	339 (%)
Block 1 - demographic and socioeconomic variables	
Gender	
Female	207 (61.0)
Age group (years)	
60 - 70	129 (38.0)
71 - 80	121 (35.7)
80 or more	89 (26.3)
Education level	
Illiterate	42 (12.4)
1 to 7 years	250 (73.7)
8 years or more	47 (13.9)
Race / skin color	
Not white	177 (52.0)
Socioeconomic status	
A or B	108 (31.9)
C	200 (59.0)
D or E	31 (9.1)

to be continued

Continuation of Table 1

Variables	339 (%)
Home arrangement	
Lives alone	21 (6.2)
Lives accompanied	318 (93.8)
Block 2.a - variables related to the health profile	
Self-perception of general health [a]	
Positive	149 (58.4)
Self-perception of visual health [a]	
Negative	137 (53.7)
Self-perception of hearing health [a]	
Positive	186 (73)
Referred morbidities	
Yes	303 (89.4)
Five or more medications for continuous use	
Yes	170 (50.1)
Anxiety symptoms [a]	
No	191 (75)
Depression symptoms [a]	
No	206 (81)
Need help walking	
No	275 (81)
Auxiliary device	37 (11)
Human assistance	27 (8)
Fear of falling [a]	
No	145 (57)
Yes	110 (43)
History of falls	
No	218 (64.3)
Yes	121 (35.7)
Functional capacity to perform IADL	
Independent	282 (83)
Dependent	57 (17)
Hand Grip Strength [b]	
Adequate	165 (51)
Low	159 (49)
Risk of falling	
Low	122 (36)
Moderate	148 (43.7)
High	69 (20.3)

Source: The author.

IADL = instrumental activities of daily living; [a]Variables investigated only when the respondent was the old person, N = 255; [b]Variable adjusted for gender and age, N = 324.

Table 2. Multinomial logistic regression by hierarchical blocks. Juiz de Fora, MG, 2015.

Variables	Moderate Risk		High risk	
	$OR_{adjusted}$ (95%CI)	*p*	$OR_{adjusted}$ (95%CI)	*p*
Block 1 - demographic and socioeconomic variables				
Gender				
Female	3.12 (1.79; 5.43)	< 0.001*	2.45 (1.19; 5.03)	0.015*
Male	1		1	
Age (years)				
More than 80	6.07 (2.64; 13.94)	< 0.001*	32.86 (11.81; 91.41)	< 0.001*
71-80	2.28 (1.28; 4.05)	0.005*	4.11 (1.67; 10.09)	0.002*
60-70	1		1	
Education				
Illiterate	2.40 (0.81; 7.17)	0.121	2.65 (0.57; 12.34)	0.213
1 to 7 years	1.56 (0.76; 3.21)	0.233	2.54 (0.77; 8.41)	0.131
8 years or more	1		1	
Block 2.a - variables related to the health profile				
Self-perception of general health[a]				
Negative	1.58 (0.85; 2.93)	0.145	3.73 (1.08; 12.87)	0.037*
Positive	1		1	
Self-perception of visual health[a]				
Negative	1.09 (0.62; 1.91)	0.765	1.31 (0.41; 4.12)	0.647
Positive	1		1	
Self-perception of hearing health [a]				
Negativ	1.82 (0.96; 3.45)	0.066	2.96 (0.95; 9.19)	0.061
Positive	1		1	
Referred morbidities				
Yes	1.61 (0.68; 3.79)	0.276		
No	1			
Five or more medications for continuous use				
Yes	1.28 (0.74; 2.22)	0.385	1.16 (0.39; 3.43)	0.799
No	1		1	
Depressive disorder[a]				
Yes	1.24 (0.37; 2.70)	0.591	2.20 (0.67; 7.28)	0.196
No	1		1	
Need help walking				
Human assistance	4.88 (0.56; 42.55)	0.152	26.77 (2.75; 260.63)	0.005*
Auxiliary device	6.39 (0.76; 53.77)	0.088	11.31 (2.12; 102.25)	<0.001*
No	1		1	
Block 2.b - variables related to geriatric syndromes and HGS				
Fear of falling[a]				
Yes	2.22 (1.25; 3.94)	0.006*	27.01 (5.76; 126. 59)	< 0.001*
No	1		1	
History of falls				
Yes	1.37 (0.76; 2.48)	0.297	2.42 (0.86; 6.79)	0.095
No	1		1	

to be continued

Continuation of Table 2

Variables	Moderate Risk		High risk	
	OR $_{adjusted}$ (95%CI)	*p*	OR $_{adjusted}$ (95%CI)	*p*
Functional capacity to perform IADL				
Dependent	3.62 (0.39; 33.36)	0.256	25.77 (2.45; 271.24)	0.007*
Independent	1		1	
Hand grip strength				
Low	2.44 (1.08; 3.29)	0.026*	2.44 (0.84; 7.12)	0.103
Adequate	1		1	

Source: The author.

IADL = instrumental activities of daily living; [a]Variables investigated only when the respondent was the old person, N = 255; [b]Variable adjusted for gender and age, N = 324; *Significant variable will be included in the final theoretical model of the study.

Table 3. Multinomial logistic regression between hierarchical blocks. Juiz de Fora, MG, 2015.

Variables	Moderate Risk		High Risk	
	OR $_{adjusted}$ (95%CI)	*p*	OR $_{adjusted}$ (95%CI)	*p*
Block 1 - Demographic and socioeconomic variables				
Gender				
Female	2.82 (1.48; 5.35)	0.002*	1.89 (0.47; 7.61)	0.370
Male	1		1	
Age (years)				
More than 80	5.36 (1.98; 14.54)	0.001*	33.25 (4.59; 241.11)	0.001*
71-80	2.15 (1.13; 4.08)	0.019*	4.49 (0.93; 21.88)	0.063
60-70	1		1	
Block 2.a - Variables related to the health of the old person: health profile				
Self-perception of general health[a]				
Positive			6.63 (1.58; 27.8)	0.010*
Negative			1	
Need help walking				
Human assistance			14.50 (1.12; 187.55)	0.041*
Auxiliary device			46.74 (4.59; 476.43)	0.001*
No			1	
Block 2.b - Variables related to the health of the old person: geriatric syndromes and HGS				
Fear of falling[a]				
Yes	1.45 (0.78; 2.73)	0.243	12.13 (2.21; 66.76)	0.004*
No	1		1	
Functional capacity to perform IADL				
Dependent			7.55 (0.52; 109.13)	0.138
Independent			1	
Hand grip strength				
Low	1.34 (0.35; 5.09)	0.667		
Adequate	1			

IADL = instrumental activities of daily living; [a]Variables investigated only when the respondent was the old person, N=255; *Variables that remained significant in the final theoretical model of the study.

DISCUSSION

The prevalence of low, moderate and high risk of falls found in the present study was 36%, 43.7% and 20.3%, respectively. The classification of the risk of falls in three strata allowed the identification of different profiles within the group that presents an increased risk of falling. This analysis, although little explored in research, is important because it allows the choice of the most appropriate intervention depending on the level (moderate or high) of the risk of falling. Systematic reviews and meta-analyzes[2,3,9], who treated this outcome in a dichotomized manner (low and high risk) reveal that the prevalence of risk of falls varies from 30% to 64%. These variations can be attributed to the particularities of each population, the different cutoff points adopted for the TUG, the different instruments used to assess the risk of falling and other methodological attributes[2].

The choice of TUG as a tool to operationalize the outcome variable risk of falling resides in the fact that, in addition to enabling the use of the three strata, as previously discussed, functional mobility is fundamental for a quality life and, often, its worsening is the first sign of functional decline for old people because it reflects the decline of the systems involved in its maintenance (nervous, vestibular, proprioceptive, cardiopulmonary, musculoskeletal systems)[17]. Park et al.[2] identified 26 fall risk assessment tools for old people, of which 23 are used in community-based old people. The TUG was used in five of the 33 studies analyzed and presented grouped high sensitivity (0.76) and low specificity (0.49)[2]. This finding may justify the high prevalence of moderate and high risk of falling (64%) found in the present study. The TUG as a more sensitive tool is of paramount importance for public health, since it can be used to track the population at risk.

As it is a multifactorial condition, some studies point to the need for the association of two or more tools to assess the risk of falling for old people[2,9]. Lusardi et al.[9] suggest that the use of the TUG, a measure of performance, be evaluated together with the investigation of the history of falls, two more measures of performance (Berg Balance Scale and the Sit and Stand Test, for example) and two more measures of self-report (Geriatric Depression Scale and FES-I, for example). The same authors reinforce that such a multifactorial approach, in addition to enabling the identification of possible modifiable risk factors, allows quantifying the change in risk after an intervention[9].

In the demographic and socioeconomic variables block, only the variables related to the biological dimension maintained an independent association with both moderate and high risk of falling. According to the literature, women are 58% more at risk of falling when compared to men[23]. The high prevalence of moderate and high risk of falls in the present study can also be attributed to the predominantly female sample (61%), since these presented 2.82 (95% CI=1.48; 5.35) times more moderate fall risk when compared to male individuals[23].

The possible causes for explaining female gender as an independent variable associated with the risk of falling can be attributed to the physiological changes inherent to women, such as less lean mass and muscle strength compared to men of the same age, greater loss of bone mass due to reduction of estrogen, higher incidence of chronic diseases and longer life expectancy[9,23,24]. A study of old people resident in the community identified a prevalence of risk of falling of 56% among individuals diagnosed with osteoporosis. Of these, 100% were female and 78% reported falling episodes in the last year[24].

While women have the advantage of living longer, they are more exposed to domestic violence and discrimination in access to education, income, meaningful work, social security measures and political power[25]. They also have a higher prevalence of dementia syndromes, depression and functional dependence, with decreased life expectancy free of disabilities[25]. The data found in the literature[9,23-25] draw attention to the complexity of the factors that involve the increased risk of falls in women, and, although it is not possible to act directly on biological factors, intersectoral public policies focused on reducing gender inequities, are fundamental to reduce the risk of falls in old women living in the community.

Although female gender is a variable associated with an increased risk of falling, mortality from falling in old males is higher[7]. This can be explained by the greater involvement of male individuals in intense and dangerous physical activities, which cause more serious events that lead to hospitalizations and deaths[7]. The influence of sociocultural patterns established from early childhood to old age, such as machismo, may partly explain this process, since old men can have an overestimated self-efficacy to avoid falls, which, many times, do not corresponds to their real capacity, resulting in fatal falls[7,10]. According to Abreu et al.[7] these data reinforce the greater vulnerability of men in relation to external causes of morbidity and mortality.

It is widely discussed in the literature that advancing age also increases the risk of falls in the old population[1,9,25]. This relationship between age and risk of falling increases because biological aging is associated with the functional decline of several systems involved in maintaining mobility (neurological, musculoskeletal, cardiovascular, visual, vestibular and proprioceptive)[13,25] which modify the interaction of old people with the external environment and their social relationships. However, it is worth mentioning that the aging process is not determined in isolation by biological processes dictated by chronological age, but by a sum of several factors and experiences accumulated in life cycles, within a logic of understanding the model of social determination of the health-illness process.

Long-lived old people, those aged 80 or over, are four times more likely to fall when compared to younger old people[1]. In the present study, the subgroup of long-lived old people with a moderate risk of falling presented 5.36 (95% CI=1.98; 14.54) times higher risk of falling when compared to old people aged less than 71 years. In a sample of 1005 old people resident in the community, a 0.25 second increase in TUG performance was found for each additional year of age[10]. In the present study, the subgroup of old people aged 80 or over was associated with both moderate and high risk of falling, while the age group 71 to 80 years old maintained an association with moderate risk of falling, data that reinforce the need for screening of this population in order to prevent an increased risk of falling. However, the confidence intervals presented suggest a degree of inaccuracy in the analysis of the association of the risk of falling in this subgroup and point to the need for studies with larger population contingents in older strata.

General self-perceived health is a reliable and robust global health indicator, cited in the literature as a predictor of morbidity and mortality and physical decline in the old people population[26]. Because it is a subjective assessment, self-perceived health has a multidimensional character, which involves lifestyles, in addition to psychological, demographic and socioeconomic aspects.[26-28]. Studies have identified the association between general self-perception of negative health, female gender, advanced age, low education, difficulty in mobility, inability to perform activities of daily living (ADL), fear of falling and falling[26-28]. The present study identified a similar profile of the old people, and the negative self-perception of general health was 6.63 times (95% CI=1.58; 27.8) more associated with the high risk of falling when compared to the positive.

The fear of falling, although it is more prevalent in old people fallers, is also present in the old people population without a history of falls. Our findings revealed a prevalence of falls of 35.7% and fear of falling of 43%. It is widely discussed that the fear of falling may play a protective role against the occurrence of falls, as the low self-efficacy to avoid the event would limit the old people to exposure in situations of high risk[5,29]. In contrast, excessive fear is able to trigger a vicious cycle by leading the old people to functional restriction and its consequences such as decreased muscle strength and changes in pace, which would, in turn, increase the risk of falls[5,18,27,29].

Most studies indicate that the etiology of fear of falling is multifactorial in nature[5,18,27,29]. Adequate physical environments provide the old people with greater independence and security, because when they encounter barriers in the environment there is a tendency to social isolation, depression, functional decline and a consequent increase in fear of falling. About 30% of the old people limit the performance

of ADLs due to fear of falling[18]. In the present study, the fear of falling maintained an independent association with the high risk of falling (OR=12.13; 95% CI=2.21; 66.76).

In the study by Cruz et al.[27], fear of falling was more frequent in old people who had difficulty walking, which corroborates the findings of the present study. It is likely that subjects who report difficulties in walking already show some decline in functional capacity and neuromotor disorders. These changes impair the safety and efficacy of walking and hinder the self-confidence of these old people in preventing falls, creating a basis for building fear[27]. The need for help to walk using both human aid and an auxiliary device remained associated with the high risk of falling in the final model of the present study. While walking aid is a strategy that aims to optimize mobility and increase the safety of the old people during locomotion, it does not always meet this objective and as some studies show, it can increase the risk of falling[5,27].

Numerous factors can be discussed in this context with the aim of promoting strategies that minimize the risk of falling for the old people, such as the training of the caregiver who will assist the old person, the proper prescription of the auxiliary device, the training of the old person to use it, a support network offered by Primary Health Care (PHC), through home visits aimed at identifying potential environmental risk factors such as difficult access to the home, inadequate lighting, objects on the floor, excess furniture around the house, loose rugs, among others; as well as a periodic review that assesses the need for the device and which device is suitable for that old person[5,30]. It is necessary to take into account the importance of the low socioeconomic level of the studied population, which directly influences the living conditions and housing arrangements of the population. In this sense, the old person's own place of residence added to the conditions mentioned above would justify such a finding.

The main limitations of the present study reside in the study design itself, which does not allow establishing a causal relationship, and in the observation of some large confidence intervals, which suggest a degree of inaccuracy in the analysis of the association of the risk of falling in the subgroup of old people aged 80 and over and also for the subgroup of variables investigated only when the respondent was the old person (n=255). Thus, longitudinal studies, with a larger population contingent in older strata and with a greater number of old people respondents, are necessary in order to confirm the results found. On the other hand, it is worth mentioning the careful sample calculation and quality control carried out during all stages of the present study, such as training and retraining of field researchers, testing the instruments, conducting a pilot study, standardization and daily verification of the data obtained and control and thorough analysis of the database, ensuring greater credibility to the data analyzed.

CONCLUSION

The study showed a high prevalence of moderate and high risk of falling. The factors associated with moderate and high risk are distinct, only advanced age remained in both outcomes. The identification of the profile of old people with increased risk of falling is extremely important for public health, since it can assist local managers and professionals of Primary Health Care in tracking the population at risk. Additionally, it will be able to guide prevention and health promotion actions directed to specific individual and collective needs with a focus on active and healthy aging, comprehensive health care, encouragement of intersectoral actions and the guarantee of adequate budget and social control as recommended by the National Policy Health of Old People. The strengthening of health care for old people through discussions with multiprofessional teams, their preparation through continuous training with caregivers and family members of the old people, and the use of appropriate instruments are undoubtedly essential for the prevention of falls.

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Oral health and access to dental services in old quilombolas: a population-based study

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Abstract

Objective: to investigate the oral health conditions, access to dental services and sociodemographic factors associated with this acessibility in rural quilombolas elderly in the north of the state of Minas Gerais, Brazil. *Method*: this is an analytical and cross-sectional population-based study, in which cluster sampling was used with probability proportional to size (n=406). Data collection involved structured interviews and clinical dental examinations. *Result*: it was found that the majority of the elderly had low income and low level education. It was observed that a significant portion of individuals reported access to a dental surgeon (97.5%) and that they had had their last dental appointment three years or more ago (60.4%). It was also found that the majority of the elderly were edentulous (52.0%) and that the majority of respondents needen prostheses (88%). A high DMFT index was found in the individuals studied (mean value of 27.25). Advanced age, absence of partner e retirement were associated with irregular access to dental services. *Conclusion*: the local quilombolas elderly had poor oral health and restricted access to dental services. Age, marital status and employment status demonstrated association with low accessibility to oral health services in the elderly investigated.

Keywords: Oral Health. Health of the Elderly. Ethnic Groups. Risk Groups. Public Health. Public Policy. Quilombolas. Vulnerable Communities.

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INTRODUCTION

The number of epidemiological studies addressing the relevance and implications of the ethnic-racial dimension in the field of health is increasing[1,2]. Focusing on public health management and planning, it is noteworthy that the subsidiary establishment of a diagnosis related to the reality of minority groups is beneficial since they usually suffer from social and health inequalities, as it is the case of the quilombola population[2-4].

Quilombola communities are characterized as spaces inhabited for centuries by free black people and descendants of slaves[5]. Thus, the remnants of quilombo communities are conceptualized as "ethnic-racial groups according to the criteria of self-attribution, with their own history endowed with specific territorial relations and the belief of black ancestry related to the resistance to the historical oppression suffered."[6]. Furthermore, it is emphasized that said communities are distinguished by their ethnic identity, the peculiarity of their social organization, and the predominant rural location[7].

As estimated by Fundação Palmares, there are about 2 million people living in approximately 3,212 remaining certified quilombo communities in Brazil, with 527 communities located in the southeast and 366 located in Minas Gerais[8].

Apparently, the quilombola communities commonly have a low socioeconomic level, and live with precarious social infrastructure, notably lack of paving, basic sanitation, water supply, and waste disposal[2,3]. These communities still show a high prevalence of basic health problems related to poor living conditions[7,3], they have a lower life expectancy when compared to the white population[9], and live with restricted access to health services, including dental care[2-4].

It is noteworthy that oral health plays a key role in people's general health and quality of life. Poor oral conditions can affect the nutritional level, physical and mental well-being, as well as interfere negatively in people's social lives[10]. However, it is observed that there is little research in the literature on the subject of oral conditions of quilombolas, mainly involving the old people. The limited data available related to the aforementioned age group reveals individuals with poor oral health and a high prevalence of edentulism[4,11] regarding the epidemiological condition of the Brazilian old people[12].

The international literature also emphasizes that diverse rural populations often have low socioeconomic level, restricted access to oral health services, and a high prevalence of oral diseases[13,14], showing an intricate scenario with ethnic issues that is not exclusive to developing countries.

It is noticed that the conditions experienced by quilombola communities denote a scenario of social vulnerability that needs and urgently demands epidemiological studies to characterize the health situation of this population[2,3,15] aimed at the development and implementation of local public policies.

Thus, it seems that the sociodemographic and epidemiological profiles presented by the present study can plausibly subsidize the planning and execution of oral health actions at the regional level.

Thus, the main objective of the present study was to investigate the condition of oral health, access to dental services, and the sociodemographic factors associated with this accessibility in rural old quilombolas in the north of the state of Minas Gerais, Brazil.

METHOD

This is an analytical, cross-sectional, population-based study carried out in the extension of the northern health macro-region located in the north of the state of Minas Gerais, Brazil. The macro-region expressed comprises 86 municipalities grouped into nine health micro-regions defined in the present study as conglomerates[8].

Local quilombos were identified using data available on the websites of Fundação Cultural Palmares[8] and Centro de Documentação Eloy Ferreira da Silva - CEDEFES[16], as well as on the local Municipal Health and Social Development Secretaries and Centro de Agricultura Alternativa (CAA) located in the municipality of Montes Claros-

MG. Thus, there were 79 quilombola communities encompassing approximately 19 thousand inhabitants. Regarding the total number of old people in these communities, and considering the lack of official data, a proportion of 14% of individuals in this age group was estimated in relation to the general population (19,000), following the national estimate of the proportion of old people in the Brazilian population[17]. Thus, the universe of old people (N) estimated in the communities expressed was 2,660 individuals.

Regarding the sample size and for the purpose of calculation, we estimated a prevalence of 50% of oral diseases in a finite population due to the heterogeneity of the events measured, confidence level of 90%, margin of error of 5%, design effect (*deff*) equal to 1.5, and an estimated 10% loss, thus considering individuals who did not accept to participate on the survey or gave up during it, thus making up a minimum necessary sample (n) of 406 old people.

For the selection of the sample, sampling by conglomerates with probability proportional to size (PPS) was adopted, thus selecting a total of 30 communities. Thus, the probability of selecting each community (primary sampling unit) during the drawing process was directly proportional to its number of inhabitants. The selection of households in each community was based on a previous definition of the central community region, with subsequent displacement of researchers *in loco* in a spiral direction (considering the prevalent geographic distribution spaced between residences in these rural communities), traversing the households , identifying the old people, and conducting interviews and exams until reaching the sample established for each community. All the old people (≥60 years old) of the houses visited were invited to participate in the survey.

The inclusion criteria were to be at least 60 years old, self-declare as quilombola, and live in a quilombola community certified by Fundação Cultural Palmares[8]. In addition, the old people manifesting cognitive deficits were excluded from the survey; this condition could hinder or prevent the transmission of information regarding the variables studied. The cognitive impairment was screened using the Portuguese version - translated and modified - of the Mini Mental-State Examination (MMSE)[18], considering cutoff points of 19 and 25 according to the absence (illiterate) or presence of prior formal schooling, respectively. Thus, illiterate old people who obtained a score ≤19 and literate individuals with a score ≤25[18]were considered to have cognitive deficit.

The variables of the present study are related to sociodemographic characteristics, access to dental services, and oral health condition of the local quilombola old people. The prevalence of dental cavities was investigated using the DMFT Index, considering the number of decayed (D), Missing due to caries (M) and filled (F) teeth. The periodontal condition was assessed using Community Periodontal Index (CPI) and Periodontal Insertion Loss (PIL).

In the bivariate and multiple analyses, access to dental services was adopted as a dependent variable, and the sociodemographic factors of the investigated were adopted as independent variables. The dependent variable was dichotomized in regular and irregular access, having as standard reference the criteria adopted in the Survey of Oral Health Conditions of the Brazilian Population (SB Brazil 2010)[19]. Thus, the regular category included the old people who reported the last visit to the dentist occurred in the last two years; the irregular category comprised those who reported the last visit with dentist occurred three years or more ago. In addition, the old people who had never consulted with the aforementioned professional were excluded in this analysis.

It is emphasized that this dental survey is an integral part of a broad matrix study carried out with the quilombolas of the region addressing a varied theme related to the field of health and work. The matrix study had the participation of six researchers (four nurses and two dentists), and six undergraduate students from health areas.

Visits to the communities were previously scheduled by contact between researchers and local representatives of the Municipal Health Secretaries, community leaders, and family health strategy professionals. Dental data was collected between

January and August, 2019 by two examiners (dentists), and involved structured interviews and clinical dental examinations. The interview followed a structured questionnaire was used to collect information regarding the sociodemographic variables, access to dental services, and oral conditions of the investigated. The definition of the items of the data collection instrument, as well as the definition of the criteria adopted in the survey followed basically those adopted in the Survey of Oral Health Conditions of the Brazilian Population (SB Brazil 2010)[19].

The clinical examinations were carried out in an airy place, under natural light, and using explorer probe no. 5, flat dental mirror, periodontal probe developed by the WHO (Golgran®), wooden spatulas, and personal protective equipment. Individuals with dental needs were duly referred to local reference health care units. A pre-test study was carried out involving 5% of the sample in order to verify the applicability of the data collection instrument. The examiners were previously trained and calibrated.

Data was tabulated and analyzed using a specific statistical program. Initially, the descriptive analysis of the data was made. Subsequently, a bivariate analysis was conducted using the chi-square test of *Pearson* - X^2 to verify the association between access to dental services and variables related to sociodemographic characteristics. Finally, a multiple analysis was performed adopting the Bivariate Logistic Regression Model, and using the variables presenting a *p*-value ≤ 0.20 in the bivariate analysis. In the multiple analysis, the category adopted as reference of the dependent variable was the *regular access*. After regression, the magnitude of association between variables was estimated in the final model using the crude and adjusted Prevalence Ratio (PR) (with 95% confidence interval), and the significance level α considered was 5%. The adjustment quality of the model was assessed using the *Hosmer-Lemeshow* test.

The present study was developed according to the precepts determined by resolutions No. 466/2012 and 510/2016 of the National Health Council of the Ministry of Health, and in line with those dictated by resolution CFO 179/91 of the Dental Professional Code of Ethics. The present study was analised by the research ethics committee of Universidade Estadual de Montes Claros (COEP-Unimontes), which approved it by the embodied opinion No. 2,821,454. All participants were duly informed about the research, and instructed to sign the free and informed consent form for permission to participate and analyze the data.

RESULTS

Table 1 shows data on the sociodemographic characteristics of the quilombolas old people surveyed. There was a predominance of young old people (aged 60 to 69 years - 64.4%), with spouse (58.3%), literate (61.4%), with black skin color (58.1%), retired (77.1%), and with monthly family income of up to two minimum wages (53.4%).

Table 2 shows data on access to oral health services in the quilombola old people investigated. We found that the majority of the surveyed had access at least to a dental appointment (97.5%), with a report of occurrence of the last appointment 3 years or more ago (60.4%). The largest proportion of old people (52.2%) reported that the last dental appointment was in the private service, and 45.2% declared assistance received in the public service. Tooth extraction was reported as a relevant reason to search for a dentist (38.1%). The old people were satisfied with the last dental care received, with 89.4% rating it as good or excellent.

Table 3 expresses the data concerning the oral health conditions of quilombola old people. There was a predominance of edentulism (52.0%), and 53.5% of individuals used some type of dental prosthesis, as well as a significant portion of the old people (88.0%) needed some kind of prosthesis. Additionally, we observed that the majority of the old people had the oral sextants excluded in the periodontal evaluation (49.5%) for not having at least two functional teeth per sextant, and that 45.3% manifested the presence of periodontal alterations. The absence of alterations in oral soft tissues (89.1%) and the lack of need for immediate dental care (82.8%) also predominated. The most prevalent DMFT Index was 32, found in 50.7% of the old people.

Table 1. Sociodemographic characteristics of rural quilombola old people in northern Minas Gerais (n=406), Brazil, 2019.

Sociodemographic characteristics	n (%*)
Gender	
Male	175 (41,1)
Female	231 (58,9)
Age group (years)	
≥ 80	53 (11,9)
70 to 79	103 (23,6)
60 to 69	250 (64,4)
Marital status	
Without spouse	179 (41,7)
With spouse	224 (58,3)
Skin color	
Not black	190 (41,9)
Black	214 (58,1)
Education	
Non-literate	170 (38,6)
Literate	234 (61,4)
Work	
Not working	45 (8,0)
Retired	286 (77,1)
Working	75 (15,0)
Family income (minimum wage)	
≤ 1	82 (21,4)
Between 1 and 2	224 (53,4)
>2	90 (25,2)
Religion	
Catholic	352 (87,6)
Evangelical	50 (12,4)

*Corrected by the design effect; minimum wage (current value at the time: R$998.00).

Table 2. Access to dental services by rural quilombola old people from northern Minas Gerais (n=406), Brazil, 2019.

Access to dental services	n (%*)
Have already been to the dentist.	
Yes	397 (97,5)
No	9 (2,5)
Time since the last appointment	
Have never been to the dentist	9 (2,5)
3 years or more	270 (60,4)
2 years or less	127 (37,1)

to be continued

Continuation Table 2

Access to dental services	n (%*)
Reason for the last appointment	
Have never been to the dentist	9 (2,5)
Pain	26 (9,0)
Extraction	170 (38,1)
Treatment/checkup/others	201 (50,4)
Where was the last appointment	
Have never been to the dentist	9 (2,5)
Public	181 (45,2)
Private	213 (52,2)
Evaluation of care service	
Have never been to the dentist	9 (2,5)
Regular/bad/terrible	27 (8,0)
Good/great	369 (89,4)

*Corrected by the design effect.

Table 3. Oral health condition of rural quilombola old people in northern Minas Gerais (n=406), Brazil, 2019.

Oral health condition	n (%*)	Mean (±SD)
Edentulism		
No	192 (48,0)	
Yes	214 (52,0)	
Use of prosthesis		
Does not use	202 (46,5)	
Uses	204 (53,5)	
Needs prosthesis		
Does not need	63 (12,0)	
Needs	343 (88,0)	
DMFT		27,25 (±6,97)
32	235 (50,7)	
21 to 31	90 (25,2)	
≤20	81 (24,1)	
Periodontal alteration (CPI)		
All sextants excluded	230 (49,5)	
Present	152 (45,3)	
Absent	24 (5,2)	
Periodontal alteration (PIL)		
All sextants excluded	230 (49,5)	
Present	147 (42,6)	
Absent	29 (7,8)	
Alteration of soft tissue		
Yes	48 (10,9)	
No	358 (89,1)	
Needs immediate care		
Yes	76 (17,2)	
No	330 (82,8)	

*Corrected by the design effect; SD: standard deviation.

Table 4 shows the bivariate analysis of data revealing the statistical association between the dependent variable (access to dental services) and the independent variables (sociodemographic factors). In this phase, the variables age, marital status, education, work, and religion were associated with the outcome at the significance level of 20%.

It is clarified that in the bivariate and multiple analyses, a total of 397 old people were considered, since 9 were excluded because they declared *never* having used dental services. Thus, the following absolute and relative frequencies were obtained: regular access (n=127 - 32.0%); irregular access (n=270 - 68.0%). Thus, a high prevalence of irregular access = 68.0% was observed: IC95% [63.4 -72.6].

Table 5 expresses the logistic regression analysis, demonstrating the statistical associations between the dependent variable (irregular access category) and the independent variables included in the final model. At this stage, there was a statistically significant association (p-0.05) between irregular access to dental services and the sociodemographic variables related to age group, marital status, and work.

Table 4. Distribution according to access to dental services and sociodemographic characteristics (bivariate analysis) related to the rural quilombola old people from northern Minas Gerais, Brazil, 2019.

Sociodemographic characteristics	Use of dental services		*p*-Value**
	Irregular	Regular	
	n* (%)	n* (%)	
Gender			0,546
Male	112 (60,1)	56 (39,9)	
Female	158 (63,2)	71 (36,8)	
Age group (years)			0,029
≥ 80	44 (79,4)	6 (20,6)	
70 to 79	78 (73,2)	24 (26,8)	
60 to 69	148 (54,9)	97 (54,1)	
Marital status			0,094
Without spouse	131 (68,6)	43 (41,4)	
With spouse	138 (57,9)	82 (42,1)	
Skin color			0,496
Not black	125 (65,4)	63 (34,6)	
Black	145 (60,2)	62 (39,8)	
Education			0,004
Non-literate	125 (73,0)	38 (27,0)	
Literate	144 (55,5)	88 (44,5)	
Work			0,021
Not working	25 (63,6)	18 (36,4)	
Retired	206 (66,5)	73 (33,5)	
Currently working	39 (38,7)	36 (61,3)	
Family income (minimum wage)			0,376
≤ 1	56 (72,0)	24 (28,0)	
Between 1 and 2	148 (57,6)	70 (42,4)	
>2	59 (61,2)	30 (38,8)	
Religion			0,079
Catholic	233 (61,6)	110 (38,4)	
Evangelical	35 (71,1)	15 (28,9)	

*Totals vary due to information losses;**Chi-Square Test; Percentages corrected by the design effect.

Table 5. Result of the logistic regression analysis related to data from rural quilombola old people in northern Minas Gerais, Brazil, 2019.

Sociodemographic Characteristics	PR_b (95% CI)	PR_{to} (95% CI)	*p*-Value
Age group (years)			
≥ 80	4,81 (1,97-11,71)	**4,18 (1,57 -11,12**)	**0,004**
70 to 79	2,13 (1,26 -3,60)	1,68 (0,96 -2,94)	0,069
60 to 69	1,00	1,00	
Marital status			
Without spouse	1,81 (1,17-2,81)	**1,76 (1,11-2,80)**	**0,017**
With spouse	1,00	1,00	
Work			
Not working	1,28 (0,60-2,73)	1,16 (0,53-2,53)	0,716
Retired	2,61 (1,54-4,41)	**2,16 (1,24-3,78**)	**0,007**
Currently working	1,00	1,00	

Hosmer-Lemeshow Test = 0.994; Crude prevalence ratio (PR_b) and Adjusted prevalence ratio (PR_a) with respective 95% confidence intervals (95% CI).

DISCUSSION

Focusing on the descriptive analysis of the data presented, we found that a significant portion of the investigated were old people without spouse, corroborating the data found dor Brazilian old people [20,21]. It should also be noted that certain diseases in old people are associated with the absence of a partner, such as depression[22], a condition that is also associated with oral alterations in old people[23].

The results of the present study demonstrated a notorious prevalence of illiteracy, approximately 39%. In Bahia, researchers found a similar rate of illiterate in local quilombolas[2]. It should be noted that old people with low education has been associated with a worse oral health condition[24].

Regarding skin color, the majority of the respondents self-declared as black, consistent with the results of the studies carried out in Minas Gerais, Bahia, and Pará[3,4,2,25]. These data denote the preponderance of this skin color in the quilombolas studied in the country.

It is important to point out that the literature relates skin color to access to oral health services. Thus, when analyzing data related to Brazilian old people and from the National Survey of Oral Health, researchers[26] demonstrated that self-declared skin color was a limiting factor in the use of dental care services. According to these authors, the chance of a black old person never going to the dentist is higher (approximately twice) when compared to their white correspondent, and that the chance of a black old person having used oral health services in the last year is lower than their white correspondent[26]. Thus, it is clearly perceived that the Brazilian black population still lives with discrimination, prejudice, and inequities related to skin color, as is the case of quilombolas[5,26].

Regarding the work profile of the sample studied, it was observed that 77.1% of the old people were retired, with a report of predominant labor as farmers. We emphasize that no research was found in the literature expressing labor data related to the old quilombolas. However, we emphasize that the work process in quilombola communities, especially rural communities, is closely linked to the cultivation of swiddens, planting, and harvesting of grains[27], which was confirmed in this investigation.

The old quilombolas investigated showed low income, corroborating the findings of other studies with quilombolas[2,3,25]. A study carried out in Minas Gerais observed that local old quilombolas had low income and bad oral conditions[4]. Moreover, a study on Brazilian old people showed that low education, low income, and living in rural areas can negatively interfere with access to oral health services[28].

Focusing on religion, we noticed that most of the sample reported being linked to the Catholic religion (87.6%). A study investigating religiosity in quilombolas from Bahia found that the studied community showed a religious belief matching Catholicism with Afro-Brazilian cults[29]. The present investigation also showed that the local communities manifested and nurtured typical cultural traditions that were mixed with religious aspects.

The discussion on dental care services showed that almost all of the sample has been to the dentist at some point in life. However, a significant part of the old people (60.4%) reported that the last dental appointment had been more than 3 years before denoting lack of longitudinal attention in oral health. This data coincides with the findings of another study[4]. In India, it was observed that 32% of the old people living in rural communities had visited the dentist more than a year before[30].

In a counterproductive way, it is noteworthy that 52.2% of the old quilombolas reported that the last dental appointment was in the private service, and 45.2% in the public one. These values may indicate a local restriction to access and offer of public oral health services, generating a demand and consequent search for the private dental care service. It is also noted that the population studied had low income. Another study carried out in Minas Gerais showed opposite findings, revealing that 58.2% of old quilombolas surveyed reported that the last dental appointment took place in the public system, and 41.8% in the private system.

Regarding the reason for the last dental appointment and evaluation of this service, a significant portion (38.1%) reported tooth extraction as the main reason for seeking the service, and most were satisfied with the service offered. The data expressed confirms the findings of another study[4]. It should be emphasized that the relevant rate of self-reported demand by the oral health service for dental extraction denotes a probable dental impairment in this population. A study involving rural old people in India identified that the majority of respondents reported pain in the teeth and gums as the reason for the last visit to the dentist[30].

The individuals surveyed revealed a prevalence of edentulism of 52.0%, confirming the results of another study carried out with old quilombolas[4]. In a homologous manner, the National Oral Health Survey (Project SB Brazil 2010) showed that Brazilian old people showed a high prevalence of edentulism (63.1%)[12]. Thus, in view of the data observed, it is inferred that the high rate of tooth loss still impacts negatively the oral health and quality of life of the Brazilian old people, including the quilombolas.

It was noticed that approximately 54% of the sample used some type of dental prosthesis, coincident with the findings of another study[4]. In India, 97.8% of rural old people who had no dental absence did not use any type of prosthesis[30].

The present study found that 88.0% of the elderly needed dental prosthesis. Similar findings were observed in old quilombolas in another study in Minas Gerais[4]. These data indicate the relevant need for rehabilitation in oral health manifested by this population group that could be mitigated with the consolidation of local public policies and effective implementation of oral health teams linked to family health teams, and directed to longitudinal community care.

The average DMFT index found was 27.25 matching the results obtained for old quilombolas and Brazilian old people[4,12]. It is noteworthy that the component lost due to dental caries was the most prevalent in the index given the large amount of old people who showed edentulism and partial tooth loss. A study carried out with Japanese rural old people showed that the geographical distance between the place of residence and the place of dental care is a risk factor for tooth loss[31].

Said study showed that 10.9% of those investigated had alterations in the soft tissues of the oral cavity. Old people living in a rural area in Brazil showed a higher prevalence of alterations in the oral mucosa (40.79%)[32]. The difference observed between prevalences may be linked to the lifestyle or behavioral factors peculiar to members of these communities. In Minas Gerais, old quilombolas reported the local habit of chewing tobacco and using this product and ash from wood stoves to clean their

teeth routinely. Said habit may increase the risk of alterations in the oral mucosa of these individuals[11].

A Brazilian study carried out with old quilombolas in rural areas corroborated these findings, and showed individuals with low education, low income, restricted access to dental care services and a high prevalence of tooth loss, with the majority being edentulous in need of a complete dental prosthesis. The study authors also pointed out that the majority of those investigated reported dissatisfaction with oral health[4].

Regarding the multiple analysis, it was found that irregular access to dental care services was associated with the variables of age group, marital status, and work. Thus, old quilombolas with older age (80 years old or more) showed greater chances of having irregular access to dental care services (PR=4.81) when compared to younger old people (60 to 69 years old). Furthermore, individuals without spouses were more likely (PR=1.81) to have irregular access to the aforementioned services when compared to those who had spouses. In addition, retired old people showed greater chances of having irregular access to the aforementioned services (PR=2.61) when compared to those who worked. Therefore, it seems that oral health care directed to the local old quilombolas should have an equitable focus, and action aimed primarily at individuals with greater age progression, those who mentioned not having spouse, and retired, as exposed, in order to guarantee greater accessibility to dental care services.

National studies based on multiple analysis have shown that the lack of access to dental care services was more intense among individuals with older age and among those more socially vulnerable[33,34]. Extensive research on Brazilian old people has also shown that the use of public oral health services decreases with age, proving a low prevalence of access to dental care services among older people[35].

The results obtained in the present study show the need for a greater offer of oral health promotion services, disease prevention, and curative/rehabilitation care services focused on the population group investigated. We found that several local quilombola communities manifested geographic isolation and were far from urban centers, thus lacking accessibility, integrality, and longitudinality of health care. In addition, it was observed that most of these communities experience situations of social vulnerability, thus having a direct impact on the health and quality of life of their residents.

It is important to emphasize that the data found in the present study have external validity. Therefore, they are extensible to old quilombolas resident in the northern macro-region of health of Minas Gerais. Additionally, the difficult geographical and road access to communities stood out as obstacles to the execution of the present study. It should be added that the self-reported information obtained in this investigation proved to be susceptible to interference from the memory bias of the interviewees, with possible impacts on the accuracy of the data collected. However, it should be emphasized that this type of bias is commonly manifested in cross-sectional epidemiological surveys. It is also emphasized that the methodology and criteria used in this cross-sectional design basically followed those adopted by the Ministry of Health in the latest national epidemiological surveys on oral health. Furthermore, in view of the scarcity of studies addressing the issue of oral health in old quilombolas, it is suggested that further studies are carried out focusing on this population group and with the primary purpose of public health.

CONCLUSION

It was observed that the old quilombolas presented a precarious oral health condition, and had restricted access to dental care services revealing a scenario of social and health inequities in urgent need of specific public policies. It was also found that irregular access to dental care services proved to be associated and with a high magnitude among old people with more advanced age, and among those without a spouse and retired. Furthermore, the results found indicate the community existence of dental demands that lack longitudinal professional care. Thus, we emphasize that this local deficit of oral health care can be mitigated by expanding the accessibility and comprehensiveness of care offered by the public health system, which must be based on resolute primary care, and based on a health strategy of the proficient family.

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Factors associated to the condition of bedridden in Brazilian old people, results from the National Health Survey, 2013

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Abstract

Objective: to identify the factors associated to bedridden condition among Brazilian old people, analyzing socioeconomic and health conditions and the use of health services. Method: cross-sectional study, with secondary data from National Health Survey (2013). It counted on the population of individuals ≥60 aged (n=11.177). The bedridden condition was considered a dependent variable and the sociodemographic characteristics, health conditions and use of medical services as independent. Crude and adjusted logistic regression analyses were performed and reported crude and Adjusted Odds Ratio ($OR_{adjusted}$), with 95% confidence interval (95%CI). Results: It was found that 4.9% of the old people were bedridden. This condition was shown to be associated to male gender ($OR_{adjusted}$=1.45; 95%CI= 1.13-1.84), illiteracy ($OR_{adjusted}$=1.37 95%CI= 1.11-1.70) and number of chronic diseases, old people who had five chronic diseases were 4.96 (95%CI=2.78-8.85) times more likely than those without disease. The diseases associated to bedridden condition were stroke episode ($OR_{adjusted}$=3.03; 95%CI=1.29-8.43), diagnosis of systemic arterial hypertension ($OR_{adjusted}$=1.71; 95%CI=1.31-2.24), changes in cholesterol levels ($OR_{adjusted}$=2.08; CI95%= 1.37-3.17) and depression ($OR_{adjusted}$=5.64; 95%CI=2.42-13.14). Still, old people who needed care related to their own health (OR=16.94; 95%CI=7.15-40.16), hospitalization ($OR_{adjusted}$=8.10; 95%CI=4.20-15.54) and emergency home care in the last 12 months ($OR_{adjusted}$=1.78; 95%CI=1.25-2.55) and who considered the condition of poor general health ($OR_{adjusted}$=2.68; 95%CI=2.05-3.51) were more likely to be bedridden. Conclusion: This study allowed the identification of important factors associated with the bedridden condition of Brazilian old people, with emphasis on gender and education, the clinical variables of chronic diseases, and the more frequent use of health services.

Keywords: Aged. Bedridden Persons. Health Status Indicators. Geriatric Nursing.

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INTRODUCTION

The accelerated aging of the population poses challenges to health systems, since old people have a high prevalence of chronic diseases, which can evolve to a decline in functional and cognitive capacity. In this situation, an increase in the number of bedridden old people with a high degree of dependence is expected[1]. Often progressive and variable in severity, impaired mobility in old people has a multifactorial origin, with neurological and musculoskeletal disorders predominating[2], as well as the presence of diseases and the hospitalization process[3].

Conceptually, the bedridden patient is characterized by being unable to exercise self-care, either partially or totally, requiring assistance to perform activities of daily living[4]. In addition to the functional damage to several physiological systems, the restriction to the bed can favor changes in the emotional state, manifested by anxiety attacks, apathy, depression and social isolation[4]. It is estimated that 30 to 40% of hospitalized old people, regardless of the cause of hospitalization, develop some type of immobility after hospitalization[5].

The bedridden condition in old people is an important factor to be evaluated and monitored by the multidisciplinary health team. Furthermore, interventions related to prevention and care are effective and can significantly reduce the incidence of complications from this condition[1,4]. It is worth mentioning that the discussion about the bedridden condition and the associated factors that have national coverage is an unprecedented theme in Brazil and constitutes a differential. Given the above, the present study aimed to identify the factors associated with bedridden condition among Brazilian old people, analyzing socioeconomic conditions, health and use of health services.

METHOD

This is a study with secondary data from the last population-based survey, the National Health Survey (PNS-2013), conducted throughout the Brazilian territory[6]. PNS-2013 is a cross-sectional, quantitative, population-based study, carried out at the national level, proposed by the Ministry of Health and conducted by the Brazilian Institute of Geography and Statistics (IBGE).

The sampling plan used by the PNS had a probabilistic sampling by clusters in three stages, with the set of census sectors being the primary sampling units, the households the secondary units and the legal-age residents selected, the tertiary units. The sample size was defined considering the level of precision desired for the estimates of some indicators of interest, resulting in the investigation of 64,348 households, of which 60,202 residents were selected for individual interviews.

Data collection was carried out in the interstice from August 2013 to February 2014 by trained researchers, conducted by three questionnaires referring to the home, the residents and the individual. The instruments include topics related to the perception of health status, risk and protection factors, chronic diseases, health of the old people, among others. Details on the sampling process, data collection and questionnaires are available on the IBGE website and in the PNS-2013 report[6,7]. It is worth mentioning that the referred survey was approved by the National Commission for Ethics in Research for Human Beings, of the Ministry of Health, under Opinion No. 328.159/2013, and the data were made available publicly and free of charge (https://www.pns.icict.fiocruz.br/).

In the present study, only information from individuals aged ≥60 years was used, who answered the individual's questionnaire, resulting in a final sample of 11,177 subjects. PNS-2013 data were obtained from the aforementioned website. All variables underwent treatment, the numerical ones were transformed into categorical ones, some variables were recategorized, and others were dichotomized as recommended in the literature. Next, the variables considered in the study and the categories formed are exposed.

The dependent variable Bedridden is the result of the question: *Have you been bedridden in the last two weeks?* with answers yes and no.

The independent variables referred to the:

- *Sociodemographic characteristics:* gender (female and male); age, followed the categorization as recommended by Morais et al.,[8] in its instrument that assesses the functional clinical condition of old people (60 to 74 years, 75 to 84 years, ≥85 years); skin color (white, black, brown, others); living with the spouse (yes and no); marital status (married, separated / divorced, widowed, single) literate (yes and no); education (literacy, elementary, middle, undergraduate); and income, being categorized according to the minimum wages at the time of the study (up to 680 Reais, 681>1,320 reais, 1,321>2,640 reais, more than 2,641 reais).

- *Health condition:* self-perception of the general health condition (positive, negative); chronic diseases, with their categorization classified according to the frequency of the number of diseases, grouping from five diseases to present a lower frequency (none, one, two, three, four, five or more); diagnosis of: depression; systemic arterial hypertension; diabetes *mellitus*; rheumatoid arthritis; spine problem; chronic obstructive pulmonary disease; repetitive strain injury; hypercholesterolemia; cancer and previous stroke, as well as smoking and drinking were all dichotomized into *yes* and *no*.

- *Use of medical services:* frequency of medical consultations in the last year (numerical variable categorized in up to three consultations and four or more consultations) this classification followed that developed in the study by Meier et al.,[9] where he mentions that the categorization followed a document from the Ministry of Health, which foresees in the year 3 consultations in primary care and 1 consultation in secondary care; hospitalization in the last 12 months (no, yes); length of stay in days (numerical variable categorized up to three days; four or more days); in the last visit, medicines were prescribed (no, yes); emergency care at home in the last 12 months (no, yes); seeking health care in the last two weeks (no, yes). The lost data were counted in the descriptive tables as not informed and were not part of the statistical tests.

The results were analyzed descriptively by means of absolute and relative frequency. To test the association between the dependent variable and the independent variables, a bivariate analysis was initially performed using the chi-square test. Then, a logistic regression analysis was performed using the stepwise input method, based on the likelihood value. The variables that presented a value of $p \leq 0.20$ in the bivariate analysis were selected to enter the multiple model, remaining in the models if they reached $p < 0.05$ and / or adjusted the model. Then, the model was adjusted according to the variables that showed an association with the dependent variable: search in the last two weeks for health care vs. hospitalization; seeking in the last two weeks for health care vs. stroke; diagnosis of depression vs. gender; diagnosis of hypertension vs. diagnosis of cholesterol. The model generated an explanatory capacity of 95.1% in the crude and adjusted analysis.

RESULTS

It was found that of the 11,177 old people who made up the sample 4.9% (n=549) presented the bedridden condition at the time of the interview. In the sample, men prevailed, aged between 60 and 74 years, white, do not live with a spouse, married, literate, with low education and income below six hundred and eighty reais. Among the sociodemographic characteristics, an association with bedridden condition was found: gender, age, living with the spouse and being literate ($p < 0.05$) (Table 1).

Regarding the health condition of Brazilian old people, it was associated with the condition of being bedridden: self-perceived general health, number of chronic diseases, diagnosis of depression, systemic arterial hypertension, diabetes *mellitus*, rheumatoid arthritis, spinal problem, chronic obstructive pulmonary disease, hypercholesterolemia, repetitive strain injury, cancer and previous episode of stroke ($p<0.05$). Still, smoking and drinking were associated with bedridden condition ($p<0.05$) (Table 2).

As for the use of health services, shown in Table 3, all the variables investigated showed an association with the condition of being bedridden ($p < 0.05$), denoting greater use of these services by old people who were bedridden.

Table 1. Sociodemographic profile of Brazilian old people, according to their bedridden condition (n=11177). Brazil, 2013.

Variables n(%)	Bedridden		Total n(%) (n=11177; 100%)	*p*
	Yes n(%) (n=549; 4.9%)	No n(%) (n=10,628; 95.1%)		
Gender				
Female	178(32.4)	4377(41.2)	4555(40.8)	<0.001
Male	371(67.6)	6251(58.8)	6622(59.2)	
Age (years)				
60 to 74	391(71.2)	7899(74.3)	8290(74.2)	0.040
75 to 84	112(20.4)	2142(20.2)	2254(20.2)	
≥ 85	45(8.2)	779(7.3)	824(7.4)	
Not informed *	1(0.2)	8(0.1)	9(0.1)	
Skin color				
White	270(49.2)	5044(47.5)	5314(47.5)	0.370
Black	48(8.7)	1001(9.4)	1049(9.4)	
Brown	219(39.9)	4433(41.7)	4652(41.6)	
Others	12(2.2)	150(1.4)	162(1.4)	
Living with a spouse				
Yes	212(38.6)	4836(45.5)	5048(45.2)	0.002
No	337(61.4)	5792(54.5)	6129(54.8)	
Marital status				
Married	208(37.9)	4600(43.3)	4808(43.0)	0.088
Separated / Divorced	57(10.4)	1076(10.1)	1133(10.1)	
Widower	192(35.0)	3234(30.4)	3426(30.7)	
Not married	92(16.8)	1718(16.2)	1810(16.2)	
Literate				
Yes	371(67.6)	8015(75.4)	8386(75.0)	<0.001
No	178(32.4)	2613(24.6)	2791(25.0)	
Education				
Basic	213(38.8)	3993(37.6)	4206(37.6)	0.090
Fundamental	66(12.0)	1710(16.1)	1776(15.9)	
Medium	60(10.9)	1431(13.5)	1491(13.3)	
University graduate	55(10.0)	1112(10.5)	1167(10.4)	
Not informed *	155(28.2)	2382(22.4)	2537(22.7)	
Income				
> 680 Reais	279(50.8)	4806(45.2)	5085(45.5)	0.180
680> 1.320 Reais	74(13.5)	1238(11.6)	1312(11.7)	
1.320> 2.640 Reais	73(13.3)	1318(12.4)	1391(12.4)	
More than 2.640 Reais	62(11.3)	1433(13.5)	1495(13.4)	
Not informed *	61(11.1)	1760(16.6)	1821(16.3)	

Source: PNS/ IBGE, 2013. * These data were not part of the analysis.

Table 2. Health condition of Brazilian old people, according to bedridden condition (n=11177). Brazil. 2013.

Variables	Bedridden		Total n(%)	*p*
	Yes n(%)	No n(%)		
Self-perceived general health condition				
Positive	77(14.0)	4855(45.7)	4932(44.1)	<0.001
Negative	472(86.0)	5773(54.3)	6245(55.9)	
Number of chronic diseases				
None	41(7.5)	2735(25.7)	2776(24.8)	<0.001
One	107(19.5)	3047(28.7)	3154(28.2)	
Two	118(21.5)	2296(21.6)	2414(21.6)	
Three	109(19.9)	1366(12.9)	1475(13.2)	
Four	80(14.6)	736(6.9)	816(7.3)	
Five or more	94(17.1)	448(4.2)	542(4.8)	
Diagnosis of depression				
No	377(68.7)	9790(92.1)	10167(91.0)	<0.001
Yes	172(31.3)	838(7.9)	1010(9.0)	
Diagnosis of systemic arterial hypertension				
No	212(38.6)	5318(50.0)	5530(49.5)	<0.001
Yes	336(61.2)	5188(48.8)	5524(49.4)	
Not informed *	1(0.2)	122(1.1)	123(1.1)	
Diagnosis of diabetes *mellitus*				
No	391(71.2)	8298(78.1)	8689(77.7)	<0.001
Yes	134(24.4)	1762(16.6)	1896(17.0)	
Not informed *	24(4.4)	568(5.3)	592(5.3)	
Diagnosis of rheumatoid arthritis				
No	366(66.7)	8931(84.0)	9297(83.2)	<0.001
Yes	183(33.3)	1697(16.0)	1880(16.8)	
Diagnosis of any spine problem				
No	321(58.5)	7959(74.9)	8280(74.1)	<0.001
Yes	228(41.5)	2669(25.1)	2897(25.9)	
Diagnosis of any chronic obstructive pulmonary disease				
No	508(92.5)	10317(97.1)	10825(96.9)	<0.001
Yes	41(7.5)	311(2.9)	352(3.1)	
Diagnosis of hypercholesterolemia				
No	356(64.8)	7480(70.4)	7836(70.1)	<0.001
Yes	166(30.2)	2438(22.9)	2604(23.3)	
Not informed *	27(4.9)	710(6.7)	737(6.6)	
Diagnosis of any type of cancer				
No	507(92.3)	10128(95.3)	10635(95.2)	0.002
Yes	42(7.7)	500(4.7)	542(4.8)	
Previous episode of stroke				
No	472(86.0)	10142(95.4)	10614(95.0)	<0.001
Yes	77(14.0)	486(4.6)	563(5.0)	

to be continued

Continuation of Table 2

Variables	Bedridden		Total n(%)	*p*
	Yes n(%)	No n(%)		
Presence of any repetitive strain injury				
No	541(98.5)	10492(98.7)	11033(98.7)	0.720
Yes	8(1.5)	136(1.3)	144(1.3)	
Smoking				
No	504(91.8)	9429(88.7)	9933(88.9)	0.030
Yes	45(8.2)	1199(11.3)	1244(11.1)	
Drinking				
No	479(87.2)	8266(77.8)	8745(78.2)	<0.001
Yes	70(12.8)	2362(22.2)	2432(21.8)	

Source: PNS/ IBGE, 2013. * These data were not part of the analysis.

Table 3. Use of health services by Brazilian old people, according to their bedridden condition. (n=11177). Brazil. 2013.

Variables	Bedridden		Total n(%)	*p*
	Yes n(%)	No n(%)		
Frequency of medical consultation in the last year				
Up to 3	207(37.7)	5808(54.6)	6015(53.8)	<0.001
4 or more	316(57.6)	2959(27.8)	3275(29.3)	
Not informed*	26(4.7)	1861(17.5)	1887(16.9)	
Hospitalization in the last 12 months				
No	360(65.6)	9712(91.4)	10072(90.1)	<0.001
Yes	189(34.4)	916(8.6)	1105(9.9)	
Length of stay (days)				
Up to 3	169(30.8)	866(8.1)	1035(9.3)	0.008
4 or more	20(3.6)	50(0.4)	70(0.6)	
Not applicable*	360(65.6)	9712(91.4)	10072(90.1)	
In the last visit, medicines were prescribed				
No	58(10.6)	786(7.4)	844(7.6)	<0.001
Yes	285(51.9)	1573(14.8)	1858(16.6)	
Not applicable*	206(37.5)	8269(77.8)	8475(75.8)	
Emergency care at home in the last 12 months				
No	488(88.9)	10381(97.7)	10869(97.2)	<0.001
Yes	61(11.1)	247(2.3)	308(2.8)	
Search in the last two weeks for health care				
No	108(19.7)	8036(75.6)	8144(72.9)	<0.001
Yes	308(56.1)	2345(22.1)	2653(23.7)	

Source: PNS/ IBGE, 2013.

* These data were not part of the analysis.

Table 4 shows that males and illiterate old people were 1.45 and 1.37, respectively more likely to experience bedridden than women and literate individuals. The number of chronic diseases was a contributing factor for old people to be bedridden. Old people with a chronic disease are 2.04 more likely to be bedridden, while an old person who had five chronic diseases had 4.96. Experiencing an episode of stroke, having a diagnosis of systemic arterial hypertension (SAH) and changes in cholesterol levels also increased the chances of the old person being bedridden.

Still, old people who needed some care related to their own health considering the two weeks prior to data collection were more likely to be bedridden, as well as those who were hospitalized and required emergency care at home in the last 12 months. The general health condition considered poor and the diagnosis of depression were also factors associated with the condition of being bedridden with old people (Table 4).

Table 4. Crude and adjusted final model of the bedridden condition. (n = 11177). Brazil. 2013.

Variable	OR_{crude} (95%CI)*	*p*	$OR_{adjusted}$ (95%CI)**	*p*
Gender				
Female	1.00	0.03	1.00	0.003
Male	1.26 (1.02-1.56)		1.45 (1.13-1.84)	
Illiterate				
No	1.00	0.004	1.00	0.003
Yes	1.37 (1.02-1.56)		1.37 (1.11-1.70)	
Chronic disease number				
None	1.00	<0.001	1.00	<0.001
One	1.93 (1.28-2.91)	0.002	2.04 (1.35-3.10)	0.001
Two	2.31 (1.50-3.56)	<0.001	2.48 (1.59-3.87)	<0.001
Three	2.88 (1.79-4.64)	<0.001	3.10 (1.91-5.05)	<0.001
Four	4.69 (2.64-8.33)	<0.001	3.25 (1.91-5.53)	<0.001
Five or more	4.69 (2.64-8.33)	<0.001	4.96 (2.78-8.85)	<0.001
Previous episode of stroke				
No	1.00	0.004	1.00	0.012
Yes	1.59 (1.16-2.17)		3.03 (1.29-8.43)	
Diagnosis of systemic arterial hypertension				
No	1.00	0.001	1.00	<0.001
Yes	1.48 (1.17-1.86)		1.71 (1.31-2.24)	
Diagnosis of hypercholesterolemia				
No	1.00	0.003	1.00	0.001
Yes	1.44 (1.11-1.69)		2.08(1.37-3.17)	
Search in the last two weeks for health care				
No	1.00	<0.001	1.00	<0.001
Yes	4.21 (3.46-5.13)		16.94 (7.15-40.16)	
Hospital admission in the last 12 months				
No	1.00	<0.001	1.00	<0.001
Yes	3.12 (2.51-3.88)		8.10 (4.20-15.54)	

to be continued

Continuation of Table 2

Variable	OR_{crude} (95%CI)*	*p*	$OR_{adjusted}$ (95%CI)**	*p*
Emergency care at home in the last 12 months				
No	1.00	0.002	1.00	0.002
Yes	1.74 (1.23-2.48)		1.78 (1.25-2.55)	
General health condition				
Boa	1.00	<0.001	1.00	<0.001
Ruim	2.65 (2.03-3.47)		2.68 (2.05-3.51)	
Diagnosis of depression				
No	1.00	<0.001	1.00	<0.001
Yes	2.20 (1.71-2.83)		5.64 (2.42-13.14)	

Source: PNS/ IBGE, 2013.

OR=Odds Ratio; *Explanatory capacity of the final model 95.1%. -2 Log likelihood: 3285,710; Cox & Snell R^2: 0.079; Nagelkerke R^2: 0.240. **Explanatory capacity of the final model 95.1% -2 Log likelihood: 3255,634; Cox & Snell R^2: 0.082; Nagelkerke R^2: 0.248.

DISCUSSION

The present study, which assessed the prevalence of bedridden condition in old people and its associated factors, found that approximately 5% of the old people investigated were in this condition. And that illiterate male individuals with multimorbidity, episodes of stroke, diagnosis of SAH and hypercholesterolemia were more likely to be bedridden. As well as those who sought health care in the last two weeks, needed hospitalization and emergency care at home in the last 12 months, who had negative self-perception of general health and depression.

It is noteworthy that in the literature there are no studies of national scope, with old people living at home, who refer to the prevalence of the bedridden condition for the purpose of comparing the findings of the present study. However, a study carried out in long-term care facilities for old people found a prevalence of 24% of bedridden[1].

Although the prevalence of bedridden condition, when compared to other diseases that affect the old people population, is low, it is a complication that leads to an important social, economic and family impact[10]. The immobility associated with the prolonged period of bed rest can trigger several health complications, in addition to causing problems with people's usual activities, mobility and self-care[11]. In old people, these complications added to changes of the aging process itself can lead to even greater complications[3].

The cardiovascular, pulmonary, gastrointestinal, musculoskeletal and urinary systems are the most affected, and the prolonged period of bed rest favors the development of diseases that have affected these systems, such as deep venous thrombosis[12], pressure injury[13], pneumonia[14] and urinary tract infection[15]. In this way, bedridden old people require health care in a continuous and systematic way, a caregiver must be aware of some signs and symptoms that may mean some harm to the health of the old person.

As for the factors associated with the bedridden condition, it was found that old men were more likely to be bedridden. This fact may be due to the lower demand for health services by men in relation to women, as well as less preventive care provided to their own health and greater exposure to risk factors throughout life[16].

It was also found that illiterate old people were more likely to be bedridden, in relation to the literate. Studies are consistent with the findings of previous studies[17,18] and demonstrate that individuals with a low level of education are more likely to have diseases and disabilities, due to limited access to health information. Illiteracy has a cumulative burden, as it reflects, throughout life, less self-care and self-perception about their health status and understanding about diseases, thus inferring less search for health services, late diagnoses timely treatment, increasing the aggravation of diseases and resulting in more serious limitations, such as

bedridden condition[19]. In addition, illiterates have more unfavorable social determinants of health, a condition that also weakens the individual[19] and increases the chances of being bedridden.

The quality of life of the old person can be hindered with the onset of chronic non-communicable diseases (NCDs), such diseases can be responsible for what is defined as functional disability of the old person, that is, affecting the functionality and independence of these individuals, in temporary or permanent form[20], as observed in the present study. In addition, the greater the number of chronic diseases, the greater the chance of disability of this individual, since NCDs can trigger other complications and, consequently, the need to seek medical attention, hospitalizations, reduced functional capacity and mortality is increased[18,21,22].

The gradual increase in the chances of being bedridden according to the growing number of chronic diseases found in the present study can be explained in two ways: cause and consequence. "Cause" because, with the increase in the number of NCDs, the weaknesses in old people also increase due to the continuous loss of the functions of the organs and biological system; and "consequence" because the bedridden condition weakens the functioning of the organism and increases the chances of having new injuries, these being linked to the time the individual is in that condition[23].

Stroke is among the most common diseases of death and permanent disability[24], which may result in bedridden condition. Among the main consequences of stroke, the following can be observed: cognitive, motor, emotional changes, memory and speech problems, attention, language and impairment in executive functions[24], factors that hinder the quality of life of the old person and their family.

Studies show that SAH and hypercholesterolemia are present in the majority of the old people population, and end up becoming one of the main causes for the development of other complications, whether or not it is associated with another disease.[23,25–27]. SAH and high cholesterol can trigger cardiac, renal, peripheral and cerebral vascular impairment, leading to a hindered quality of life, resulting in the old person being unable to perform their activities due to neurological and motor complications[23,25–27], condition that explains the association found between NCDs, SAH, hypercholesterolemia and being bedridden.

The cross-sectional research carried out with Japanese old people with the objective of testing the hypothesis that an increase in the difference in systolic blood pressure between the arms would be associated with a reduction in physical activity in old people, found that bedridden old people presented a difference in the systolic blood pressure between the arms in relation to walking and wheelchair-using old people[26]. Still, the bedridden lack of physical activity can be a predictive factor to raise blood pressure.

A similar condition was observed in relation to the relationship found between bedridden condition and hypercholesterolemia, a study that analyzed fasting blood samples in clinically stable bedridden patients under long-term and sedentary normolipidemic care, concluded that inactivity has a major impact in reducing serum levels of HDL and elevated lipid concentration[28].

Still, another chronic disease that was associated with mobility restricted to the bed was depression, which can be caused by several factors, such as mourning, abandonment, disabling diseases, among others[29]. The depressive disorder causes the old person to not perform self-care, not eating properly and staying in bed longer, increasing their degree of fragility and having more chances of becoming bedridden[30]. However, the opposite also happens, since in this study, it was shown that the number of bedridden old people with depression has an odds ratio of 2.13, since the loss of functional capacity, the appearance of NCDs, the use of medicines, can make this old person feel useless, leading them to develop these disorders[29,30].

It was also found, in the present study, that bedridden old people require a greater need for health-related care, be it for outpatient care, hospitalization, or urgent and emergency care in relation to old people with mobility, since the condition of being bedridden, by itself, denotes greater health care for the individual, since their health is at a greater level of fragility, as explained above. And it also ends up being a risk factor for the appearance of

complications and health problems, such as the development of pressure injuries, worsening of the respiratory condition, anxiety and infections, social isolation, depression, hospitalization, which when it comes to old people, the hospitalization period may be even longer, as it is a more fragile individual where the outcome may be death[23].

When talking about health perception, it is observed that having a bad perception about health increases the chance of the old person being bedridden. The condition that the old person is, in the presence of chronic diseases, prevented from carrying out their activities, makes the old person assess their health as a bad condition. The presence of diseases changes the quality of life, which leads to a negative perception of health[31]. The bedridden self-perception ends up generating a certain type of insecurity, since they need care and attention, whether basic or more complex, which makes this old person see their life as a burden on the life of a family member or caregiver[32]. Thus, this old person ends up losing the desire to relate maintaining social isolation, which causes the decline of their health to occur even more, increase their dependence and with this the appearance of new complications, such as hospitalizations, depression, and even lead to death[31].

The study's limitation is the use of secondary data from cross-sectional research, which makes it impossible to analyze cause and effect and the time elapsed in the collection of these data. However, the data came from a research with great methodological rigor and quality. In addition, it is worth highlighting the limited number of studies, in recent national and international literature, that addresses prevalence and factors associated with the theme of bedridden condition, making it difficult to compare the findings. However, the importance of carrying out studies that address this condition is emphasized, since the number of old people is growing, both nationally and worldwide. The findings of the present study may support the planning of gerontological care aimed at the specific needs of this age group, considering active and healthy aging and providing better quality of life for old people.

CONCLUSION

It is concluded that the prevalence of bedridden condition in Brazilian old people is low, when compared to other health problems, and that it was associated with sociodemographic conditions, male gender and illiteracy; and also to health conditions expressed by the presence of chronic non-communicable diseases, with a greater predilection for stroke, systemic arterial hypertension, changes in cholesterol levels, depression and worse health perception. Regarding the use of health services, it was shown to be associated with the recent search for health services, hospitalizations and emergency home care.

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Prevalence and associated factors to the cognitive deficit in community-dwelling elderly

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Abstract

Objective: To estimate the prevalence of cognitive deficit and verify associations with sociodemographic and individual health variables in senior patients from units in the primary health system. *Method:* Prevalence and association study about the elderly population. The instruments used were the Mini-Mental State Examination (cognitive function), Shorten Geriatric Depression Scale (depression symptoms), Lawton Scale (functional capacity), Mini-Nutritional Assessment (nutritional state), and *Timed Up and Go* Test (fall risk). The association between cognitive deficit and independent variables was verified by the Chi-square test. Multivariate analysis was performed using a logistic regression model with the prevalence ratio (PR) and 95% confidence interval (95%CI). *Results:* The data were collected from 818 old-aged patients. The cognitive deficit had a prevalence of 65.9% (95%CI= 62.50-69.10). In the multivariate analysis model, it was verified a larger occurrence of cognitive deficit individuals, with risks of malnutrition (PR=2.09; CI95%=1.47-2.96), illiteracy (PR=1.66; 95%CI=1.15-2.40), dependents (PR=3.27; 95%CI=2.01-5.10), and with more than 70 years old (PR=1.48; 95%CI=1.07-2.05). *Conclusion:* The present study showed a high prevalence of cognitive deficit and was associated with age, education, functional capacity, and nutritional status. It is possible to question if it is caused by the big amount of people with mild cognitive impairment without dementia with posterior remission of the symptoms, or by the occurrence of early start dementia.

Keywords: Aging. Cognitive Deficit. Dementia. Elderly. Prevalence.

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INTRODUCTION

Mild Cognitive Impairment (CLC) corresponds in many cases to an incipient stage of some form of dementia, such as Alzheimer's disease or vascular dementia[1]. Dementia is one of the main causes of morbidity and mortality among the older adult, defined as a chronic syndrome characterized by progressive impairment of cognition involving one or more domains, such as memory, learning, language, executive functions, visuospatial skills and behavior, as well as disability and impairment in psychosocial development[2,3]. Cognitive deficit, evolving to dementia or not, can cause cognitive impairment, behavioral symptoms, depression and apathy[4].

Cognitive impairment is associated with increased age group[5], change of environment, immobility and depression[6]. Timely diagnosis of dementia is important to release portals for care, promote proper coping, treat or delay the progression of cognitive and neuropsychiatric symptoms, and prepare for the future[7]. Aging causes individuals to present cognitive decline. This fact leads the older adult to have difficulties in remembering recent facts, calculating and to deficit with attention[8]. Dementia has a multifactorial origin and has a considerable financial impact. Understanding these factors helps in the diagnosis and management of the older adult with this problem[9].

Cognitive disability is a theme that needs further studies, given the numerous factors that predispose it and the growing number of older adults in the population. In addition, more attention is needed in the predisposing variables in order to set goals for prevention and health care in this population, resulting in improvement in quality of life and reduction of dependence[10]. Therefore, the aim of this study was to estimate the prevalence of cognitive deficit and associated factors in the older adult assisted by Basic Health Units (UBSs) of a city in the interior of northeastern Brazil.

METHOD

This is a cross-sectional study that provides an important view for understanding the associations between the degree of cognition and risk for depression, malnutrition, functional capacity and mobility of the older adult, conducted in the municipality of Mossoró (RN), a municipality with a population of 294,076 inhabitants[11]. Among these, 24,238 are older adults (8.24%). Although this is a percentage below the national average (13.5%), it is a significant number of people who need assistance, and there is a lack of studies that demonstrate the profile of this population.

The selection of participants took place in a non-probabilistic manner. They were previously invited by community health agents or when they sought the UBS (Basic Care Unit - *Unidade Básica de Saúde*) for care. The inclusion criteria were older adults living in the area covered by the UBSs for more than one year who were registered by the family health teams. The only exclusion criterion was that the individual could not be bedridden (restricted to the bed). This study, which comprised the period of one year (April 2017 to April 2018), reached 818 older adults. At the time of the study, Mossoró had 70 family health teams (ESFs), and the study was conducted in 4 UBSs, with 6 ESFs (in two of the UBSs two teams operated). The study covered 8.57% of Mossoró's ESFs.

Considering that four UBSs were drawn in the municipality, with a sum of 1,200 older adults treated in the same period in the previous year and that this population is finite (< 10,000), it was necessary to adopt the finite sample calculation (correction). Thus, considering a population of 1,200 individuals, a margin of error of 15% and a non-response rate of 20%, a sample of 937 individuals was reached. These health units are part of a group of primary care equipment that has the most older adults registered and followed up in the municipality. At the beginning of the data collection period, there was a change of the residents of a community, with about 163 older adults, attended by one of the UBSs migrated to another location, by action of the city, in order to significantly reduce the older adult population in this region. This fact made it impossible to reach the total number of the sample and was the only reason for the sample loss. The research population was of older adults (≥60 years)[12] residents in the area covered by the four Selected UBSs. The 11 researchers involved

went to the participating UBS and patients' homes to examine them. Three attempts were made to include each participant. There was no record of refusal of participants, and all participants examined were included in the study.

The research project was approved by the research ethics committee (CEP) of the State University of Rio Grande do Norte, (CAAE/SISNEP: 63909817.6.0000.5294; opinion number 1,959,345), and was conducted in accordance with Resolution 466/2012 of the National Health Council. The research participants were fully informed about the nature, risks and objectives inherent to the research and signed the Free and Informed Consent Form.

Data collection was based on an instrument divided into two parts: the first part contained sociodemographic data, such as skin color, gender, age, schooling, marital status, the second part contained the scales and tests mentioned above, which were applied by the examiners. A workshop was held with the purpose of calibrating the examiners regarding the instruments. A Kappa calibration level greater than or equal to 0.80 was considered.

The dependent variable was cognitive function, which evaluated the Mini-Mental State Examination (MMSE), which assesses temporal and spatial orientation, memory, attention and calculus, language and visuospatial skills[13]. The following cutoff points were adopted to characterize cognitive deficit: <20 points for individuals without schooling and <24 points for individuals with some schooling[14].

The Abbreviated Geriatric Depression Scale (GDS), composed of 15 items, was used to assess depressive symptoms[15]. It is usually considered that the score of up to 5 as without depression, between 6 and 10 mild depression and 11 or more severe depression[16]. In the present study, depression was considered not to be up to five and as having a depression score of six or more points.

The Capacity Assessment Scale for Instrumental Activities of Daily Living (Lawton Scale) was used to assess functional capacity by establishing the level of independence of the individual in the exercise of certain functions, varying his score from nine to 27 points[17]. The participants were classified as dependent and independent and the cutoff point used was 20[18].

The Mini Nutritional Assessment (MAN), composed of 18 questions, was used to assess the nutritional status of the participants[19]. Older adults with scores of up to 23.5 were classified as malnourished or at risk for malnutrition, and those who obtained a higher score were considered as normal nutritional status[20].

The *Timed Up and Go* (TUG) test was used to assess the risk of falls. Tug evaluates sitting balance, seated-to-foot transfer, walking stability and gait changes, by performing a simple test by requesting that the participant get up from a chair, walk a distance of three meters, turn and return the course, sitting again, so that adult individuals without changes in balance perform the test in 10 seconds or less[21]. The score used for dichotomization was 10 seconds for the risk of falls[22]. Finally, the age of the participants was dichotomized from the median (70 years).

After the construction of the database, the process of cleaning and verifying the completeness of information was carried out. Quantitative variables were tested for their normality from the verification of asymmetry, shortse, normal curve, standard deviation, mean, median and by the Kolmogorov-Sminorv normality test. The bivariate association between cognitive deficit and independent variables was verified by the Chi-square Test. To check the magnitude of these associations, we used the Prevalence Ratios PR and their respective Confidence Intervals 95%. The multivariate analysis was performed using a logistic regression model, through hierarchical analysis to estimate the RPs for the occurrence of cognitive deficit adjusted for age, schooling, sex, color, marital status, nutritional status, functional capacity, risk of falls and geriatric depression. The model was started by the most significant variables, followed by the variables added individually, considering the *p* critical value for entry into the 0.250 model. The permanence of the variable in the model was based on the likelihood test, multicolinearity, as well as the Hosmer and Lemeshow test (0.449). The *p value* <0.05 were considered significant.

RESULTS

We evaluated 818 older adults aged 60 to 100 years, most of them female (63.3%), non-white skin color (63.2%), age up to 70 years (51.7%), literate (71.5%) and without a partner (single, widowed or separated; 54.6%). Among the health variables, 34% of the individuals presented scores compatible with depression, 36.1% of the participants were malnourished or at risk for malnutrition, 28% of the older adults were dependent for the instrumental activities of daily living and 84.2% of the subjects presented increased risk for falls.

In the sample studied, 65.9% (95% CI = 62.50 - 69.10) of the older adults presented cognitive deficit. In the bivariate analysis, the occurrence of cognitive deficit was significantly higher in older, illiterate, with depression, malnourished or at risk of malnutrition, dependent and at risk of falls (Table 1). When comcomming the regression model, the variables age, schooling, nutritional status and functional capacity adjusted by color were maintained (Table 2). The variables depression, gender, marital status and risk of falls lost significance and did not remain in the final model.

Table 1. Simple frequency values (%) cognitive deficit (Mini Mental State Examination) in individuals (n = 818). Mossoró, RN, 2020.

Variables	Cognitive deficit		X^2	RP (IC95%)	*p*-value
	Yes n (%)	No n (%)			
Color					
White	190 (63.1)	111 (36.9)	1.436	0.94 (0.84-1.04)	0.231
Other	349 (67.5)	168 (32.5)			
Gender					
Female	382 (67.7)	182 (32.3)	2.473	1.10 (0.98-1.23)	0.116
Male	157 (61.8)	97 (38.2)			
Age					
71 years or older	295 (74.7)	100 (25.3)	25.516	1.30 (1.17-1.43)	0.001
Up to 70 years	244 (57.7)	179 (42.3)			
Marital status					
No companions	308 (68.9)	139 (31.1)	3.687	1.11 (1.00-1.22)	0.055
With partner	231 (62.3)	140 (37.7)			
Education					
Illiterate	179 (76.8)	54 (23.2)	16.650	1.25 (1.14- 1.37)	0.001
Literate	360 (61.5)	225 (38.5)			
Geriatric depression					
Yes	212 (74.4)	73 (25.6)	13,466	1.21 (1.10-1.33)	0.001
No	327 (61.4)	206 (38.6)			
Dietary status					
Risk for malnutrition or malnourished	234 (79.3)	61 (20.7)	36.098	1.36 (1.24-1.49)	0.001
Normal	305 (58.3)	218 (41.7)			
Funcional capacity					
Dependent	199 (86.9)	30 (13.1)	61.157	1.51 (1.38-1.64)	0.001
Independent	340 (57.7)	249 (42.3)			
Drops risk					
Yes	490 (68.4)	226 (31.6)	15.632	1.43 (1.16-1.75)	0.001
No	49 (48.0)	53 (52.0)			

RP: Ratio of prevalence (CI95%) 95% CI 95% Confidence Interval

Table 2. Logistic regression model between occurrence of cognitive deficit and sociodemographic, occupational and general health variables. Mossoró, RN, 2020.

Variables	Reference	Exposure	RPnaj* (95% CI)	P (naj)	RPaj** (IC95%)	P (aj)
Functional capacity	Independent	Dependent	1.51 (1.38-164)	0.001	3.27 (2.01-5.10)	0.001
Dietary status	Normal	Risk for malnutrition or malnourished	1.36 (1.24-1.49)	0.001	2.09 (1.47-2.96)	0.001
Age	Up to 70 years	71 years or older	1.30 (1.17-1.43)	0.001	1.48 (1.07-2.05)	0.017
Education	Illiterate	Literate	1.25 (1.14-1.37)	0.001	1.66 (1.15-2.40)	0.007
Color	White	Other	0.94 (0.84-1.04)	0.231	0.76 (0.55-1.05)	0.762

*unadjusted **set

DISCUSSION

The present study evaluated the prevalence of cognitive deficit and associated factors in the older adult treated by UBSs in a city in the interior of northeastern Brazil. The main results showed a high prevalence of cognitive deficit (65.9%) which was associated with age (≥71 years), schooling (illiterate), functional capacity (dependent) and nutritional status (risk of malnutrition or malnourished) in the adjusted multivariate analysis model. The results of the research reinforce the multifactorial condition of cognitive deficit.

Cognitive deficit, both in the form of CCL and in the form of dementia, is a multisystemic condition. This makes it difficult to compare with other studies, as the definition is still evolving in research communities and clinics.[23] In 2017, a study conducted in Natal/RN, Brazil, identified the prevalence of cognitive disability and its associated factors in institutionalized older adults[10]. The prevalence of cognitive disability was more significant in moderate or severe classifications, with 83.6% of the older adults affected[10]. This lower cognitive performance in older adult residents of LSIE may suggest that institutionalization may aggravate this picture[10].

The prevalence found in the present study was higher than that of the study by Bui et al.[24], which was 55%, but this research was conducted with hospitalized older adults, which leads to the belief that they are more frail older adults. In addition, the MiniCog, another evaluation instrument, was used[24], while in the present study the MMSE was used. The prevalence found in the study by Rosa et al.[8] was lower (27.6%), however, the cutoff point used was 13 for illiterate participants and 18 for the older adults with up to 8 years of schooling, cutoff points lower than that were used in the present study.

In this study, schooling was significantly associated with cognitive deficit. Illiterate individuals had a 65% higher occurrence of cognitive deficit. It is noteworthy that the cutoff used was of 20 for individuals without schooling. The majority of the participants declared themselves literate (71.5%), although there is still a significant proportion of illiterate. A study conducted in a rural area in South Korea identified that a longer period of education may provide a stronger protective effect for dementia. Six years of studies were sufficient to ensure a lower prevalence of dementia among the older adult[25]. In a population-based longitudinal survey conducted in the United States with more than 21,000 individuals[26], more years of education were associated with a lower risk of dementia. Frota et al.[27] suggest illiteracy as a risk factor for the occurrence of dementia and its association with a lower cognitive reserve.

Older participants (71 years or older) had a higher occurrence of cognitive deficit regardless of the variables schooling, functional capacity and nutritional status. It has been described that dementia occurs mainly over 65 years[28]. The currently accepted model is an exponential increase related to age in the prevalence and incidence of dementia, with few cases before the age of 70 years. However, emerging data suggests that this model may be changing[23]. Although dementia usually occurs in older adults, it

can also affect people under 65 in the form of Early Onset Dementia. In addition, compared to people with Late-onset Alzheimer's disease, those with early onset may often have impaired attention skills, verbal fluency, motor, executive and consciousness functions, as well as less illusion, hallucination, agitation, and aberrant motor behavior[29].

The occurrence of risk for malnutrition and malnutrition itself was significantly associated with cognitive deficit. As in the present study, in the research by Sanders et al.[30], compared to well-nourished patients, malnourished patients had three to four times the risk of severe dementia. Nutritional status is an important predictor of clinical outcomes in dementia and may provide a path to intervention. In a cross-sectional cohort study conducted with more than 5,000 older adults in Singapore, a significant association was found between malnutrition and cognitive deficit[31].

The occurrence of functional dependence was also associated with cognitive impairment. Data on functional disability from a study conducted in the urban area of Uberaba-MG draw attention to the high number of skills that the older adult with cognitive decline cannot perform, leading to greater dependence and restricting autonomy[32]. The older adults decrease their level of physical activity, either due to their own age or functional disability. This context of physical/motor influence on cognition and vice versa can lead to dementia[33].

No information was collected in this study about alcohol consumption among participants, as well as about exposure to other risk factors for cognitive impairment, such as smoking, sleep disorders, metabolic syndromes. The typology of epidemiological study adopted in this study does not make it possible to establish cause and effect. In addition, the sample was not stratified and the study was done in only one center. Further studies are needed in order to corroborate or refute the data found, as well as to explain them. In addition, the data were self-reported and some variables are susceptible to memory biases.

The identification of dementia and functional capacity in the older adult enables the implementation of health promotion activities and better prognosis[34]. In addition, it may represent an opportunity for monitoring the living and health conditions of the older adult in Primary Care - the implementation of the Family Health Strategy, in which the family is responsible for providing care to the older adult[35].

CONCLUSION

The present study showed a high prevalence of cognitive deficit (65.9%) among the older adult in the area covered by the UBS in the municipality of Mossoró (RN). Among the sociodemographic variables, there was also a predominance of cognitive deficit in individuals aged 71 years or older, dependent, at risk of malnutrition or malnourished and illiterate.

Cognitive impairment can impair the ability of individuals to live independently, but if identified and treated early, it may eventually be reversed or their progression to dementia may be delayed. From this perspective, future studies are necessary to clarify the causal relationship between the associations found. Nevertheless, this study proved to be important as an initial step towards understanding the prevalence of cognitive deficit among the target population and its correlation with the variables studied.

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Vitamin B12 deficiency and associated factors in institutionalized old people

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Abstract

Objective: To assess the frequency of vitamin B12 deficiency and associated factors in institutionalized old people. *Method:* We analyzed 65 old people, with an average age of 80±9 years (61-113), from a long-term philanthropic geriatric institution. The serum dosage of vitamin B12 was analyzed and classified as: normal (≥299 pg/mL), borderline (200-298 pg/mL) and deficiency (<200 pg/mL). The association with length of stay in the institution, cognitive and functional decline, regular use of biguanides and proton pump inhibitors, considered risk factors for B12 hypovitaminosis, was analyzed using the bivariate analysis tests (parametric and non-parametric) and Poisson regression. *Results*: Vitamin B12 deficiency was present in 21.5% and borderline values in 32.3% of the sample. Among the old people, 52.9% had dementia of different causes, 49.2% had arterial hypertension, 29.2% with anemia (21.5% normocytic, 4.6% microcytic and 3.1% macrocytic), 18.5 % diabetics; 27.7% used polypharmacy, with 12.3% using metformin and 16.9% using proton pump inhibitors. In the multivariate model, there was no association between vitamin B12 deficiency and the variables studied. *Conclusion*: We observed an important frequency of borderline and low values of vitamin B12 in the patients of this geriatric institution of permanent care, but without association with the risk factors for their deficiency studied, which makes it important to include the serum dosage of this vitamin in the laboratory tests routine of that group.

Keywords: Vitamin B12. Vitamin B12 Deficiency. Homes for the aged. Health of Institutionalized Elderly.

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INTRODUCTION

Vitamin B12 is an essential water-soluble micronutrient, indispensable for the metabolism of all cells in the body. Two enzyme reactions are dependent on vitamin B12: meltilmalonic coenzyme A mutase reaction and 5-meltiltrehydrofolate-homocysteine methyltransferase reaction, important in the extraction of energy from proteins and fats in the mitochondrial citric acid cycle, which maintains the integrity of the nervous system and DNA synthesis (deoxyribonucleic acid)[1]. In addition, the interaction between vitamin B12 and folate is responsible for megaloblastic anemia[2]. In general, vitamin B12 is available through regular consumption of animal products, including red meat, eggs and dairy products. When consumed, it binds to the protein R present in saliva and gastric secretions. Subsequently, the intrinsic factor, which is produced by the parietal cells of the stomach, binds to vitamin B12 until intestinal reabsorption in the distal ilium[3].

Vitamin B12 deficiency can cause megaloblastic anemia and demyelinating neurological symptoms, with irreversible damage to nerves and peripheral neuropathy, in addition to having a strong protective effect on cognitive decline in old people[4]. Studies associate arterial hypertension and elevated homocysteine, with a four-fold risk of atrial fibrillation and, as a consequence, stroke[5]. Among the causes of vitamin B12 deficiency we can mention: the malabsorption of cobalamin from the diet; atrophy of the gastric mucosa with decreased intrinsic factor; gastric hypochlorhydria; drugs (prolonged use of biguamides and proton pump inhibitors - PPI); pernicious anemia; insufficient diet and alteration of cobalamin metabolism[3,6].

Old people have an increased risk of developing vitamin B12 (cobalamin) deficiency, being present in 12% of the old people population in the community in the Framingham cohort study[7]. Among institutionalized old people, this deficiency varies between 30-40%[8]. Vitamin B12 deficiency, in addition to the association with typical aging, may be increased by 4.5 times in those who use drugs such as proton pump inhibitors (PPIs) and H2 receptor antagonists[9]. In addition, metformin may interfere with the mechanism of action of the calcium-dependent membrane in the terminal ileum, responsible for the absorption of the intrinsic factor-vitamin B12 complex[10]. In this sense, old people residing in Long-Term Geriatric Institutions (LTIEs) often have several chronic diseases and non-communicable diseases, concomitant use of various drugs and fragility that associate them with an increased risk of developing B12 hypovitaminosis[11].

The clinical manifestations of vitamin B12 deficiency in old people are nonspecific and variable, generally absent and difficult to identify, frequent in common chronic diseases with aging, especially in people with dementia[11]. On the other hand, it presents low sensitivity of the biomarkers methylmalonic acid and plasma homocysteine due to the decrease in glomerular filtration[12], however, if left untreated, it can cause anemia and neurological changes, which are progressive and potentially fatal[13]. Therefore, considering the risk related to vitamin B12 deficiency and the lack of studies in the literature, especially with institutionalized old people, the objective of the present study was to assess the frequency of vitamin B12 deficiency and associated factors in residents of an LTIE.-

METHOD

This is a cross-sectional, observational and analytical study conducted with people ≥60 years of age residing in a philanthropic LTIE, located in a municipality in the state of Espírito Santo, Brazil.

To define the sample size, the sample calculation was performed considering the target population the number of residents (72 LTIE residents), with a 95% confidence interval, frequency of hypovitaminosis B12 deficiency in LTIE estimated at approximately 35%, considering the prevalence of 30-40% of vitamin B12 deficiency, in studies conducted outside Brazil[8] and a margin of error of 5%, which resulted in a sample of 60 individuals, we added approximately 10% to cover possible losses.

A total of 65 individuals were included in the analysis (36 women and 29 men), aged 80?9 years (from 61 to 113 years), permanence in the LTIE of 4.4?4.3 years (from 1 to 18 years): 52.9% up to two

years, 20% from three to five years and 27.7% over six years. The inclusion criteria were: age ≥60 years and being a resident of the institution for a period greater than one year. The exclusion criteria were: previous gastric surgery, incomplete laboratory tests, use of dietary supplements with polyvitamins and use of oral or injectable multivamines in the last six months. Seven residents were excluded: two for receiving dietary supplements with multivitamins, two for presenting incomplete laboratory tests and three for using multivitamins. The patient's family member and/or caregiver signed the Free and Informed Consent Form. The research is in accordance with Resolution No. 466/2012 and Resolution No. 510/2016. Project approved in CEP-EMESCAM CAAE: 29112914.9.0000.5065.

The serum dosage of vitamin B12 was analyzed, being considered as: normal (≥299 pg/mL), borderline (200-298 pg/mL) and deficiency (<200 pg/mL)[14]. Macrocytosis is considered, in Mean Corpuscular Volume (MCV) values greater than 98 fL and anemia in hemoglobin values less than 13g/dL for men and 12g/dL for women[15,16]. Laboratory tests were carried out on fasting research participants in July 2018 by employees of a specialized laboratory, accredited by ISO 9001:2015 and ONA 3.

The data not measured by the authors were obtained from the institution's electronic medical record - all residents are regularly evaluated by the multidisciplinary team, through a comprehensive geriatric evaluation. The dichotomous variables (yes/no) analyzed were: presence of arterial hypertension (patients with blood pressure of 140/90mmHg or higher, or in regular use of antihypertensive drugs)[17], diabetes mellitus (presence of fasting glucose greater than 126 mg/dL on two occasions, or using oral antidiabetics or insulin)[18], diagnosed dementia completed by the Diagnostic and Statistical Manual of Mental Disorders - 4th Edition and the National Institute of Neurological and Communicative Diseases and Stroke/ Diseaseand Related Disorders Association[19]. Functional dependence was assessed using the Katz Scale, validated for Brazil[20], which includes six items that measure the performance of the old person in activities of daily living, with the following hierarchy of complexity: food, sphincter control, transfer, personal hygiene, ability to dress and bathe, being stratified into dependents and independents.

Among the causes of vitamin B12 deficiency we analyzed the continuous use of drugs (yes vs. no) in bivariate analysis: biguamides (metformin) and PPI[21]. Polypharmacy is more commonly defined in the literature as continuous use of five or more drugs[22].

The Mini Mental State Examination (MMSE) was used for cognitive screening, being performed by a psychologist. The total score is 30 points, stratified by schooling: for illiterate, ≥20 points; for ages 1 to 4 years, ≥25 points; from 5 to 8 years, ≥26 points; from 9 to 11 years, ≥28 points; for individuals with more than 11 years of schooling, ≥29 points[23,24].

To evaluate the normality of the data, the Kolmogorov-Smirnov test was used. The following did not present a normal distribution: institutionalization time, immobility and vitamin B12. The variables were represented in percentage when categorical, and by the mean and standard deviation when continuous. Continuous variables with non-normal distribution were represented by the median. The association between the dependent variable (vitamin B12) and the independent variables was analyzed using the chi-square test and for the continuous variables (age, institutionalization time, vitamin B12, MMSE, MCV, hemoglobin and hematocrit), Student's *t* test was used. for independent samples for variables with normal distribution or their nonparametric equivalent, the Mann-Whitney test to compare research participants with normal (≥200 pg/mL) and low (<200 pg/mL) values of vitamin B12.

To compare the continuous variables (age, MMSE, MCV, hemoglobin and time spent in the institution), in groups of patients with deficient, borderline and normal values of vitamin B12, we used the one-way ANOVA test, with Levene's test to assess the homogeneity of the variances. The Kruskal-Wallis non-parametric test was used for variables with uneven variance.

Independent variables with significance level ≤0.20 in the bivariate statistical analysis were

included in the Poisson regression model with robust variance to assess the association with the dependent variable, vitamin B12 deficiency, through the crude and age-adjusted prevalence ratio, gender, arterial hypertension and diabetes mellitus, in the 95% confidence interval (95% CI). Values of p <0.05 were considered significant.

RESULTS

The sample is shown in Table 1. The following presented vitamin B12 deficiency: 14 patients (21.5%) and borderline values 21 (32.3%). The average values of vitamin B12 in the sample were 352?226 pg/mL (98 to 1803). Absence of anemia in 70.8% (n=46). Normocytic anemia in 21.5% (n = 14), microcytic in 4.6% (n=3) and macrocytic in 3.1% (n=2). A total of 76.9% had cognitive decline. Four patients had total functional dependence (6.2%) and seven, partial dependence (10.8%).

No significant differences were found in the analysis of variance when comparing the variables analyzed between the normal, borderline and vitamin B12 deficiency groups (Table 2).

The results of the Poisson regression with the gross prevalence ratios (PR) and with adjustments between the independent variables with *p* value <0,20 in the bivariate analysis, to identify the possible causes associated with vitamin B12 deficiency is shown in Table 3.

Table 1. Distribution of sample participants in relation to vitamin B12.

Variable	Total sample (n=65)	Vitamin B12		ρ
		≥200 pg/mL (n=51)	<200 pg/mL (n=14)	
Age (years)*	80 ± 9	80 ± 10	83 ± 7	0.30
Female/Male# (%)	55.4/44.6 %	54.9/45.1%	57.1/42.9%	0.37
MMSE*	12.32 ± 9.06	12.36 ± 9.39	11.07 ± 7.21	0.63
Functional dependency (KATZ)#	34 (52.3%)	49.0%	64.3%	0.19
Diabetes Mellitus#	12 (18.5%)	19.6%	14.3%	0.49
Arterial hypertension#	32 (49.2%)	45.1%	64.3%	0.24
Anemia#	19 (29.2%)	31.4%	21.4%	0.74
Dementia#	37 (56.9%)	54.9%	64.3%	0.76
Polypharmacy#	18 (27.7%)	26.7%	30.0%	0.50
Metformin#	8 (12.3%)	13.7%	7.1%	0.68
PPI#	11 (16.9%)	15.7%	21.4%	0.69
Hemoglobin (g/dL)*	13.0 ± 1.6	13.0 ± 1.8	13.0 ± 1.1	0.42
HTc (%)*	40.0 ± 4.9	39.0 ± 5.0	40.0 ± 3.0	0.48
MCV (fL)*	88.0 ± 6.0	88.0 ± 6.0	90.0 ± 5.0	0.22
Glycemia (mg/dL)**	94.0 ± 18	95.0 ± 16	89.0 ± 10	0.35
Time in institution (years)**	4.40 ± 4.30	3.82 ± 3.74	6.73 ± 5.59	0.06

Note: Data presented as average ± standard deviation or with n (%); #chi-square test** Mann-Whitney test, *t test for independent samples. MCV, mean corpuscular volume; HTc, hematocrit; MMSE, Mini-Mental State Examination; PPIs, proton pump inhibitors; Functional dependence (Katz scale). *ρ* (significance). Vitamin B12 values ≥200 pg/mL (normal) and <200 pg/mL (deficiency).

Table 2. Comparison between old people with normal concentration (≥299 pg/mL), borderline (200 to 298 pg/mL) and vitamin B12 deficiency (<200 pg/mL).

Variable	Normal (n=30)	Borderline (n=21)	Deficiency (n=14)	ρ
Age (years)*	79 ± 10	81 09	83 ± 07	0.27
LTIE time (years)**	3.5 ± 3.9	4.3 ± 3.6	6.5 ± 5.7	0.10
Hemoglobin*	13.5 ± 1.6	13.1 ± 2.0	13.1 ± 1.1	0.53
MCV*	88 6	88 ± 6	90 ± 4	0.45
MMSE*	11 ± 9	16 ± 6	13 ± 8	0.76

Note: One-way ANOVA* with Levene homogenization test of variances, Kruskal-Wallis test**. MMSEE, Mini Mental State Examination; LTIE, long-term geriatric institution; MCV, mean corpuscular volume. *ρ* (significance).

Table 3. Crude and adjusted prevalence ratio (age, sex, arterial hypertension, diabetes mellitus) to assess the association between independent variables and B12 hypovitaminosis.

Variable	PR (95% CI) without adjustments	ρ	PR (95% CI) with adjustments	ρ
Time in LTIE	1.09 (1.01 - 1.18)	0.02	1.06 (0.98 - 1.15)	0.10
Functional dependency	1.64 (0.61 - 4.36)	0.32	0.50 (0.45 - 1.53)	0.39

Note: Functional dependence (Katz). LTIE: Long-term geriatric institution. PR (prevalence ratio). Prevalence ratio in the 95% confidence interval (95% CI). *ρ* (significance).

DISCUSSION

Approximately one fifth of participants with vitamin B12 deficiency were observed. When analyzed in the Poisson regression model, no association was found between residence time at LTIE, functionality and vitamin B12 deficiency in the crude analysis, and absent when adjusted for age, sex, presence of arterial hypertension or diabetes mellitus, in the multivariable model .

The philanthropic LTIE, with old people at social risk and vulnerable, had a different prevalence than studies carried out on LTIEs abroad, which showed a higher frequency of vitamin B12 deficiency(30-40%)[12,25]. In institutionalized old people, Wong[26] observed a 34.9% prevalence of vitamin B12 deficiency (China) and Mirkazemi et al.[27] found a frequency of vitamin B12 deficiency at 14% (Australia), borderline values at 36% and a weak negative correlation between vitamin B12 deficiency and use of oral multivitamins. However, these studies used higher cutoff points than in the present study (vitamin B12 values: <203 pg/mL as deficiency and 203-338 pg/mL as borderline). This fact occurs because there is no "gold standard" test to diagnose vitamin B12 deficiency. The diagnosis is generally based on the identification of a low serological level of vitamin B12 with clinical evidence of deficiency, which responds to therapy with vitamin B12[26]. To estimate deficiency and borderline values of vitamin B12, the values used in several countries were used[12]. It is worth mentioning that studies carried out in Brazil were not found in the literature, which makes it impossible to compare with national samples.

A little more than half of the research participants had some degree of functional dependence (52.3%) without association with B12 hypovitaminosis. Functional dependence, assessed through basic activities of daily living, was not associated with vitamin B12 or homocysteine deficiency in the 1999-2000 and 2001-2002 National Health and Nutrition Surveys[28]. This association could be explained by the relationship between vitamin B12 deficiency with altered balance, peripheral neuropathy, activation of inflammatory pathways through increased levels of homocysteine and cognitive decline that would lead

to important functional dependence, not found in the NHANES population study due to methodological limitations of the occasion when it was carried out and because it is a cross-sectional study, whose interpretation would not reflect the causal relationship[28,29]. Interestingly, recently published guidelines have a high level of recommendation for the dosage of vitamin B12 in patients with frailty and sarcopenia[30].

Megaloblastic anemia is the classic hematological manifestation of vitamin B12 deficiency, affecting both the synthesis and shape of red and white blood cells[21], however, neither anemia nor macrocytosis is very sensitive for the diagnosis of vitamin B12 deficiency[11]. There were no significant hematological differences between the groups related to the concentration of vitamin B12, even considering the frequency of anemia in the sample (Table 1).

Old people residing in LTIE may be functionally and cognitively dependent, with multiple chronic diseases and using various drugs that can interfere with nutrient absorption. More than half of the old people studied had dementia of different causes, a portion with functional dependence or using PPI and polypharmacy. Regular use of metformin in diabetic patients[31] and PPI has been linked to vitamin B12 deficiency[21]. We did not find an association between these drugs with vitamin B12 deficiency in the present study, probably due to the reduced number of patients using these drugs in our group, making statistical inference difficult. Metformin-related vitamin B12 deficiency has been known for over 40 years[10], for interfering with absorption in the distal ilium[26]. Similarly, PPI use hinders gastric absorption of vitamin B12[9,26]. In addition, drug-drug interaction in polypharmacy is common, in addition to the summation effect on vitamin B12 absorption phases[32], however, there was no association in our sample between polypharmacy and vitamin B12 deficiency.

There are studies showing that vitamin B12 replacement leads to improvements in common clinical conditions in this population group, such as: reduced homocysteine with reduced cardiovascular risk[33] and reduced rate of cerebral atrophy[34]. The early detection of vitamin B12 deficiency is essential in the search for better quality of life and reduction of public health costs in this population segment, given the frequency observed in the sample studied. In addition, the lack of relationship with variables considered as risk factors or markers of vitamin B12 deficiency found in the present study highlights the need for the inclusion of vitamin B12 serum dosage in the assessment routines of old people, especially those institutionalized.

The results of this study must be considered, observing some limitations. There was only one dosage of vitamin B12, as it is a cross-sectional study, which makes causal inference difficult and the present study was carried out in a single institution, in a single municipality in a Brazilian state, which can be influenced by eating habits and availability of food sources of vitamin B12.

CONCLUSION

Old people residents of a long-term geriatric institution had a significant proportion of borderline (32%) and low (21%) values of vitamin B12, but without association with known risk factors. Future studies, including a larger number of residents encompassing several LTIEs, are necessary to confirm these findings. Thus, it is important to include vitamin B12 dosage in the routine of laboratory tests of this group, even in the absence of symptoms, for an early diagnosis of this deficiency.

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Comparison between two therapeutic modalities on postural balance and fear of falling in postmenopausal women: a randomized and controlled clinical trial

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Abstract

Objective: To compare the effects of Pilates vs. whole body vibration (WBV) and no treatment controls on postural balance and fear of falling in postmenopausal women. *Method:* Single-blind randomized clinical trial, with 51 participants randomized into three groups (Pilates, WBV, or control). Evaluations were performed of static postural balance on a force platform, dynamic postural balance by the Timed Up & Go test, and fear of falling by the Falls Efficacy Scale-International (FES-I). Pilates and WBV were performed three times a week for six months. *Results:* After the intervention, no difference (p>0.05) was observed for static postural balance, however, for the majority of variables, Pilates and WBV demonstrated a large effect size (d>0.80) when compared to control. For dynamic postural balance and risk of falls, Pilates and WBV showed a significant (p=0.032) improvement compared to the control. Fear of falling did not change (p=0.055) between groups over time. *Conclusion:* In view of the clinical representativeness evidenced by the effect sizes, Pilates and WBV can be recommended to improve postural balance in postmenopausal women. However, in relation to fear of falling, these therapeutic modalities require further investigation.

Keywords: Exercise Therapy. Postural Balance. Accidental Falls. Menopause.

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INTRODUCTION

Falls and their consequences are an important risk factor for morbidity and mortality in old people, being the most common cause of injuries and deaths from injuries in this population[1]. Among the variables that can potentiate the occurrence of falls are deficits in postural balance and fear of falls. During the aging process, these factors start to become more evident at menopause and tend to worsen over time. It has been demonstrated that postural balance suffers a significant decline during the transition to postmenopausal, considering, among other factors, the estrogen deficiency resulting from this period. On the other hand, fear of falls is also associated with a higher incidence of this event in postmenopausal women, which increases the risk of fractures and their consequences over the following years[2].

To mitigate these factors that significantly affect older people, different forms of interventions are being investigated. Evidence presented by meta-analysis studies shows that therapeutic modalities such as Pilates and whole body vibration (WBV) can improve postural balance, contributing to reducing the risk of falls during the aging process[3-9]. However, only two meta-analyzes, with contradictory results, were grouped in studies that assessed postural balance by displacing the plantar pressure center, using devices that provide more accurate data, such as area and speed of displacement in different directions[4,6]. In addition, meta-analysis studies conducted to date have described a high risk of bias in randomized controlled trials (RCTs) included in the analyzes[3-9].

Pilates is characterized as a therapeutic modality that involves physical exercise of localized muscular resistance, which uses springs of different intensities coupled in specific equipment, providing progressive muscular tension[10]. Pilates exercises focus on strengthening the entire body, with priority for the upper-body muscles that stabilize the spine. The muscular strength of the trunk, among other factors, is related to postural balance, when correcting the posture and preparing the body for the movements of the extremities (lower and upper limbs) during the execution of daily life tasks[6].

On the other hand, unlike therapeutic modalities that involve physical exercise, WBV requires little effort from the practitioner, requiring only that the person remain in an orthostatic position on a vibrating plate that oscillates in the vertical direction. Vibration can be administered at different intensities, with the aim of stimulating alpha motor neurons through mono-polysynaptic pathways, which leads to the adaptation of muscle tension, capable of directly impacting postural stability[7].

Thus, it is important to verify the differences between these therapeutic modalities, in variables related to postural balance and fear of falls, considering that Pilates exercises are increasingly sought after by women after the menopause period and throughout of the entire aging process[11], while WBV presents itself as an alternative modality, requiring reduced intervention time, little motivation and effort, which can be an alternative when conventional physical exercises are not possible[12]. Thus, the aim of the present study was to verify the effects of Pilates exercises, compared to WBV and no treatment, on postural balance and fear of falls in postmenopausal women.

METHODS

The present study is characterized as a mono-blind RCT, which followed the recommendations of CONSORT (http://www.consort-statement.org/). The intervention involved 51 postmenopausal women living in Jacarezinho, state of Paraná, Brazil. The sample was calculated using the Bioestat 5.3 program (Instituto Mamirauá, Amazonas, Brazil), taking into account the values of the average speed of displacement of the pressure center with eyes open, available in a previous study[13]. In this case, the post-intervention mean and standard deviation between the Pilates (0.68±0.04) and control (0.73±0.04) groups were used, with 80% test power and 0.05 alpha value, which generated the need for at least 10 participants in each group.

The ethical standards of Resolution No. 466 of December 12, 2012, were followed and all participants signed a Free and Informed Consent

Form, after approval by the Ethics Committee on Research with Human Beings (opinion 1.032.182). Participants were recruited through posters made available in public places, advertisements in newspapers, radio, Internet sites and leaflets left in medical clinics and health facilities. In this case, posters and leaflets were distributed at random in all districts of the municipality.

The inclusion criteria were: a) post-menopause, for at least 12 months; b) not practicing physical exercise for at least six months; c) agreement not to practice another type of exercise during the research; d) ability to perform basic and instrumental activities of daily life without assistance, using the Katz index[14], and Lawton and Brody[15], respectively; e) presentation of a medical certificate indicating that she is healthy and able to exercise; f) score ≥19 on the Mini Mental State Examination[16].

The exclusion criteria were: a) musculoskeletal disorders in the spine or lower limbs in the previous six months; b) fracture of the spine or lower limbs after 40 years of age; c) prosthesis in the lower limbs or implants in the spine; d) secondary causes of bone loss; e) other metabolic bone diseases or diseases that affect bone metabolism; f) history of cancer in the last five years; g) vascular changes, epilepsy or seizures; h) arrhythmia; i) use of pacemaker; j) eye disease that affects the retina; k) cardiorespiratory diseases; l) diseases of the neuromuscular system; m) labyrinthitis or vertigo; n) hospitalization in the previous six months for surgical reasons; o) thyroid disorder; p) smoking; q) frequent use of alcoholic beverages; r) use of supplements based on calcium or vitamin D, isoflavone, medications for increasing bone mineral density or increasing muscle mass in the previous 12 months; s) inability to tolerate WBV for five minutes.

Randomization occurred only after the inclusion of all participants. A random permutation of whole numbers (randomization.com) distributed equal numbers (n=17) of participants in each group. The process was carried out by an independent researcher, who sealed the opaque envelopes containing the group to which each participant would be allocated and handed them over to the main researcher.

All participants included in the present study were instructed to maintain their usual routines, as well as their daily physical activities (for example, household chores, paid work) and nutritional habits. They were also instructed not to take any medication or supplements that could influence muscle or bone mass.

All procedures were performed by blind evaluators. To assess static postural balance, a BIOMEC400 force platform (Sistema EMG do Brasil Ltda., São Paulo) was used. The evaluator explained the test procedures to the participants, who had a brief familiarization period (approximately 5 minutes) with the equipment and the tests to be performed. Subsequently, the participants performed the following tasks: bipedal support (eyes open and closed), semi-tandem (eyes open and closed) and unipedal with the dominant lower limb (eyes open) (Figure 1). The order of execution of each task (bipedal, semi-tandem and unipedal) was randomized. For each task, three attempts of 30 seconds were made, with an equal rest interval. For data analysis, the average of the three trials was used. The participants were barefoot, with their arms loose and relaxed at their sides and the cephalic positioning horizontal to the ground plane, keeping their gaze towards a fixed target (in the shape of a cross, measuring 15 cm x 15 cm), positioned at a wall, at eye level, at a distance of 2 meters

Figure 1. Positioning of feet on the force platform during postural balance tasks. Jacarezinho, PR, 2020.

Key: a) bipedal; b) semi-tandem; c) unipedal.

The signals of the ground reaction force were collected in a 100 Hz sampling, and passed through a second order Butterworth low-pass filter at 35 Hz. The signals were converted through a stabilographic analysis, compiled with the MatLab routines of the platform software itself (The Mathworks, Natick, MA). The equilibrium parameters calculated were: displacement area of the center of pressure (A-COP) expressed in square centimeters (cm2) and average oscillation speed (MVeloc) expressed in centimeters per second (cm/s), in the anteroposterior direction (A/P) and mid-lateral (M/L). These parameters were chosen because they showed good reliability in older adults[17].

Dynamic balance was assessed by the Timed Up & Go test[18]. Upon hearing the command "go", the participants got up from an armless chair, walked three meters to a mark placed on the floor, turned around, went back to the chair and sat down again. Three attempts were made for each volunteer and the average time in seconds was used in the analyzes.

The Brazilian version of the Falls Efficacy Scale-International (FES-I) was used to measure fear of falls[19]. FES-I is a structured questionnaire that contains questions about concerns about the possibility of falling when performing 16 activities, with the respective scores from one to four. The total score can range from 16 (no concern) to 64 (extreme concern).

The interventions took place three times a week, on non-consecutive days, for six months (78 sessions), in a private clinic located in the city of Jacarezinho, Paraná, Brazil. The experimental groups (Pilates and Vibration) were supervised by two professionals with experience in Pilates and WBV. As the intervention included physical exercise, it was not possible to blind the participants or the professionals responsible for the interventions.

The first Pilates session was used to familiarize participants with the technique, providing an explanation of the correct execution of each movement and the principles of the method. The following equipment was used to perform the exercises: Cadillac, Reformer, Ladder Barrel, Wall Unit, Chair, Spine Corrector and Small Barrel (ISP, Cascavel, PR, Brazil). 21 strengthening and stretching exercises were selected for the main body segments: a) lower limbs b) flexors, extensors and lateral flexors of the trunk; c) upper limbs. Two exercise protocols were applied during the six months of intervention, each performed for three months. Each session lasted 60 minutes.

All exercises were performed in a series of ten repetitions, with a one-minute interval between exercises. The intensity of the overload in Pilates is mainly determined by the use of springs, which have been modified according to the evolution of the strength of each participant (changing the position of the springs in the equipment or changing the spring for another one with greater resistance)[20], always maintaining the number of repetitions and sets. To determine the level of effort of the participants and the consequent evolution of overload, a verbal description was used according to the Borg CR10 scale: light load (Borg ≤2), moderate load (Borg> 2

and <5), heavy load (Borg ≥5 and <7) and load close to maximum (Borg ≥7)[21]. The level of perception of the effort maintained during the sessions was heavy (Borg between 5 and 6). Whenever the intensity of the exercise was changed, the new load was immediately noted on an individual record used to record the training.

The WBV group was exposed to whole-body vibration for five minutes, on an alternating-side vibrating platform (Arktus, Cascavel, PR, Brazil), which oscillates through an anteroposterior axis, causing the right and left sides to alternate horizontally. A frequency of 20 Hz (1 Hz = 1 oscillation / second) and a peak-to-peak displacement of 4 mm (with reference to the second toe) were used, resulting in a magnitude of 31.5 m/s^2 or 3.2 g (gravity: 1g = 9.8 m/s^2). The participants were instructed to remain on the platform's oscillation plate with their knees semi-flexed at 30 degrees and their bare feet spaced at a distance of 50 cm, keeping their torso upright and holding the platform support with both hands. No accessories were placed on the platform's oscillating plate to cushion the impacts. All parameters used in the equipment and positioning of the participants were maintained throughout the six months of intervention. A skid test ensured that the participants' feet remained in contact with the oscillating plate during WBV[12].

An exposure time of 5 minutes was chosen, since the alternating-side platform generates a wide amplitude peak-to-peak displacement, which does not allow prolonged exposure. Other studies that used similar vibration parameters to identify effects on postural balance also used equally short exposure times[22-24].

The control group did not perform any type of intervention. The researcher responsible for the study contacted the participants every month during the intervention, to emphasize the importance of maintaining the usual routine related to physical activity, eating habits, not using supplements or medications that could affect bone or muscle mass and not to start any kind of physical exercise. This procedure was also adopted for Pilates and WBV Groups. At that time, the participants were also asked about possible adverse events.

A standardized form was used to record occurrences of adverse events in the three groups. Every month, participants were asked about any complications, such as muscle spasms or pain, joint pain, dizziness, falls, cramps and changes in blood pressure.

Regarding the statistical analysis, the normality of the data was assessed by the Shapiro-Wilk test. To compare groups at baseline, one-way ANOVA was used for data with normal distribution. Otherwise, the Kruskal-Wallis test was used. This same test was used to compare differences between groups after the intervention, except for the Timed Up & Go test, for which covariance analyzes were used, adjusted for the pre-intervention results. Effect sizes were calculated using Cohen's d, which was considered small (0.2), medium (0.5) or large (0.8). The data were analyzed by intention to treat (baseline data were allocated in the post-intervention for two participants in the control group). The level of significance was set at $p<0.05$.

RESULTS

Initially, 620 women were interviewed. After applying the inclusion / exclusion criteria, 51 participants were eligible and agreed to participate. Of these, 49 (96.1%) completed the follow-up. Two participants in the control group abandoned the study (Figure 2). The average rates of participation in intervention activities in the Pilates and WBV groups were 92.6% and 91.3%, respectively.

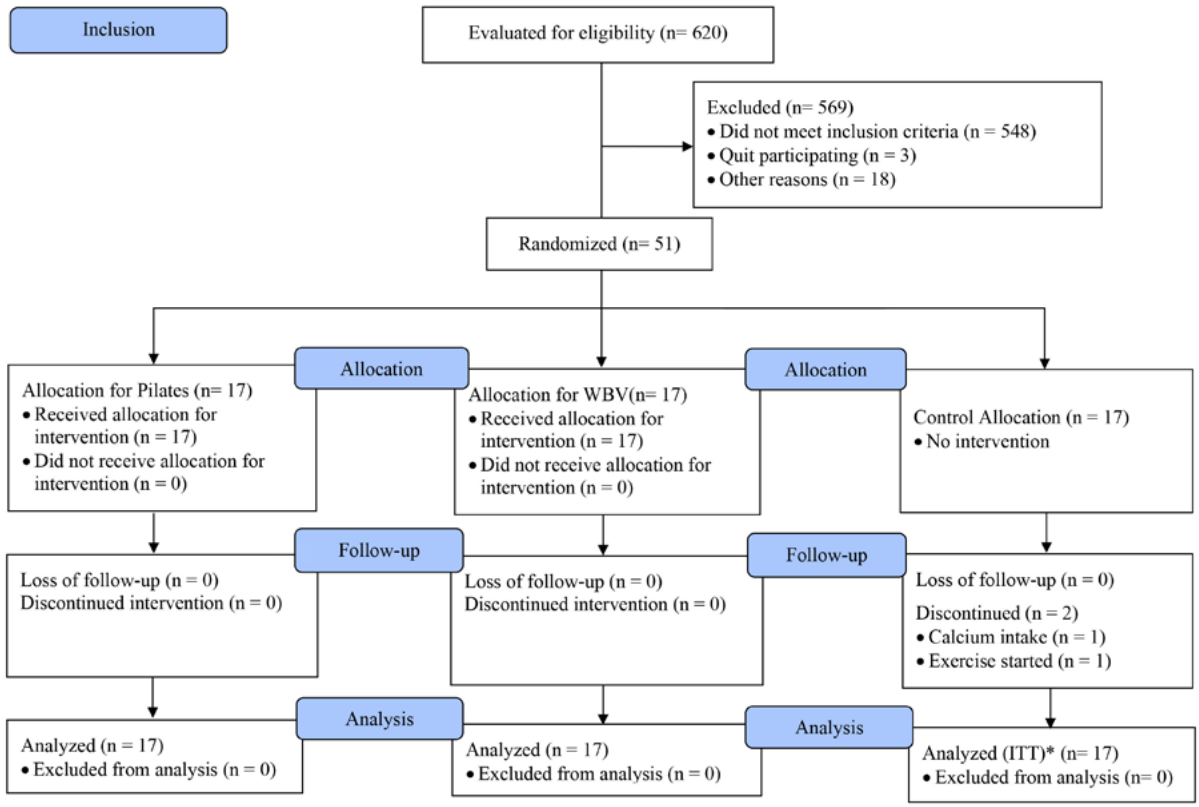

Figure 2. CONSORT Diagram. Jacarezinho, PR, 2020.

*ITT: Intention-to-treat (pre-intervention data were allocated to two participants).

Initial characteristics and post-intervention outcomes

Table 1 shows the participants' initial characteristics. Of the total sample, 12 (23.5%) postmenopausal women were 60 years of age or older, being: five (29.4%) in the Pilates group; five (29.4%) in the WBV group and two (11.8%) in the control group. There were no significant differences between groups for any variable. Table 2 shows the results for postural balance and fear of falling after six months of intervention. No variable of static postural balance measured by the force platform showed any difference between the groups after the intervention ($p>0.05$). However, for most variables, Pilates and WBV demonstrated a large effect size ($d> 0.80$) when compared to the control group (Table 3).

Table 1. Initial characteristics of the participants (N= 51). Jacarezinho, PR, 2020.

Variables	Pilates n = 17 Média (dp)	WBV n = 17 Média (dp)	Control n = 17 Média (dp)	P Value*
Age	55.5±6.8	56.3±6.4	54.1±5.2	0.571†
BMI (Kg/m²)	27.2±2.7	26.2±2.5	27.3± 2.4	0.410†
Years of menopause	8.8± 5.1	8.4±7.1	9.1± 7.0	0.503
A-COP (cm²)				
Bipedal eyes open	1.3 ±0.8	1.3±0.6	1.1±0.5	0.225
Bipedal eyes closed	1.7±1.7	1.2±0.6	1.2±0.4	0.731
Semi-tandem eyes open	8.2±3.6	7.3±4.8	6.6±3.8	0.225
Semi-tandem eyes closed	12.0±8.5	9.8±5.1	7.5±3.7	0.225
Unipedal eyes open	21.9±15.0	21.0±18.0	16.0±4.6	0.361
MVeloc A/P (cm/s)				
Bipedal eyes open	1.4±0.3	1.5±0.2	1.4±0.2	0.225
Bipedal eyes closed	1.5±0.4	1.6±0.3	1.5±0.3	0.088
Semi-tandem eyes open	1.9±0.4	2.2±1.0	1.8±0.3	0.111
Semi-tandem eyes closed	2.7±0.8	2.6±0.8	2.1±0.4	0.141
Unipedal eyes open	4.5±1.4	4.6±1.6	3.8±0.9	0.111
MVeloc M/L (cm/s)				
Bipedal eyes open	1.1±0.2	1.2±0.2	1.1±0.2	0.492
Bipedal eyes closed	1.2±0.2	1.2±0.2	1.2±0.2	0.361
Semi-tandem eyes open	2.4±0.5	2.6±1.3	2.1±0.3	0.731
Semi-tandem eyes closed	3.2±0.9	3.3±1.2	2.7±0.6	0.361
Unipedal eyes open	5.0±1.1	5.3±1.3	4.5±0.9	0.225
Dynamic balance				
Timed Up & Go test (s)	6.5±1.0	6.8±1.1	6.5±1.1	0.697†
Fear of falling (*score*)				
FES-I	25.1±5.9	25.4±5.7	26.7±7.0	0.577

Median±DP; *Kruskal–Wallis test, unless otherwise noted (†*ANOVA one way*); WBV: whole body vibration; BMI: body mass index; A-COP: pressure center displacement area; MVeloc A/P: average oscillation speed in the anteroposterior direction; MVeloc M/L: average oscillation speed in the mid-lateral direction; FES-I: *Falls Efficacy Scale-International.*

Table 2. Result for postural balance and fear of falling after six months of intervention (N= 51). Jacarezinho, PR, 2020.

Variables	Pilates After 6 months n = 17 Median (dp)	Difference pre-post	WBV After 6 months n = 17 Median (dp)	Difference pre-post	Control After 6 months n = 17 Median (dp)	Difference pre-post	*P Value**
A-COP (cm^2)							
Bipedal eyes open	1.1±0.5	-0.2±0.4	1.1±0.5	-0.2±0.2	1.7±0.9	0.6±0.8	0.088
Bipedal eyes closed	1.6±1.2	-0.1±0.6	1.3±0.6	0.1±0.2	1.8±0.9	0.6±0.7	0.577
Semi-tandem eyes open	7.5±3.1	-0.7±2.4	7.2±4.1	-0.1±1.5	8.3±2.9	1.7±3.3	0.225
Semi-tandem eyes closed	12.6±8.4	0.6±2.1	11.0±5.1	1.2±1.5	11.6±4.7	4.1±3.8	0.925
Unipedal eyes open	17.8±4.9	-4.1±12.3	17.3±7.6	-3.7±14.8	19.6±6.2	3.6±4.5	0.088
MVeloc A/P (cm/s)							
Bipedal eyes open	1.2±0.2	-0.2±0.1	1.3±0.3	-0.2±0.2	1.3±0.2	-0.1±0.1	0.361
Bipedal eyes closed	1.3±0.3	-0.2±0.2	1.4±0.2	-0.2±0.1	1.5±0.2	0.0±0.3	0.389
Semi-tandem eyes open	1.6±0.3	-0.3±0.2	1.8±0.7	-0.4±0.4	1.7±0.2	-0.1±0.1	0.225
Semi-tandem eyes closed	2.1±0.4	-0.6±0.5	2.3±0.7	-0.3±0.4	2.2±0.4	0.1±0.2	0.225
Unipedal eyes open	3.8±0.7	-0.7±1.1	4.0±1.6	-0.6±0.7	3.8±1.1	0.0±0.6	0.577
MVeloc M/L (cm/s)							
Bipedal eyes open	0.9±0.2	-0.2±0.1	1.0±0.2	-0.2±0.1	1.0±0.2	-0.1±0.0	0.141
Bipedal eyes closed	1.0±0.2	-0.2±0.1	1.1±0.2	-0.1±0.1	1.1±0.1	-0.1±0.1	0.361
Semi-tandem eyes open	2.1±0.4	-0.3±0.3	2.2±0.8	-0.4±0.6	2.2±0.3	0.1±0.3	0.225
Semi-tandem eyes closed	2.9±0.9	-0.3±0.4	2.9±1.3	-0.4±0.3	2.9±0.6	0.2±0.4	0.790
Unipedal eyes open	4.8±1.1	-0.2±0.8	5.0±1.3	-0.3±0.9	5.3±1.4	0.8±1.1	0.790
Dynamic balance							
Timed Up & Go test (s)	5.7±0.9	-0.8±1.1§	5.9±1.1	-0.9±0.6§	6.3±1.1	-0.2±0.7	0.032†
Fear of falling (*score*)							
FES-I	22.7±4.4	-2.4±3.3	23.4±4.8	-2.0±4.6	26.2±5.7	-0.5±3.3	0.055

Median±dp; *Kruskal–Wallis test, unless otherwise noted (†ANCOVA adjusted for pre-intervention results with the Bonferroni *post-hoc* test); WBV: whole body vibration; A-COP: pressure center displacement area; MVeloc A/P: average oscillation speed in the anteroposterior direction; MVeloc M/L: average oscillation speed in the mid-lateral direction; FES-I: *Falls Efficacy Scale-International.* §Significantly different from the Control Group ($p<0,05$).

Table 3. Effect sizes (Cohen's d) for measures of postural balance and fear of falling after 6 months (N= 51). Jacarezinho, PR, 2020.

Variables	Pilates *vs* WBV	Pilates *vs* Control	WBV *vs* Control
A-COP (cm^2)			
Bipedal eyes open	0.00	1.26	1.37
Bipedal eyes closed	0.44	1.07	0.97
Semi-tandem eyes open	0.29	0.83	0.70
Semi-tandem eyes closed	0.32	1.14	1.00
Unipedal eyes open	0.02	0.83	0.66
MVeloc A/P (cm/s)			
Bipedal eyes open	0.00	1.00	0.63
Bipedal eyes closed	0.00	0.78	0.89
Semi-tandem eyes open	0.31	1.26	1.02
Semi-tandem eyes closed	0.66	1.83	1.26
Unipedal eyes open	0.10	0.79	0.92
MVeloc M/L (cm/s)			
Bipedal eyes open	0.00	1.40	1.40
Bipedal eyes closed	1.00	1.00	0.00
Semi-tandem eyes open	0.21	1.33	1.05
Semi-tandem eyes closed	0.28	1.25	1.69
Unipedal eyes open	0.11	1.03	1.09
Dynamic postural balance			
Timed Up & Go test (s)	0.11	0.65	1.07
Fear of falling (*score*)			
FES-I	0.09	0.57	0.37

A-COP: pressure center displacement area; MVeloc A/P: average oscillation speed in the anteroposterior direction; MVeloc M/L: average oscillation speed in the mid-lateral direction; FES-I: Falls Efficacy Scale-International.

Regarding the dynamic postural balance, measured by the Timed Up & Go test, Pilates and WBV performed better ($p<0.05$) when compared to the control group, with medium ($d = 0.65$) and large ($d=1, 07$) effect size, respectively. For fear of falling, no changes were observed after the interventions ($p>0.05$), although the Pilates group had a medium effect size ($d=0.57$) when compared to the control group.

Serious adverse events were reported in the three groups: two falls in the Pilates group (11.8%), two in the WBV group (11.8%) and one fall in the control group (5.8%) (which led to a fractured wrist for the control group participant). All falls occurred outside exercise sessions. Other less serious adverse events, such as pain in specific regions of the body, muscle spasms and cramps, occurred less frequently.

DISCUSSION

Meta-analysis studies with older adults, which aimed to verify the effects of Pilates on static and dynamic balance, mostly identified significant results in favor of this intervention when compared to control groups[3-6]. However, in general, the analyzes were performed with more simplified and low-cost motor tests, such as One Leg Stance and Timed Up & Go, for example. The exceptions are the studies by Bueno de Souza et al.[4] and Casonatto and Yamacita[6], who carried out analyzes involving the displacement of the plantar pressure center through a force platform and found controversial results. In the first study, the analysis involved only two RCTs that used a force platform, in which no significant results were observed[4]. However, in the second study, the analyzes

involved six RCTs, which demonstrated significant effects of the Pilates method on static postural balance[6]. Still, both studies included a small number of RCTs, which limits the extrapolation of results.

In all studies included in the analyzes by Bueno de Souza et al.[4] and Casonatto and Yamacita[6], the intervention time was a maximum of 12 weeks. The present study was carried out for six months and, in spite of that, no results were observed for static postural balance. However, despite the non-significant result, for most variables, the clinical effect of Pilates exercises draws attention when compared to no treatment (d>0,80).

For dynamic balance, measured by the Timed Up & Go test, as in the present study, all meta-analyzes found significant results in favor of Pilates exercises[3-5]. In the present study, the significant result was accompanied by a moderate effect size (d=0.65). This result corroborates the meta-analyzes by Moreno-Segura et al.3 and Barker, Bird and Talevski[5], who also found a moderate effect size for Pilates exercises compared to control groups, while the study by Bueno de Souza et al.[4] observed a large effect size.

Regarding WBV, meta-analysis studies conducted with older adults showed conflicting results for postural balance[7,8]. Rogan et al.[7] grouped studies that assessed static postural balance using three different motor tests (Single Leg Stance, Limits of Stability, and Balance Index). In this case, there were significant results in favor of WBV only when synchronous type vibration was used, with no significant results for alternating-side vibration. Furthermore, in Orr's meta-analysis[8], in which only the Single Leg Stance test was considered, the WBV also did not demonstrate significant effects for static balance. In the present study, we used alternating-side vibration and we also found no significant effects on static postural balance, in this case, in five different tasks on the force platform.

Although no significant results were observed, it is worth mentioning that, in the present study, WBV demonstrated a large effect size to improve static postural balance when compared to the control group, for most variables (d> 0.80), this should be considered in clinical practice. It is possible that the large effect size is linked to the frequency of vibration used in the present study (20 Hz). Tseng et al.[25] demonstrated that the WBV configured at 20 Hz provides a large effect size in improving postural stability measured by a balance platform in old people, but not when using frequencies of 0 Hz (control) or 40 Hz.

Regarding the assessment of dynamic postural balance, the Orr meta-analysis[8] demonstrated that a significant improvement in the Timed Up & Go test occurred only when WBV was associated with physical exercise. In the meta-analysis by Lam et al.[9], WBV proved to be significantly effective in improving the dynamic balance measured by that same test; however, there were no subgroup analyzes to demonstrate whether the effects were dependent on physical exercise during vibration[6]. In the present study, significant results were found for the Timed Up & Go test, in which alternating-side vibration without the addition of exercises provided significant effects on dynamic postural balance, with a large effect size (d = 1.07), when compared with no treatment.

Although the protocol of the present study did not include exercises during WBV, the significant improvement and the large effect size observed for the Timed Up & Go test may be related to the intervention time (6 months), in addition to the type of vibration (side -alternated). Subgroup analyzes of the meta-analysis studies carried out to date have not explored these factors in isolation. In Orr's meta-analysis[8], that did not observe significant results for WBV performed without the addition of exercises, most studies performed synchronous vibration and with intervention time ≤2 months.

Regarding the fear of falls, in the present study, we did not observe any significant difference in favor of Pilates exercises, compared to WBV or control through FES-I. Despite this, it should be considered that a moderate effect size (d=0.57) was observed in comparison with no intervention. The average reduction of -2.4 points on the scale after Pilates exercises, which went from 25.1 to 22.7, may be clinically relevant, since the cut-off point of 23 at FES-I was shown to differentiate old people with and without incidence of falls[19].

The few studies that explored the fear of falling in interventions with Pilates found contradictory results. Aibar-Almazán et al.[26] identified a decrease in fear of falling in old people after 12 weeks of Pilates compared to the control group, however, the decrease in the FES-I score had a small effect size (d=0.41). The authors also used the Activities-Specific Balance Confidence Scale (ABC), which assesses confidence in balance, without significant differences between groups being observed, in addition to a small effect size (d=0.30). In the study by Irez[27], also through the ABC scale, a significant improvement in confidence in balance was found in old people after 14 weeks of intervention with Pilates; however, the authors performed only intra-group comparisons, which limits the validity of the findings. Besides that, Josephs et al.[28], when comparing Pilates with conventional exercises, did not identify any significant difference between the groups for confidence in the balance measured by the ABC, after 12 weeks of intervention in old people.

For WBV, the present study also did not identify any significant results in relation to the fear of falling, in addition to a small effect size when compared with no intervention (d = 0.37). For comparison, only two RCTs were found that verified the effects of WBV on fear of falling in old people. Pollock, Martin and Newham[29] performed eight weeks of intervention comparing WBV with addition of physical exercise and WBV alone, without differences being observed between groups for FES-I. Sobhani et al.[30] did not identify any significant differences in fear of falling using FES among old people who wore shoes with a stable base compared to an unstable base during WBV sessions, after four weeks of intervention.

For both Pilates and WBV, the results of the present study suggest that the fear of falling variable should be further investigated. A possible limitation of this and other studies may be linked to the sample size. Sample size calculations are performed for the main variable and fear of falling is typically a secondary objective. In this sense, it is possible that the number of volunteers did not make it possible to detect post-intervention differences between groups for this variable.

Finally, it is worth noting that the fear of falling is dependent on different factors that coexist and interact, in addition to postural balance or the incidence of falls, such as physiological, psychological and neurocognitive mediators[31], not being so, exclusively associated with the effectiveness of the interventions proposed in this study. In addition, adverse events demonstrated that Pilates and WBV were not sufficient to prevent the incidence of falls.

This study has limitations that need to be highlighted: a) comparison of results in just two moments; b) not being able to blind participants and therapists; c) use of a simplified test to assess dynamic balance. Regarding the strengths, we highlight: a) use of a "gold standard" instrument to analyze static postural balance; b) six-month intervention time; c) follow-up rate of 96.1% of participants.

CONCLUSION

The results of the present study suggest that Pilates and WBV can be recommended for the improvement of static and dynamic postural balance in postmenopausal women, evidenced by the clinical representativeness demonstrated by the treatment effect sizes. On the other hand, Pilates and WBV should be better investigated with regard to reducing the fear of falling, so that they can eventually be indicated for this purpose.

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