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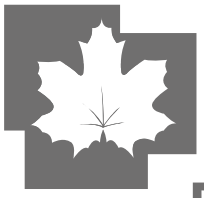

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REVIEW ARTICLES

Aging from the perspective of racism and other forms of discrimination: influences of institutional and structural determinants on the lives of older adults

The area of gerontology and geriatrics has grown a great deal in recent years. This is due to the advanced levels of training of professionals who work in the area, the interest demonstrated by those entering the field and the growing demand for services from the emerging population of older Brazilian adults. The challenges and changes are innumerable and influence every sphere: education, health, work, leisure, conjugality, sexuality, political participation, residences and neighborhoods.

It was also observed in 2019 that academia, both in terms of its institutions and in its student and teaching bodies, through public as well as private services, involving both leaders and collaborators, has not yet fully embraced the new challenges of today, especially with regard to the need to alter the life courses of social groups that face great difficulties when aging. This is the subject that this editorial dares to tackle.

Historically, the foundations that structure Brazilian society have been hidden: racism, patriarchy, sexism, the determination of social classes and religiosity. For years we have tried to hide these structures as though they are small, blunt pins. However, such determinants create situations that not only reveal the differences between social groups, but are markers of inequalities, occurring repeatedly and systematically, generating life courses for social groups such as black and brown-skinned Brazilians and indigenous people whose finishing line often arrives prior to old age. Many such black Brazilians die young[1], suffer functional disabilities earlier, reside in areas that lack opportunities for active aging[2], live alone through no choice of their own[2], some are forced to hide their sexual identity or live apart from the person they love, and finally, many will not live to see 60 because of these social determinants! On the other hand, and this is something that has been extensively studied, there are groups of ninety or one hundred year old people who, in the vast majority of cases, are white, and so do not face the structural barriers imposed by Brazilian society, obtaining access to effective public and private services, eating healthy food, living in neighborhoods that promote wellness and other practices consistent with our guidelines and systematic reviews.

Many health practitioners and researchers do not attempt to understand the "failures or shortcomings" of our practices and epistemologies. There are limitations to scientific knowledge, as well as ignorance and a lack of validation of the folk-knowledge possessed by the broad range of older adult social groups, which, if respected, could change therapeutic itineraries and perspectives of life[3].

Such determinants are fearsome demons, yet are invisible to the eyes of many. I invite RBGG readers and authors to reflect on a number of issues, namely: do educational institutions include in their curricula the social determinations of health, disease and care, taking into account the racial, ethnic, age and gender

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diversity of Brazil? How many students in higher education devote an extended part of their study timetable to aging, rather than allocating the minimum of hours to the subject, as is common? Do our health services know how to properly conjugate the verbs "get old", conceptualized by the writer Oswaldo Faustino, or "gerontologize", or in other words, are our services oriented to the logic of aging, using appropriate indicators such as functional disability and its intersections with ethnicity/skin color and gender, creating specific priorities and lines of care for each group of older adults? Do our health professionals know how to properly receive and treat a poor black older woman or an older gay couple? How can we review our rehabilitation services, which today should be one of the priorities of Primary Care for the elderly, especially for the poor, who have to continue working to meet their daily costs of living? What about leisure activities, which have not yet been adopted by many of our black older adults? How can we have services that meet the real desires of older adults and their cultural and ethnic values, such as *quilombolas* (Afro-Brazilian residents of settlements first established by escaped slaves) and various indigenous tribes? Are we aware that all of this should be part of the Brazilian Research Priority Agenda?[4]

This editorial therefore seeks to raise questions and provide certain answers about how we must urgently review our practices and knowledge if we are to understand black or indigenous adults who strive to live beyond 60 and, with constant support and dialogue, include practices of equity in our activities, thereby reducing inequities, such as the institutionalized or unconscious prejudices that many still possess. It is by understanding that we are not equal but different, and that this difference has generated inequality and inequity, and through policies, services and activities geared to addressing racism, sexism and other structuring determinants, that we will succeed.

Alexandre da Silva

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An education revolution in response to the longevity revolution

Alexandre Kalache[1]

It is increasingly argued that the most consequential legacy of the past century is the gift of longer life. Currently, two people in the world reach their 60th birthday every second[1]. By 2050, the 60-plus age group will constitute 30% of the populations in 64 countries[1]. Almost all developed countries will be on that list but so too will be most of Latin America, the Caribbean and large parts of Asia, including China[1]. By this time, the over 60s will form a worldwide bloc of more than 2 billion people that will outnumber those under 15 years of age[2]. Already, there are currently more people over the age of 60 than children below the age of five[2]. Reaching older age has ceased to be the privilege of the few and has become the realistic expectation of the many, in most regions of the world.

This longevity revolution forces us to totally rethink previously-held notions about ageing and older age. It has revealed to us that life is now more like a marathon than a 100-metre sprint. But it is a marathon with an indeterminate finish line that is run in a continuously changing landscape where there is a perpetual interplay between risk and opportunity. Ageing is a dynamic relational process. We are all unsteady travellers throughout the journey – buffeted daily by the conditions and the contradictions of our own histories. Our longer lives are increasingly being lived in the context of a barrage of disruptive changes that are upending our assumptions and undermining many of our skill sets. We are living longer but the relevance of much of our acquired knowledge is expiring earlier.

Parallel to the longevity revolution is a technology revolution characterised by an unprecedented hyper-connectivity between a vast range of previously

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segregated components. This fusion reaches across all digital, physical and biological domains to create a complex and extraordinary web. This so-called Fourth Industrial Revolution is "the inexorable shift from the simple digitalisation that characterised the Third Industrial Revolution to a much more complex form of innovation based on the combination of multiple technologies in novel ways" [3]. It is a fast-moving revolution with very pronounced human repercussions - such as increased job insecurity; a growing need for multiple identities; an imposed mobility; and an uneven ownership of the new technologies.

Debate about the future impacts of the Fourth Industrial Revolution is on-going. A much referenced Oxford University study predicted that almost half of all present-day jobs are at high risk over the next two decades[4]. Other studies suggest a much lower risk of the wholesale displacement of jobs yet nevertheless warn that a likely majority of occupations will be radically redefined through new technologies[5]. The OECD estimates that an average of only 9% of jobs are at risk of total disappearance but predict that between 50-70% of all jobs will be radically transformed[5]. It is suggested that as many as sixty percent of the jobs that will be performed by the next generation do not yet even exist[6]. It is clear that the educational assets acquired in youth and early adulthood no longer provide sufficient currency for longer, big change impacted lives.

The powerful synergy of the Longevity Revolution and the Fourth Industrial Revolution necessitate a corresponding Education Revolution that structurally embeds a comprehensive culture of rights-based, life-long learning. At each stage of life, *all* individuals must gain a familiarity with the necessary intellectual and emotional tools for a rapidly evolving present and an unclear future. A fit-for-purpose 21st century architecture of inclusive, people-centred learning *at all ages* must go beyond a narrow focus on employment skills. The new model must strengthen health, technology, environmental, financial and citizenship literacy. It must value experience, metacognition and intuition. And, it must seek to enhance resilience, self-reflection and empathy.

Access to information, or content, is no longer the main driver of change. "Knowledge was the key asset for the 20th century. Imagination is the key asset for the 21st" [7]. Information is now instantly available at the fingertips. According to an FGV study, there were already 198 million smart phones in use in Brazil in 2017[8]. "Favelados" may not have functioning sewerage systems but they have the same lens on the world as citizens of the developed world. Having information is now less of an issue than knowing what to do with that information. It is discernment and application of information that is now the main driver of change.

Universities all over the world are experiencing an existential crisis. Concerns about rising costs (outstanding student loan debt in the US now stands at 1.41 trillion dollars[9]) are loudly voiced. Questions are raised about the value-for-money and the practical relevance of much of the offered study. Accusations of an inward-looking exclusivity are increasingly articulated. There are suspicions of a causal link between rising student debt and declining rates of entrepreneurship, particularly among the so-called millennials. Innovators such as Bill Gates (Microsoft); Steve Jobs (Apple); Mark Zuckerberg (Facebook); Michael Dell (Dell Computers); Larry Ellison (Oracle); and Travis Kalanick (Uber); famously dropped out of their respective universities. Controversial billionaire "disrupter" Peter Thiel (Pay Pal) is currently paying students to reject their universities in the belief that the institutions themselves actually hinder innovation. There are indications that more employers are now valuing such features as curiosity and adaptability over formal qualifications. Goggle and other tech giants no longer insist upon diplomas for employment at all. "If there were more disruption within the ivory tower, economies just might be more resilient to disruption outside it"[10].

The first conversations to define age-friendly environments took place at the World Health Organisation (WHO) in the 1990s. In 2007 the, Age-friendly Cities Guide, the founding document of the WHO Age-friendly Cities and Communities Network, was launched. It was called *age-friendly* and not old age or senior-friendly for a reason. Age-

friendly is about optimising opportunities for health, life-long learning, participation and security as we age. The "as we age" is fundamental. Age-friendly was designed to be friendly to all ages. It is an obvious but neglected truth –that ageing is the one human experience that we all share – even if we do not share it on equal terms. There is no singular constituency for age-friendly. The sciences of physiology and psychology show us that the ageing journey up until our mid-twenties (when we reach the peak of our functional physical capacity) has different features from the ageing journey that we take beyond our mid-twenties. But it is the same journey. We do not become a different person as we age. We become *more of the same person* as we age.

Our longer lives are increasingly required to respond to a more complex range of intermingling and sometimes recurring variables. The boundaries of the traditional three stage life-course model (learning, working, retiring) are inevitably going to become even more blurred. Learning may continue to predominate in the first decades of life but it will not stop there. The OECD considers continuous learning to be one of the most important components of human capital in an ageing world[11]. According to UNESCO, it is "the key philosophy, conceptual framework and organising principle for education in the 21st century"[12] and the United Nations` regards it as a key priority issue in the global development agenda[13]. WHO takes the view that investment in education is also an investment in health and well-being[14]. The International Labour Organisation (ILO) is calling for the formal recognition of a "universal entitlement to Lifelong Learning"[15]. Continuous in-job training, short courses, on-line tutorials and stackable diplomas to keep pace with the ever-more rapid changes in knowledge and technology will need to accompany people throughout the entirety of their lives. The trend toward extended working lives is likely to continue but more people will retire in a more gradual and individualised manner[16]. The sharing of family and home management duties within relationships will continue to be negotiated[17]. Some research in developed countries predicts that a more equal division between women and men in the home will evolve[18]. Individuals will learn, care, work and take leisure throughout their lives with much less attention to both social expectation and chronological age. As the borders to the different stages of life become more porous and variable, there will be less segregation of age groups. More generations, but fewer representatives of each, will be simultaneously present and engaging in society. Larger numbers of older and younger adults will contemporaneously share the same spaces and experiences – such as university classes, in-job training and leisure pursuits.

Individuals must adapt to these cultural shifts inherent within the longevity and technology revolutions - but so too must institutions. Furthermore, these institutions must be strategic. Many of the studies indicate that life-long learning as currently offered is inclined toward the already advantaged. Similar concerns have been expressed about many of the Age-friendly Cities and Communities initiatives. Those who could benefit the most tend to participate the least[19], and participation tends to decrease with age[20]. It is clear too, that the nature and application of the new technologies themselves are also reinforcing inequalities because they impact disproportionately. According to the OECD, 40% of workers with a lower secondary degree are in jobs with a high risk of displacement whereas less than 5% of workers with a tertiary degree are expected to face such a threat[21].

Political disaffection from groups of people who feel marginalized is increasingly evident throughout the world. All educational institutions must play a role in the response to this alienation and an age-friendly educational approach must form part of the new paradigm. There must be a targeting of key demographics, such as men in blue-collar jobs, who are at the very highest risk from technological disruption. Imaginative retraining pathways must be established that counter this groups` rejection of roles that are seen as less masculine, such as those found in fast-expanding areas such as health care. All training grounds, including universities, must focus on the widest possible range of learners (such as those emerging from care responsibilities or displaced occupational roles) and the enormous diversity of their needs. They must recognise that the new model must go far beyond any single institution, or even groups of institutions – that it must involve many partners and many routes (both formal and informal). Age-friendly learning

institutions must tailor outreach to such bodies as employer associations, unions, technical colleges, job centres, prisons and seniors` organisations. They must offer the very broadest possible vision of a la carte, modular learning for all ages. They must also develop comparable levels of institutional awareness and self-regulation on ageism as many increasing do in relation to sexism and racism. In addition to their own staff and student bodies, they must embed an on-going dialogue about ageism with government, civil society organisations and the private sector. They must be alert to ageist attitudes in their employment practices, student induction and research agendas and extend an invitation to alumni and retired staff for stronger collaboration. They must embrace the full life-course and aim to build resilience and citizenship far beyond their traditional student base.

The longevity revolution is impacting virtually every aspect of human life yet our educational curricula still does not reflect this reality. Institutions are still training health professionals for the requirements of previous times – with an exaggerated emphasis on maternal and child health and an under-emphasis in all aspects related to ageing. (More than 100 countries now have total fertility rates at or below replacement level) [22]. Our architects, engineers, and urban planners are still leaving educational institutions without an informed understanding of the design requirements of an ageing population. Our business graduates, public administrators and future policy-makers are still woefully under-briefed about the demographic realities. All designers, whether of products, services or environments, need to be fully aware that *every* age-group is a rich and essential cultural reference[23]. For any teaching facility to claim age-friendliness there must be a commitment to mainstream ageing throughout its entire curricula. There is a need for more geriatricians and gerontologists but even more important is the need for *all* professionals, not only those in the health sector, to have an understanding of older age. Whether in service or product oriented fields, nearly all professionals are finding that an increasing proportion of their clients, customers and patients are older adults. This trend will continue.

The Longevity Revolution has engendered many predictions of dire economic and social consequences based on an assumption that older persons constitute a growing burden on the rest of society. The substantial and fast-moving demographic transitions do not signal macro-economic catastrophe but they do point to the need for an urgent re-evaluation of the life-course trajectory and older adulthood itself[24]. The gift of longer life is arguably the finest achievement of civilisation and it is generating almost limitless potential for overall human development. It is unimaginable that current and future generations will experience older age like their antecedents. In much the same way that the social construct of adolescence developed in the early to mid 20th century, *gerontolescence* (is the period of early old age; a transitional phase between senior adulthood and more pronounced senescence. It is an emerging stage of human development that is still being defined by the first cohort of gerontolescents) - a contemporary transitional phase at the beginning of older adulthood that is delineated more by functional markers than chronological age – is now emerging in the 21st century. It was the baby-boomers who defined the former in their youth and they are now defining the latter in the present. As *gerontolescents*, they are reinventing the way that older age is lived and viewed and humanity is forever different as a result.

It is the dynamic, life-long interplay of opportunity and risk, within both the person and the environment that informs the concept of Active Ageing. Both as an individual aspiration and a social policy framework, Active Ageing presents a roadmap toward resilience – defined as *"having access to the required reserves to adapt to, endure, or grow from the challenges encountered in life"*[25]. It emphasises the need for continual adaptation and renewal. It facilitates the development of an individual resilience, of an *active ageing* throughout the life-course, but simultaneously stresses the importance of publicly coordinated efforts. Toward this end, Active Ageing offers a broad and integrative policy framework to all social institutions – one that opens spaces for individuals to seize opportunities over the full course of their lives and to establish a trajectory toward an improved well-being in older life. The framework stresses the critical importance of lifelong

learning across all domains. It gives strong focus to health literacy (“gain access to, understand and use information in ways which promote and maintain good health” - WHO). in its widest possible sense and strives to achieve goals that are preventative, restorative and protective across a full range of capacity and resources.

Despite the promises of the new technological age, human capital remains society`s most valuable asset/renewable resource. Yet, according to the OECD, 31% of 15-19 year olds and 71% of 20-24 year olds in Brazil are not enrolled in education[26]. How will these individuals be integrated into the rapidly changing global labour force? What health behaviours will they employ throughout their life courses? What level of support will they be able to provide to their aged parents? What sort of older citizens will they themselves have become by 2060? And to what extent will their lack of skill preparedness for the new technological age continue to limit Brazil to the role of commodity exporter to the more sophisticated economies? It is incumbent upon every society to reinvent the culture of learning and to scrupulously mine the rich veins of all human capacity. As individuals, we must learn to learn and embrace our full citizenship in each of the transformative stages of the ageing continuum.

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A systematic review of economic evaluations of the use of memantine alone or combined with donepezil for moderate to severe Alzheimer's disease

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Ricardo Ewback Steffen[1]
Aline Navega Biz[1]

Abstract

Objective: To synthesize the available evidence and state of the art of economic evaluations which evaluate the use of memantine, whether alone or combined with donepezil, for moderate to severe Alzheimer's disease (AD), focusing on the analytical decision models built. *Method*: The electronic databases MEDLINE, EMBASE, NHS EED, CEA Registry and LILACS were searched for references. After duplicates were removed, two independent reviewers evaluated the titles and abstracts and subsequently the full texts. The Drummond M. tool was used to evaluate the quality of the studies. *Results:* After the application of the eligibility criteria, twelve complete economic evaluations were included. One evaluation was a clinical trial, two involved simulations and nine used Markov models. The main outcome measure adopted was dominated by cost per quality adjusted life year (QALY). The use of memantine was considered cost-effective and dominant in eight studies; while in a single study, its use was dominated when compared to donepezil for moderate AD. Sensitivity analyzes were systematically performed, with robust results. The quality assessment indicated that the methodological quality of the studies was good. *Conclusion*: Although there is some controversy regarding the benefits derived from the use of memantine, whether combined or not with donepezil, the evidence collected suggests that it is cost-effective in the countries where the studies were performed. However, local economic studies need to be performed, given the significant variability derived from the different parameters adopted in the evaluations.

Keywords: Alzheimer Disease. Memantine. Cost and Cost Analysis. Review.

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INTRODUCTION

Alzheimer's Disease (AD) represents a serious public health problem, as it is the main cause of cognitive decline and dementia in adults, especially older adults. Its diagnosis is primarily clinical, based on the application of standardized criteria, and it progresses with damage to memory and other cognitive and behavioral functions[1].

AD affects around 25 million people around the world[2] and projections suggest that this total may reach 100 million by 2050[3]. In addition, a meta-analysis published in 2013 reports that the prevalence of dementias, standardized by age, varies between 5% and 7% in those aged 60 or older, and is higher in less developed countries, most of all in Latin America[4].

It is estimated that, in 2030, the elderly population in Brazil will reach approximately 41.6 million and that by 2060, one in every three Brazilians will be older than 60[5]. Brazilian studies have indicated a prevalence of dementia in the population aged over 65 of 7.1%, with AD responsible for more than 44% of cases[6].

There is currently no cure for AD and the impact of the illness on patients and caregivers leads to political pressure to ensure that all the possible treatments are widely available. In addition, there are limited options in terms of interventions during the course of the disease, which include two main groups of drugs.

Acetylcholinesterase inhibitors represent the first line of treatment of mild to moderate AD. Their use is based on the reduction of the cholinergic deficit, through the inhibition of the enzymes that degrade acetylcholine, increasing its synaptic availability and improving cognitive symptoms[1]. Memantine is a non-competitive NMDA (N-Methyl-D-Aspartate) glutamate receptor antagonist. It is the only drug in its class used in humans and is approved by the Food and Drug Administration, the European Medicines Agency and the National Health Surveillance Agency for the treatment of moderate to severe AD[7,8].

Studies on the efficacy of memantine in severe AD have produced controversial results. The drug's ability to delay symptom worsening and improve the functional capacity of patients with moderate to severe AD was originally demonstrated in two phase III randomized controlled clinical trials (RCCT)[9,10], both with a very short follow-up of 24 weeks.

Other trials, however, have failed to show such favorable results in measures of cognitive function and activities of daily living[11]. Meta-analyzes examining the efficacy of memantine used alone or in combination with anticolinesterase inhibitors have found that improvements in cognitive functions and activities of daily living in patients with moderate to severe AD when present were systematically small in scale[12-14]. The evidence is also conflicting in terms of behavioral and neuropsychiatric symptoms[15]. In contrast, although usually mild to moderate, patients on memantine may experience headaches, dizziness, fatigue, mental confusion, and hallucinations[10]. Some other aspects that undermine the available evidence on the efficacy of memantine are worth mentioning: some RCCTs had small sample sizes, significant follow-up losses, received direct funding, or had authors who declared having received different types of funding from the pharmaceutical industry, and, therefore, potential conflicts of interest could not be excluded[16].

Due to the transient efficacy of AD treatment drugs, the progression to functional dependence continues even with their use[17]. In addition, they are often difficult to use due to their adverse events, such as hypertension, drowsiness and central nervous system-related disorders, and interactions with other drugs.

Considering the harm-benefit ratio as unfavorable, with low efficacy results and potentially significant adverse events in frequency and severity, the French Ministry of Health decided that as of August 2018 anticholinesterases and memantine would no longer be reimbursed by the national health insurance system. At the end of 2016, the Pharmacoeconomic Transparency Committee, which makes recommendations on public drug reimbursement in France, concluded that these drugs did not bring sufficient clinical benefits and called for their exclusion from the list of publicly provided drugs in France, which only became official following the *Haute Autorité de Santé* report

in May 2018[18,19]. The drug, however, is still present in clinical treatment protocols and is reimbursed in other countries, such as through Medicare in the US, the UK and Australia[20].

In Brazil, anticholinesterases have been available in the Unified Health System (or SUS) since 2002, restricted to patients with mild to moderate forms of the disease[21]. Memantine, however, was only incorporated within the SUS for the treatment of moderate and severe AD in 2017[7]. Even before that, however, it was bought by the Ministry of Health (MoH), with a total purchase of approximately 33,000 10mg tablets between 2010 and 2014, to meet judicial orders[22].

The burden of disease and the costs associated with AD, population aging, and the lack of disease-modifying treatment options raise concerns about the efficient use of resources. While current legislation in Brazil requires comparative cost-effectiveness evidence for the incorporation of a new technology into the SUS[23], economic evaluation studies have not been carried out by the Ministry of Health, with their introduction into the system being justified by clinical data and the drug's incorporation into the payment systems of other countries[7].

Given the uncertainties in literature, the present study aimed to synthesize the evidence available in economic studies regarding the use of memantine, whether alone or combined with donepezil, to treat moderate to severe AD, focusing on the analytical decision models used in these evaluations.

METHOD

This systematic review was reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA)[24] guidelines and registered with the PROSPERO International Prospective Register of Systematic Reviews under Nº. CRD42017076469, in October 2017.

Study identification and search strategy

The MEDLINE, EMBASE, and LILACS bibliographic databases, as well as the Cochrane Collaboration and specific bases for economic studies – the NHS Economic Evaluation Database (NHS EED), the Database of Abstracts of Reviews of Effects (DARE) and the Cost-Effectiveness Analysis (CEA) Registry - were used to search for studies published up to March 2017.

Search strategies were developed for each database based on specific descriptors, combined with the Boolean operators for AD and the drugs of interest (donepezil and memantine), using specific filters for economic studies. Search strategies specific to each database can be obtained by correspondence with the authors.

There was no restriction on publication period or language in the search. Narrative and systematic reviews of economic studies on the subject were examined for cross-references that might not otherwise have been identified.

References identified in electronic databases were managed using the ENDNOTE® software (version X4) for the elimination of duplicates.

Study selection

The articles were selected in two stages (titles and abstracts and, later, the full text), by two reviewers (IAGO and ANB), with disagreements resolved by consensus or, when necessary, through consultation with a third reviewer (RC).

To be included, studies were required to meet the following eligibility criteria: either primary studies (economic assessments conducted through observational studies and randomized controlled trials) or modeling studies related to the use of memantine, whether alone or in combination with donepezil, in adult patients diagnosed with moderate to severe AD, with disease severity determined by a specified assessment scale. Only complete economic assessments (cost-effectiveness analysis, cost-utility analysis or cost-benefit analysis) with the clear identification of comparators (placebo, no specific treatment, galantamine, rivastigmine or donepezil anticholinesterases or other types of non-pharmacological treatment) and measures of

outcome, such as cost per year of life gained, cost per quality adjusted life year (QALY) and cost per time spent in a non-dependent state, were considered. All studies written in English, Portuguese and Spanish were included.

Letters, editorials, narrative reviews, partial economic assessments, and studies that did not contain explicit information on the methods and criteria defined above were excluded.

Methodological Quality Assessment

The quality assessment of the included economic studies was also performed by two independent reviewers (IAGO and RES), with disagreements resolved as described above.

The tool developed by Drummond M.[25] was used. It presents 35 evaluation items, distributed in three sections: aspects of study design; sources and quality of the collected data; data analysis and interpretation of results. Six additional items were introduced: data related to the presence of subgroup analysis, study limitations, potential for generalization of results, declarations of conflict of interest and study funding.

Each item was judged as *yes, no, not clear,* or *not-applicable*.

Data extraction

The relevant data were independently extracted by two reviewers and recorded in a standardized electronic form built on EPIDATA software, with disagreements resolved by a third reviewer.

Data were extracted related to (i) study identification; (ii) general characteristics of economic assessments (type and design of study; country; characteristics of population studied; type of intervention and comparator; measure of effectiveness adopted and data source; types and details of included costs; currency and year of reference; Alzheimer's disease progression model; outcomes; presence of cost-effectiveness threshold) (iii) general characteristics of the analytical decision models used (perspective, time horizon, main health outcomes, analytical approach, discount rate application, sensitivity analysis), as well as (iv) main model conclusions and limitations.

The collected data were analyzed descriptively using Microsoft Excel 2010. For the nominal data, numbers and percentages are provided, while median and ranges are used for the ordinal data. No summary measures related to the incremental cost-effectiveness measures, which are not usually recommended in systematic reviews of economic analyzes, were calculated, given the methodological, population and interventions predictable differences between studies, which may generate significant heterogeneity of results[26].

The characteristics and results of the included studies were summarized using tables, complemented by a narrative summary that sought to compare and evaluate the methods used and the main results between the studies.

RESULTS

A total of 1,171 references were identified in the bibliographic databases searched. After eliminating 167 duplicate records, 1,004 abstracts were examined and 63 full-text articles were evaluated. Of these, 12 economic assessments met the eligibility criteria[27-38] and were included in the review (Figure 1).

There was considerable variation in the countries where the evaluations were conducted, with five studies carried out in the United Kingdom. More than half of the studies were published from 2010 onwards. Data on the age of the simulated populations varied considerably, but 83.3% considered the study population to be 60 years or older (Table 1).

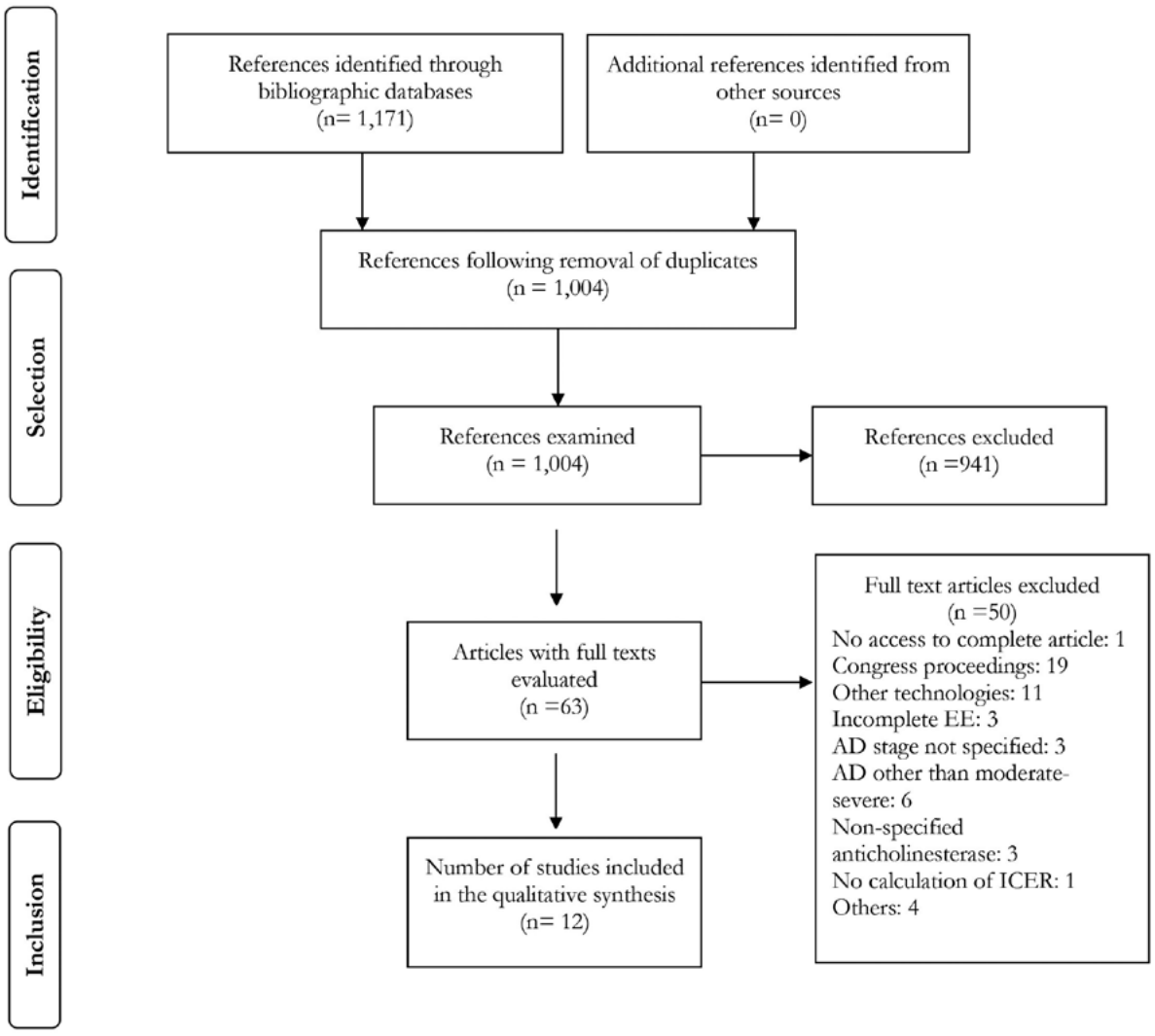
Cost-utility studies that measured outcomes in terms of cost per QALY gained were the predominant type of economic assessment (75%), and there were only two studies[35,38], both cost-effectiveness studies, in which results were expressed only in terms of cost per year of life with independence gained. Eleven studies included populations with moderate-severe

AD in their analysis. Six studies used more than one analytical perspective to assess costs and benefits; the perspective of society, in which all costs were computed, including those incurred by caregivers or due to loss of productivity of patients and their families, was adopted in seven studies (58.3%) while the health system perspective, in which only the costs incurred by the health care funder are considered, was used in seven (58.3%) studies, and social security costs were considered in three.

The main source of information on drug efficacy measures used to feed the models was previously published controlled clinical trials (75%).

As can be seen in Table 2, which summarizes the main characteristics of the models used in economic evaluations, a single study was conducted through a clinical trial (piggyback evaluation) and did not use modeling in its construction[27], while nine economic evaluations (75%) used Markov's approach as their analytical model.

The main measure of cost-effectiveness outcome was the quality-adjusted life year (QALY). Intermediate outcomes, such as cost per year or period of independence and cost per year without patient institutionalization, were used in three studies[33,35,38] (Chart 2).



EE: Economic evaluations; AD: Alzheimer's Disease; ICER: Incremental cost-effectiveness ratio.

Figure 1. Flowchart of the search and selection process of studies included in the systematic review.

Chart 1. General characteristics of economic assessment studies included in the systematic review.

Author, year Country / Currency (year*)	Type of Economic Evaluation and Target Population	Perspective of Analysis	Intervention Examined Versus Comparator Used in Economic Evaluation /Effectiveness data source type	Costs included in economic assessment studies
Knapp et al., 2016[27] UK / € (2013/14)	ACU Moderate/ severe AD	Health System Society	MEMAN *vs* PL MEMAN + DON *vs* DON/RCCT	Direct: Drugs, Consultations, Hospitalization, Caregiver / Indirect ‡
Hyde et al., 2013[28] UK / £ (2009)	ACU Moderate/ severe AD	Health System	MEMAN *vs* absence of treatment*** (Systematic Review)	Direct: Drugs, appointments, hospitalization, other health professionals
Rive et al., 2012[29] Norway / € (2009)	ACU Moderate/ severe AD	Society Health System	MEMAN *vs* Ach** (Metanalysis)	Direct: Drugs, appointments, tests, hospitalization, caregiver, other health professionals / Indirect ‡
Hartz et al., 2012[30] Germany /€ (2011)	ACU Moderate AD	Society Social Security	MEMAN *vs* DON (RCCT)	Direct: Drugs, appointments, exams, hospitalization, caregiver, other health professionals, / Indirect: ‡
Bond et al., 2012[31] UK /£ (2009)	ACU Moderate/ severe AD	Health System	MEMAN *vs* absence of treatment*** (Systematic review)	Direct: Drugs, consultations, hospitalization, caregiver, other health professionals, institutionalization costs, other support measures
Rive et al., 2010[32] UK / £ (2008/2009)	ACU Moderate/ severe AD	Health System Social Security	MEMAN *vs* Ach** RCCT	Direct: Drugs, hospitalization, other health professionals
Gagnon et al., 2007[33] Canada / CAD$ (2005)	ACU Moderate/ severe AD	Society	MEMAN *vs* absence of tto*** RCCT	Direct: Drugs, consultations, hospitalization, outpatient care, other health professionals, institutionalization costs, caregiver / Indirect ‡:
Weyker et al., 2007[34] USA / US$ (2005)	ACU Moderate/ severe AD	Society	MEMAN + DON *vs* DON RCCT	Direct: Drugs, consultations, hospitalization, institutionalization costs, outpatient appointments / Indirect ‡
Antonanzas et al., 2006[35] Spain / € (2005)	ACE Moderate/ severe AD	Society	MEMAN *vs* absence of treatment*** RCCT	Direct: Medicines, Consultations, Hospitalization / Indirect ‡
Jonsson et al., 2005[36] Sweden / SEK (2004)	ACU Moderate/ severe AD	Health system	MEMAN *vs* PL RCCT	Direct: Drugs, consultations, hospitalization, health professionals.
François et al., 2004[37] Finland / € (2001)	ACE Moderate/ severe AD	Society	MEMAN *vs* PL RCCT	Direct: Drugs, consultations, hospitalization, caregiver, institutionalization costs, other health professionals / Indirect ‡
Jones et al., 2004[38] UK / £ (2003)	ACU Moderate/ severe AD	Health system Social security	MEMAN *vs* PL RCCT	Direct: Drugs, consultations, hospitalization, outpatient care, other health professionals, institutionalization costs

Ach: Cholinesterase inhibtor, ACE: cost-effectiveness, ACU: cost-utility, AD: Alzheimer's Disease; DON: donepezil, RCCT: Randomized Clinical Controlled Trial; USA: United States; MEMAN: memantine, PL: placebo; *Year in which costs were reported, **Author does not discriminate cholinesterase chibinito; *** absence of specific pharmacological treatment; ‡ — Indirect costs involving costs of informal workers

Chart 2. General characteristics of the analytical decision model structures of the studies included in the systematic review.

Study / Year	Time horizon	Main Outcome / Measures	Analytical Approach: Model, States/Cycle Length	Discount rate (%) Costs / Benefits
Hyde et al., 2013[28]	20 years	Cost/QALY	Markov 3 states (pre-institutionalized, institutionalized and dead)/ 12 months	No Information
Rive et al., 2012[29]	5 years	Cost/QALY	Markov 3 states (pre-institutionalized, institutionalized and dead)/ 1 month	3 / 3
Hartz et al., 2012[30]	10 years	Cost/QALY	Discrete-event simulation	3 / 3
Bond et al., 2012[31]	20 years	Cost/QALY	Markov 3 states (pre-institutionalized, institutionalized and dead)/ 12 months	3.5 / 1.5
Rive et al., 2010[32]	5 years	Cost/QALY	Markov 3 states (pre-institutionalized, institutionalized and dead)/ 1 month	3.5 / 3.5
Gagnon et al., 2007[33]	2 years	Cost/QALY Cost/year of independence	Markov 5 states (combination of severity and independence and dead stages) / 6 months	5 / 5
Weyker et al., 2007[34]	6 months / 1 year / 1.5 years / 2 years / Lifetime	Cost/QALY	Discrete-event simulation	3 / 3
Antonanzas et al., 2006[35]	2 years	Cost/year of independence	Markov 6 states (combination of severity and independence and dead stage) / 6 months	6 / 6
Jonsson, 2005[36]	5 years	Cost/QALY	Markov 13 states (combination of three variables: severity, independence, institutionalization status, and dead) / 6 months	3 / 3
François et al., 2004[37]	5 years	Cost/year of independence gained Cost/year without institutionalization	Markov 13 states (combination of severity, independence, institutionalization status, and dead) / 6 months	5 / 5
Jones et al., 2004[38]	2 years	Cost/QALY	Markov 13 states (combination of three variables: severity, independence, institutionalization status, and dead) / 6 months	3.5 / 3.5

QALY: Quality-adjusted life-year;

Eight studies (66.6%) employed in its analysis a time horizon of five years or more, two had a time horizon of 20 years[28,31] and one used lifetime[34].

The number of Markov states and the duration of cycles varied between publications. Four studies (33.3%) considered only three health states (pre-institutionalized, institutionalized and dead)[28,29,31,32].

The main study designs used to investigate the progression of AD and the likelihood of change in health status were clinical trials and observational studies from population-based registries.

The scales used for the clinical evaluation of AD and the domains considered differed greatly between studies. The cognitive approach and measures related to activities of daily living, in addition to behavior, were the main competences included.

Regarding the main findings of the economic assessments included, the results of the use of memantine was considered cost-effective and dominant, i.e., less costly and more effective than its comparator, in nine studies (75%), as shown in Chart 3. In one study only[28], memantine was not cost-effective when compared to donepezil in the moderate AD population, defined by the MMSE scores of ≥10 and <25 (Table 3).

A sensitivity analysis to examine the uncertainty regarding the parameters and structure of the models was included in all studies, with deterministic analyses being the most used (66.6%); while extreme scenario analyses were included in two studies[33,36].

The methodological quality of the included studies was considered good (Figure 2). The worst quality items were the justifications for choosing the discount rate adopted, details of the statistical methods and the disaggregated presentation of results. All the manuscripts presented arguments regarding the limitations of their study. In addition, 80% declared a conflict of interest and funding in their publications. Most manuscripts were funded by industry (75%).

Chart 3. Main results of economic assessments and uncertainty analyzes

Author	Main results	Sensitivity Analysis
Knapp et al., 2016[27]	ICER*/ HS: MEMAN *vs* dominant PL / MEMAN +DON *vs* DON cost-effective; Soc. MEMAN+DON vs DON non-cost-effective	Acceptability C.: Chance 95% MEMAN cost-effective *vs* PL with threshold of £30,000 and of 55% of MEMAN + DON *vs* DON cost-effective with same threshold
Hyde et al., 2013[28]	ICER £32,100/QALY / MEMAN cost-effective *vs* no specified treatment	Acceptability C.: Chance of 38% MEMAN cost-effective *vs* no treatment with threshold of €30.000
Rive et al., 2012[29]	Negative ICER ** / MEMAN dominant *vs* Ach***	Deterministic: MEMAN dominant *vs* Ach*** Probabilistic: Chance >98% of MEMAN being cost-effective
Hartz et al., 2012[30]	MEMAN non-cost-effective and dominated by DON Δ costs DON: -€2,225 / ΔQALY: 0.017	Deterministic: DON dominant *vs* MEMAN in all simulations Probabilistic: Chance >70% of DON dominating MEMAN Acceptability C.: Chance >90% of DON cost-effective with threshold of €10,000
Bond et al., 2012[31]	ICER*£32,100/QALY / MEMAN cost-effective *vs* no specified treatment	Deterministic: MEMAN cost-effective; MEMAN effectiveness alters ICER Acceptability C.: Chance 38% MEMAN cost-effective with threshold of £30,000
Rive et al., 2010[32]	ICER negative** / MEMAN cost-effective vs Ach*** Δ costs: -£1,711/ Δ QALY: 0.031	Deterministic: MEMAN dominant *vs* Ach*** Probabilistic: Chance >99% MEMAN being cost-effective Acceptability C.: Chance >98% MEMAN cost-effective with threshold of €20,000
Gagnon et al., 2007[33]	ICER negative** / MEMAN cost-effective *vs* no treatment Δ costs: -CAD$1,276 / Δ QALY: 0.031 / Δ years without complete dependence: 0.09	Deterministic: MEMAN dominant *vs* no treatment Probabilistic: MEMAN cost-neutral in 83.3% Acceptability C.: Chance 89.5% MEMAN cost-effective with threshold of €20,000
Weyker et al., 2007[34]	ICER*: TH of 6m: 3.475 / TH of 12m: 382 / TH de 18m: -5.102 / TH entire life: -US$8,880 / MEMAN + DON is cost-effective *vs* DON	Deterministic: MEMAN cost-effective and dominant *vs* DON
Antonanzas et al., 2006[35]	ICER negative** / MEMAN cost-effective *vs* no treatment Δ costs: -€667 / Δ years independence gained: 0.202	Acceptability C.: Chance >98% MEMAN cost-effective vs PL with threshold of €30,000
Jonsson, 2005[36]	ICER negative** /MEMAN cost-effective *vs* PL Δ costs: -SEK100,528 / Δ QALY: 0,148	Deterministic: MEMAN dominant *vs* PL Extreme scenario analysis: MEMAN dominant
François et al., 2004[37]	ICER negative** / MEMAN cost-effective *vs* PL Δ costs: -€1,687 / Δ years of independence: 0.34	Probabilistic: Chance >93% MEMAN *vs* PL cost-effective and dominant Acceptability C.: Chance >99% MEMAN cost-effective with threshold of €30,000
Jones et al., 2004[38]	ICER negative** / MEMAN cost-effective *vs* PL Δ costs: -£1,963 / Δ QALY: 0.04	Deterministic univariate: MEMAN cost-effective *vs* PL in all scenarios

Acceptability C.: Acceptability Curve; DON: Donepezil; MEMAN: Memantine; PL: Placebo; TH: Time Horizon; QALY: Quality-adjusted life-year; ICER: Incremental cost-effectiveness ratio; HS: Healthcare System; Soc: Society; Δ: Difference; vs: versus; *ICER: Incremental cost-effectiveness ratio; Negative ICER **: use of intervention represents resource savings compared with comparator; Ach***: Non-specified inhibitors

EE: Economic Evaluations; CI: Confidence Intervals

Figure 2. Assessment of methodological quality of economic evaluation studies included.

DISCUSSION

The increase in health-related costs in a scenario of limited resources, as well as the growing prevalence of Alzheimer's disease associated with population aging, mean it is imperative to examine the relationship between costs and clinical benefits the drugs used in their treatment, especially when evidence of the efficacy of therapy isn't strong and the benefits are considered insufficient.

A systematic review of the risk-benefit of inhibitors and memantine use in AD states that its benefits are marginal and short-termed, indicating that it should be used cautiously in the elderly population, where side effects may be more significant, especially with inhibitors of the drugs[17]. Some health systems do not include or have withdrawn memantine funding for the treatment of moderate to severe stages of disease[18,19]. Others restrict this funding to fixed time periods (eg, one year), during which users

are periodically reassessed, with the suspension of coverage if there is evidence of disease progression supported by the application of certain scales such as the Mini-Mental State Exam (MMSE) and the Clinical Dementia Rating (CDR)[39].

Considering the incremental cost-effectiveness ratios and cost-effectiveness thresholds defined in each country, the results showed that the use of memantine for moderate to severe AD was considered cost-effective in most studies, being the dominant therapeutic strategy in eleven articles, that is, less costly and with better health outcomes. Sensitivity analyzes concerning the variation of a large number of parameters reinforce the fact that these results were robust, that is, they remained favorable to memantine.

It should be noted, however, that all studies were conducted in developed countries and mostly applied the societal perspective, computing costs that included caregiver time, costs incurred by families and productivity losses associated disease, wheter by patients or family members.

The incremental cost-effectiveness ratios resulting from the analyzes varied widely. This variability possibly resulted from aspects related to study design, the perspective adopted and the assumptions considered, resulting in limitations related to the comparability between studies.

The results are consistent with some reviews already available on the subject. In 2018, a systematic review published by Ebrahem and Oremus[16] on economic assessments related to the treatment of AD identified 14 studies related to the use of memantine alone or combined with anticholinesterases, with 93.7% of the studies also finding that memantine was cost-effective.

A single study included in the present review concluded that the strategy of using memantine alone was dominated by donepezil for moderate AD, or in other words, the inhibitors had comparatively lower costs and better health outcomes[30]. Sensitivity analyzes reinforced the robustness of these results, being favorable to donepezil based on variations in the parameters, with the acceptability curve showing a greater than 90% chance of inhibitor being cost-effective at a threshold as low as €10,000.00 (2011 figures).

The study by Hartz et al.[30], conducted in Germany with a ten-year time horizon, used discrete-event simulation to capture, from the societal perspective, the costs and effects of treatment with respect to activities of daily living, improvements in function measured by MMSE and in the neuropsychiatric inventory. Unlike the other evaluations, the target population considered had moderate AD, the clinical stage of the disease in which the effects of memantine in isolation remain controversial[40].

The included studies that examined memantine in combination with donepezil also indicated divergent cost-effectiveness results between studies, depending on the reference population[27,34]. The study by Knapp et al.[27], an economic evaluation performed in parallel with a controlled clinical trial published in 2016, showed that the memantine-donepezil combination was not cost-effective compared to donepezil alone for moderate disease[23]. The study by Weyker et al.[34], meanwhile, conducted in the US using discrete-event simulation, showed that this association was cost-effective for moderate and severe AD, considering time horizons greater than six months. In addition to examining diverse patient populations, the study designs were also distinct, which may have contributed to the difference in outcomes observed.

Markov's approach was the main type of modeling employed in the economic assessments examined (75%). The use of Markov chains is frequently recommended for modelling chronic diseases, where individuals move between different stages of the disease over time, reflecting their natural history[41].

The simulated time horizons in the studies ranged from two years to lifetime, with most having horizons of five years or more. Considering that AD has a median survival period of 8.3 years in patients diagnosed aged 65 and over[42], the chosen horizons mostly contemplate the life expectancy of these patients and can adequately capture the most relevant costs and benefits expected from the treatments used.

The cognitive domain is a relevant outcome in the natural course of the Alzheimer's disease progression

process and should be adopted in the modeling of this disease. However, modeling should also adopt domains other than the cognitive in order to consider the complexity of this disorder.

Literature suggests that modeling including aspects related to function, level of patient's dependence on a caregiver and quality of life may more accurately reflect the progression of AD[43]. Clinical trials, commonly used as a data source in the economic evaluations found, are often insufficient and too short to evaluate such results, for which economic health models that combine trial data with real-world evidence are particularly useful[44].

The vast majority of the evaluations present in this review used, as an outcome of the cost-effectiveness of the intervention, quality-adjusted life years, whether alone or combined with other dimensions. QALY is a multidimensional concept whose use is particularly important in chronic conditions, and especially when the results of the intervention affect survival less and the domains of relationships and living more (cognition, mood, behavior, functionality and the ability to live longer without requiring special care or institutionalization), as observed in AD[45]. However, some studies suggest that QALY may not be fully accurate for the evaluation of individuals living with AD, as it is often caregivers, and non-patients, who provide proxy measures[46].

There is a relative scarcity of data related to the use of drugs such as memantine and donepezil and their effects on delaying institutionalization[47]. In addition, the reasons leading to the institutionalization of AD patients are multifactorial and complex, involving patient and caregiver characteristics, and the social and cultural environment. These types of outcomes are not usually evaluated in clinical trials, have significant impacts on health costs, and may underestimate overall cost measures, particularly the indirect costs of AD patient care[48].

Finally, it should be mentioned that most evaluations assumed that the drugs did not have an effect on mortality, which was supported by the fact that symptomatic therapies generally had no effect on the underlying disease process, and the lack of evidence of such an effect from relatively short-term clinical trials.

Most of the evaluations used randomized controlled trials as a source of data on the effectiveness of treatment. This can set a good internal validity in the model construction, but has a low external validity, since most trials have a short duration and cannot add long-term treatment effects. In addition, the use of parameters from a clinical trial conducted in one country in evaluations performed in another may pose a problem in generalizing modeling results, which is further accentuated when measures are applied as utilities to generate QALY.

Few economic models used in the simulations contemplated the scope of the natural history of AD. There is great variability in the assumptions made in these studies, in their effectiveness and cost data sources, their utility measure calculations and the transparency of their models. Therefore, caution is advised regarding the conclusions of the present review.

Finally, the number of economic evaluations funded by the pharmaceutical industry in which their drugs dominated their comparators was high, increasing the risk of possible publication bias.

CONCLUSIONS

Most of the economic assessments included in this review indicate that the use of memantine alone or combined with donepezil for moderate to severe Alzheimer's disease is predominantly cost-effective in countries where the studies were conducted. Although most uncertainty analyzes confirm the robustness of the results presented, caution is required when transferring cost-effectiveness findings from one country to another, either because of the difficulty of extrapolating data costs due to different payment structures and systems and national incentives, or because considering a cost-effective strategy is closely related to the cost-effectiveness thresholds implicitly or explicitly adopted in each country. The fact that most evaluations are funded by industry highlights that studies may contain significant biases and,

for that reason, caution should be exercised in the process of interpreting these results.

Therefore, local-based analyzes should be performed in Brazil, paying close attention to the issues and limitations raised from the economic evaluations already performed, so that the cost-effectiveness of memantine, whether combined or not with donepezil, for severe Alzheimer's Disease is more accurately assessed.

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Hospitalizations due to primary care sensitive conditions in a population of older adults in the state of Rio Grande do Norte from 2008 to 2016

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Abstract

Objective: To identify hospitalizations to primary care sensitive conditions among older adults in the state of Rio Grande do Norte, Brazil. *Method:* An ecological study using information from the Hospitalization Information System of the Unified Health System was carried out. Mortality rate, permanence and costs resulting from hospitalization in the period from 2008 to 2016 were analyzed according to residence, age and sex. *Results:* The greatest proportions of hospitalizations were due to bacterial pneumonias and gastroenteritis. Illnesses that could be prevented by immunization had the longest average stay (on average 17 days); the highest admission rates were among men and for the over 80 age group, both in the period 2008-2010. In the period 2014-2016, hospitalizations for primary care sensitive conditions (or HPCSC) corresponded to 30.90% of all hospitalizations and 16.36% of the hospitalization expenses of the state. The average cost per HPCSC was R$970.54 during the same three-year period. *Conclusion:* In Rio Grande do Norte, hospitalizations due to primary care sensitive conditions among older adults is decreasing, although it is still an important cause of hospitalization and public health spending.

Keywords: Primary Health Care. Hospitalization. Old Age Assistance. Length of Stay. Quality Indicators, Health Care.

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INTRODUCTION

Primary Care (PC) is one of the main entry points to the health system. In addition to access to services, this type of care is expected to have a resolutive capacity and be a mechanism for transforming realities through health promotion, prevention and protection[1].

However, due to limitations in access to these services or the ineffectiveness of actions provided in primary care, users often require urgent and emergency care and/or hospitalizations for conditions that could be resolved at the primary level of care[2]. In this context, Hospitalizations for Primary Care Sensitive Conditions (HPCSC) represent avoidable hospitalizations or conditions sensitive to outpatient care. They are also indicators used to classify the resolutive capacity of PC, by registering hospitalizations for certain specific diseases, and which seek to evaluate and monitor the entry and efficiency of the treatment provided at this level of care, thus serving as a marker of quality[3,4]. It is understood that the greater the number of HPCSC, the lower the efficiency of PC will be, indicating failings in access to services or in the care itself [5-7].

In this context, it is important to reflect on the aging process that the Brazilian population has undergone. This process is distinctive in developing countries due to the major demographic changes that have occurred in recent years. In Brazil, the growth of the older adult population, both in absolute and proportional terms, is increasingly significant, and reflected in social, health and social security demands[8,9]. According to the Brazilian Institute of Geography and Statistics (IBGE), the Brazilian older adult population in 2000 was 14,235,731, while the projection for 2030 is 41,541,763 people[10].

Population aging is recognizably related to the increased prevalence of non-communicable chronic diseases, especially cardiovascular diseases. This situation generates greater demand for hospitalizations, drug treatments and patient rehabilitation, leading to increased spending on the secondary and tertiary care of the Unified Health System (SUS)[11].

In Brazil, SUS hospitalization rates are high, and hospitalization costs are higher in people aged 60 years or older. The number of relapses in hospitalizations in this age group is also higher, contributing to 23% of the public expenditures of these hospitalizations among this population segment[12]. The main causes of reported HPCSC in the older adult population are heart failure, angina, lung disease, and cerebrovascular disease[3,6].

The SUS evaluation process uses the Health Information System (HIS), which provides data that guide and/or generate new interventions and subsidies for strategic planning, improving management, whether in terms of control or in interventions focused on the needs encountered[13].

The analysis of HPCSC, in turn, uses the SUS Hospital Information System (SUS/HIS), which has as its basic document the Hospitalization Authorization Form (HAF), which includes, among other information, patient diagnosis, demographics, location, date, length of stay and costs of hospitalization.

Given the above, the present study asked: What are the main causes of HPCSC in the state of Rio Grande do Norte (RN)? To understand this phenomenon, it is necessary to a consider ecological studies that analyze the behavior of these events over time, and which major population groups are affected. Such knowledge is of great importance for the planning and evaluation of PHC prevention and reorganization policies.

Thus, the aim of this study was to identify hospitalizations for Primary Care sensitive conditions among older adults in the state of Rio Grande do Norte, Brazil, from 2008 to 2016.

METHOD

An ecological study was carried out analyzing HPCSC, paid for by the SUS, in the state of Rio Grande do Norte, Brazil, from 2008 to 2016. The choice of the period allows a temporal analysis over nine years to be performed, in addition to reducing the possibility of data entry delays.

For 2016, the hospital management network of Rio Grande do Norte consisted of 24 hospitals that provided 1,589 beds distributed among the eight health regions of the state as follows: eight in the Metropolitan region; three in the region of São José de Mipibu; three in the Mossoró region; three in the Caicó region; three in the Açu region; one in the João Câmara region; two in the Santa Cruz region and one in the Pau dos Ferros region[14,15].

SUS/HIS data was collected from the website of the SUS Department of Informatics (DATASUS) and those on population from the IBGE website[9]. The main diagnosis of hospitalizations registered in the SUS/HIS were HPCSC, according to code ICD-10, based on the list published in SUS/HIS Ordinance nº 221/2008 (Chart 1).

Chart 1. Diagnostic list of Primary Care Sensitive Conditions (PCSC) by group.

List of Primary Care Sensitive Conditions (PCSC)	CID-10
Preventable immunization diseases and sensitive conditions	A15 to A19, A33 to A37, A51 to A53, A95, B05, B06, B16, B26, G00.0, B50 to B54 and I00 to I02
Infectious gastroenteritis and complications	A00 to A09 and E86
Anemia	D50
Nutritional deficiencies	E40 to E46 and E50 to E64
Ear, nose and throat infections	H66, J00 to J03, J06 and J31
Bacterial Pneumonia	J13, J14, J15.3, J15.4, J15.8, J15.9 and J18.1
Asthma	J45 and J46
Lung Diseases	J20 to J21, J40 to J44 and J47
Hypertension	I10 and I11
Angina	I20
Cardiac insufficiency	I50 and J81
Cerebrovascular diseases	I63 to I67, I69, G45 and G46
Diabetes mellitus	E10 to E14
Epilepsy	G40 and G41
Kidney and urinary tract infection	N10 to N12, N30, N34 and N39.0
Skin and subcutaneous tissue infection	A46, L01 to L04 and L08
Inflammatory disease in the female pelvic organs	N70 to N76
Gastrointestinal ulcer	K25 to K28, K92.0, K92.1 and K92.2

Source: Ordinance nº 221, dated 17 April 2008.

Data collection was carried out in September 2018. The analyzes were performed from the SUS/HIS HAF system, which consists of a summary of hospital discharges completed by SUS hospitals, to receive the hospitalizations carried out.

The HPCSC profile was assessed by age group (60-69 years; 70-79 years and over 80 years), by sex (male and female) and by the health region of the residence of the patients.

The HPCSC rate (total hospitalizations for HPCSC in Rio Grande do Norte, divided by the resident older adult population in 2012, multiplied by 1,000) was calculated; by HPCSC cause group (total HPCSC of the selected cause group, divided by the resident older adult population in the selected year (2008-2016), multiplied by 1,000); HPCSC by sex (number of HPCSC of resident patients according to sex, divided by population by sex, multiplied by 1,000) and by age group (number of HPCSC of patients in the age group considered, divided by total population in age group, multiplied by 1,000). The proportion of HPCSC per health region was based on the number of HPCSC per region divided by the total HPCSC of the state over the same period, multiplied by 100. For hospital mortality rate due to HPCSC, the number of deaths by HPCSC was divided by the resident population, multiplied by 1,000.

The total values of hospitalizations for all causes and the total value of HPCSC in *reais* (R$) were calculated. The ratio of annual HPCSC spending (HPCSC spending of RN-resident patients divided by total hospitalization costs of RN-resident patients) and the average amount spent per HPCSC (HPCSC costs of RN-resident patients divided by the number of HPCSC over the same period). To assess the changes that took place over the nine years of the series, we analyzed the percentage changes between the first and last quarter (subtracting the values recorded in the first quarter from those of the first quarter, divided by the value of the first quarter, multiplied by 100). All coefficients and proportions were analyzed over three-year periods: 2008-2010; 2011-2013; 2014-2016.

This study used secondary data available on the website of the Ministry of Health, without identifying the subjects, and was therefore exempt from consideration by a Research Ethics Committee, in accordance with Resolution No. 466/2012 of the National Health Council.

RESULTS

In the period 2008-2016, 105,543 hospitalizations for HPCSC occurred among older adults in the state of Rio Grande do Norte, totaling 810,456 days of hospitalization and a total cost of R$86,785,404.58. The groups of causes with the highest proportions of hospitalizations among the older adults were bacterial pneumonias (19.92%); followed by infectious gastroenteritis and complications (17.52%); cerebrovascular diseases (14.2%); diabetes mellitus (12.09%) and heart failure (11.92%). Regarding the average length of hospitalization among such patients, the groups of causes with the highest rates were preventable diseases due to immunization and sensitive conditions (17 days on average), diabetes mellitus (10.72%) and skin infection. and subcutaneous tissue (10.05 days). Regarding the average cost, the groups of causes with the highest values were preventable diseases due to immunization and sensitive conditions (1,946.41 *reais*/hospitalization), heart failure (1,677.61 *reais*/hospitalization), cerebrovascular diseases (1,013.50 *reais*/hospitalization). hospitalization) and bacterial pneumonias (922.51 *reais*/hospitalization) (Table 1).

Table 1. Spending on hospitalization, length of stay and number of hospitalizations for primary care sensitive conditions (HPCSC) by groups of causes, among older adults, in the period 2008-2016, Rio Grande do Norte, 2018.

Groups of Causes	HPCSC among older adults		Length of hospitalization per HPCSC		Spending on HPCSC	
	N	% in relation to total hospitalizations (n=105.543)	N	Mean length of hospitalization in days	Total Spend on HPCSC (R$)	Mean spend per hospitalization (R$)
1. Preventable immunization diseases and sensitive conditions	1,283	1.216	21,856	17.04	2,497,249.47	1,946.41
2. Infectious gastroenteritis and complications	18,490	17.519	58,354	3.16	6,114,078.50	330.67
3. Anemia	190	0.180	1,161	6.11	59,106.45	311.09
4. Nutritional Deficiencies	2,978	2.822	18,205	6.11	1,514,016.01	508.40
5. Ear, nose and throat infections	210	0.199	954	4.54	89,324.28	425.35
6. Bacterial Pneumonia	21,024	19.920	162,587	7.73	19,394,786.06	922.51
7. Asthma	3,951	3.743	14,567	3.69	1,953,280.7	494.38
8. Lung Diseases	3,766	3.568	30,500	8.10	3,209,424.8	852.21
9. Essential Hypertension	2,701	2.559	9126	3.38	648,583.87	240.13
10. Angina	0	0.000	0	0.00	0	0.00
11. Heart Failure	12,581	11.920	106,546	8.47	21,106,041.17	1,677.61
12. Cerebrovascular diseases	14,979	14.192	148,453	9.91	15,181,149.47	1,013.49
13. Diabetes mellitus	12,761	12.091	136,786	10.72	7,831,165.5	613.68
14. Epilepsies	308	0.292	2,564	8.32	183,191.04	594.78
15. Kidney and urinary tract infection	418	0.396	3,309	7.92	161,992.53	387.54
16. Skin and subcutaneous tissue infection	8,581	8.130	86,251	10.05	595,5514.00	694.03
17. Inflammatory Disease Female Pelvic Organs	108	0.102	435	4.03	55,041.77	509.65
18. Gastrointestinal ulcer	1,214	1.150	8,802	7.25	831,458.96	684.89
TOTAL	105,543		810,456		86,785,404.58	

Source: DATASUS, SUS-Hospital Information System, 2018.

In the group of preventable diseases by immunization and sensitive conditions, respiratory (n=534) and pulmonary (n=511) tuberculosis together represented over 81%; while diarrhea and gastroenteritis (n=8,872), other infectious intestinal diseases (n=8,580) and volume depletion (n=994) together accounted for 99% of HPCSC cases for the infectious gastroenteritis and complications group. The group of nutritional deficiencies was represented entirely by malnutrition (n=2,976).

As shown in Table 2, the highest proportion of HPCSC occurred in the metropolitan region of the state (24.70%). The highest HPCSC coefficients were recorded in the region of Pau dos Ferros (557.33 hospitalizations/1,000 inhabitants) and Caicó (513.07 hospitalizations/1,000 inhabitants).

Table 3 shows the results of the HPCSC coefficients, the costs and the average length of stay per cause over three trienniums. The rate of HPCSC decreased, with a rate of 41.18 hospitalizations/1,000 inhabitants in the 2008-2010 triennium and a rate of 28.12 hospitalizations/1,000 inhabitants in the 2014-2016 triennium. The highest rates were observed for men, although rates decreased over time for both sexes in the same proportion. In relation to age group, older adults aged over 80 had the highest rates (89.65 hospitalizations/1,000 inhabitants) in the 2008-2010 triennium, although this age group exhibited the greatest reduction in HPCSC rates over the three trienniums. The 70-79 years age group presented the smallest reduction in the analyzed period (reduction of 5% between 2008 and 2016). Although PHCSC hospitalization rates decreased over the years, the average length of stay as well as the average amount spent on each hospitalization increased by 28.94% and 39.74%, respectively. The average length of stay per HPCSC was 8.92 days and the average amount spent per HPCSC was 970.54 *reais*, considering the three-year period 2014-2016.

Figure 1 shows that as of 2011, the rate of HPCSC decreased from 42.64 hospitalizations/1,000 inhabitants in 2009 to 25 hospitalizations/1,000 inhabitants in 2016. The highest hospital mortality rate due to HPCSC was recorded in 2009 (4.65 deaths/1,000 inhabitants) and the lowest rate was in 2016 (3.38 deaths/1,000 inhabitants).

Table 2. Rate of Hospitalizations for Primary Care Sensitive Conditions (HPCSC) and proportion of HPCSC among older adults by health region 2008-2016, Rio Grande do Norte, Brazil.

RN Health Region	Nº of HPCSC-Older Adults	Proportion (%)	Population (Older Adults)	Rate of HPCSC-Older adults by health region (1000 inhab)
São José de Mipibu	8,016	7.52	37,247	215.212
Mossoró	15,554	14.60	43,636	356.449
João Câmara	7,944	7.45	33,288	238.645
Caicó	19,823	18.60	38,637	513.057
Santa Cruz	6,831	6.41	23,067	296.137
Pau dos Ferros	17,786	16.69	31,913	557.328
Metropolitan Region	26,319	24.70	115,384	228.099
Açu	4,247	3.98	15,088	281.482

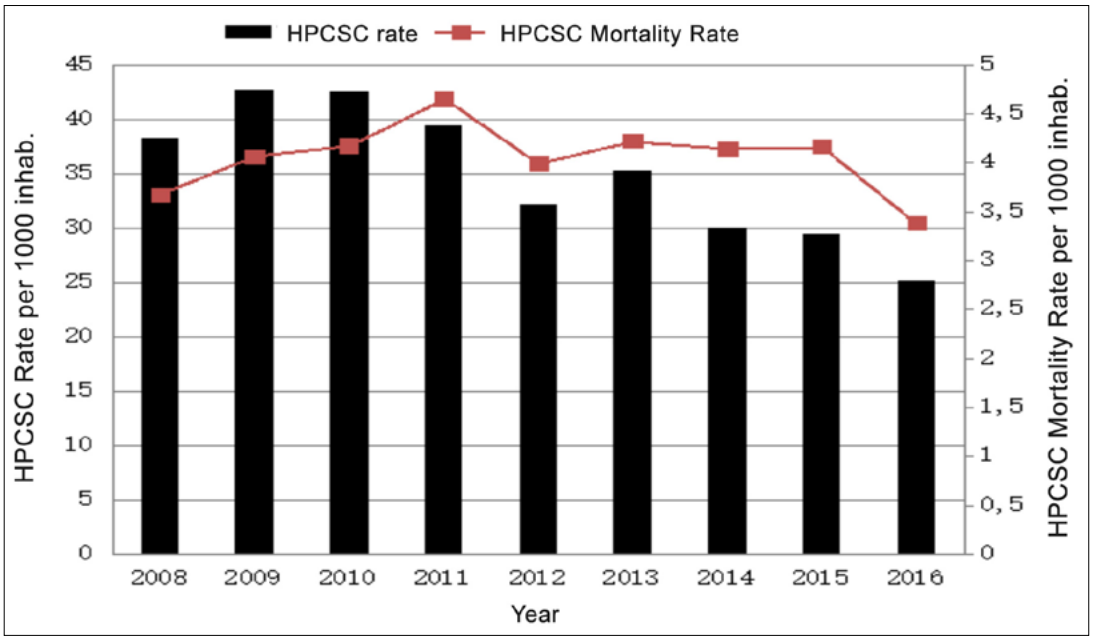
Source: DATASUS, SUS Hospital Information System, 2018.

Table 3. Analysis of rates of Hospitalizations for Primary Care Sensitive Conditions (HPCSC), HPCSC spending (R$) and length of stay for such causes in older adults 2008-2016, Rio Grande do Norte, Brazil.

Variables	Triennium			Variation*
	2008-2010	2011-2013	2014-2016	
HPCSC-Older Adults RN Rate	41.18	35.58	28.12	-31.71
HPCSC-Older Adults Rate				
Women	38.61	33.02	26.3	-31.88
Men	44.53	38.96	30.53	-31.43
HPCSC (years)				
60-69	23.71	20.18	15.6	-34.2
70-79	46.16	39.28	43.47	-5.83
>80	89.65	81.79	67.49	-24.72
N° HPCSC-Older Adults	38,182	36,116	31,247	-18.16
N° hospitalizations for all causes	94,620	101,710	101,125	6.87
Proportion HPCSC/General Hospitalization	40.35%	35.51%	30.90%	-23.43
Length of stay (days) HPCSC-Older Adults	264,257	267,377	278,847	5.52
Mean length of stay (days) HPCSC-Older Adults	6.92 days	7.40 days	8.92 days	28.94
Cost of HPCSC-Older Adults	26,519,066.98	29,941,625.70	30,.326,373.23	14.36
Cost of hospitalizations for all causes	113,455,387.00	151,089,703.50	185,394,652.80	63.41
Proportion spent on HPCSC-older adults/ general hospitalizations	23.37%	19.82%	16.36%	-30.02
Mean cost of HPCSC-Older Adults (em R$)	694.54	829.04	970.54	39.74

Source: DATASUS, SUS Hospital Information System, 2017.

* Variation in value between 3rd and 1st triennium.



Source: DATASUS, Hospitalization System, 2018.

Figure 1. Temporal analysis of the hospitalization rate and mortality due to Hospitalizations for Primary Care Sensitive Conditions (HPCSC), in the period 2008-2016, in the state of Rio Grande do Norte, Brazil.

DISCUSSION

The present study described the scenario for Rio Grande do Norte and its health regions in relation to HPCSC for the older adult population, noting a reduction in hospitalization rates for such causes in recent years. From the characterization of the hospitalizations, it was observed that the highest rates of HPCSC affected men, long-lived older adults and the health region of Pau dos Ferros and Caicó. Additionally, the costs of such hospitalizations corresponded to a considerable percentage of the amount spent on hospitalizations in the state. As HPCSC may reflect a disorganized supply or failings in resolutive capacity and access in primary care, the results of this study are important for further analysis of this stage of the care network in this region.

The occurrence of HPCSC in older adults, in addition to other factors, may be related to the most common access limitations in this population, such as mobility and transportation difficulties and a high degree of dependence[15]. With the increase in life expectancy and population aging, the health problems that most affect this population are chronic diseases and/or long-term diseases, requiring more costly actions and the use of more complex technologies. The older population makes the greatest use of health services and rate index has been increasing concomitantly with the demographic profile[16,17].

In a survey conducted in the city of Londrina (Paraná), the older adult population (9.3% of the population) corresponded to 20.2% of hospitalizations, 22.1% of days of hospital stay and 29.1% of SUS hospital costs[18]. In 2007, in the municipality of Canoas (Rio Grande do Sul), individuals aged 60 or older had a higher prevalence of hospitalization (17.2%), with a 4.96 times greater probability of being hospitalized than the age group used as reference (14-19 years)[19].

Literature[20] reports a seven times greater risk of hospitalization due to a PHCSC among older adults. The discussions describe these individuals as physically and financially vulnerable, and having little understanding of primary care practices. These characteristics may represent the under-utilization of primary care in a preventive manner, which in turn may result in avoidable hospitalizations, with increased morbidity and a direct cost impact on the public health system[21].

In the present study, the most frequent diagnoses found in HPCSC among older adults were for bacterial pneumonia, infectious gastroenteritis and complications, and diabetes mellitus. Circulatory system diseases accounted for around 25% of hospitalizations, which is similar to the results of a study that analyzed the HPCSC of older adults in the state of Rio de Janeiro[6], and found that 49.0% of hospitalizations are due to these causes. In addition, a study that analyzed HPCSC in older adults in Santa Catarina found that these causes represented 23.76% of total hospitalizations[22]. Other studies analyzing HPCSC in the adult population also corroborate these findings[12,16,23].

Immunopreventable diseases were also a notable cause of hospitalization in the present study. This finding is corroborated by a study that analyzed HPCSC in Brazilian regions and showed that, in the northeast of the country, HPCSC for preventable diseases by immunization and preventable conditions are the most prevalent[24]. For diseases prevented by immunization, as suggested by the National Immunization Program, vaccination is a highly effective preventive resource, available in primary care and carried out by nurses, both in terms of operational issues in vaccine rooms, and in the monitoring of the different stages of this process[25].

The hospitalization coefficient for gastroenteritis in the present study was notable. This finding points to possible failures in preventive and curative care in the sphere of primary care, which should be effective and resolutive against the first manifestations of this event, especially in this age group. A study conducted in the northeastern states of Brazil showed that oral rehydration serum, considered a minimal technology and low cost intervention, was highly effective in preventing deaths from gastroenteritis[26,27].

Another relevant finding is the registration of congenital syphilis among the causes of HPCSC. Sexually transmitted infections (STI) are increasingly common in this population, and according to a study by Dornelas et al.[28], an increase in the longevity of the sex life occurs in parallel with an increase

in life expectancy, whether due to technological advances (such as the use of impotence and/or hormone replacement pills), combined with greater predisposition due to physiological changes, increasing the risk of STI.

The present study observed a decline in HPCSC rates over the study period, a fact corroborated by a study that conducted a descriptive review of the results of Brazilian academic production on conditions sensitive to primary care. This study showed that, despite having high rates in some isolated states and/or municipalities, there is a tendency for HPCSC to stabilize and decline in different Brazilian regions.[29]. The study that analyzed the HPCSC of older adults in Brazil, from 2003 to 2012, found that the northeast region has the lowest hospitalization rate for these causes, and that in Brazil, there was a reduction of 17.64% in HPCSC in the period considered[30]. This tendency to reduce or stabilize hospitalizations may be justified by the transfer of procedures previously performed only through hospitalization, to outpatient and hospital day care. On the other hand, it may mean the improved access to and effectiveness of PHC[3].

Continuing with this theme, the implementation of the Family Health Strategy (FHS) in Brazil has resulted in a significant expansion of coverage in the last decade, with different rates between regions and depending on the population size of municipal regions. Administrative data from the Basic Care Department (BCD) of the Health Care Department of the Ministry of Health revealed out that in 2012, 95% of Brazilian municipal regions had a total of 33,404 FHS teams deployed, with potential to reach 55% of the population. However, there are important differences in coverage, access, and provision of care in Basic Health Units (BHU) in municipal regions, partly due to management structures and social inequalities in the country, with significant effects on inequities in access to and the use of health services[31].

HPCSC rates in Rio Grande do Norte, when compared with other areas of Brazil, are considered low. In a study conducted in the Federal District, older adults aged 70 to 79 years, for example, had significant HPCSC coefficients (60 hospitalizations/1,000 inhabitants for women and 80 hospitalizations/1,000 inhabitants for men)[26]. The continued higher proportions of HPCSC in older adults in the south and southeast may be related to the fact that these regions have the highest proportion of older adults and the highest rate of aging in the country[30].

Regarding the amount spent on HPCSC, the data from the present study were consistent with the results of a national study that showed a reduction in spending on HPCSC from 2000 to 2013. This study showed that in 2013, the costs of HPCSC were 17.4% of the spending of the public health system on all hospitalizations[23], similar to the findings of the present study.

It should be noted that there are limitations on the use of hospitalizations for conditions sensitive to primary care. A decrease in hospitalization rates for these causes indicates only possible improvements in primary care. The other numerous factors that influence hospitalization rates are not easily measured and adjusted/controlled. The analysis of these hospitalizations depends, among other things, on administrative data (such as hospitalization authorizations), and this can accentuate the problems present in these databases. The use of HPCSC in research requires careful analysis of hospital data sources themselves[32]. Nevertheless, the SUS/HIS is used in several studies and its results have been consistent and coherent with reality.

CONCLUSION

The present study allowed us to identify the evolution of hospitalizations for primary care sensitive conditions in older adults (HPCSC) in the state of Rio Grande do Norte, considering the differential roles of age, sex and diagnosis of hospitalization during the analyzed period, especially in terms of the reduction in the proportion of these expenses in the total spending on hospitalizations of the Unified Health System.

In addition, a progressive reduction in HPCSC was revealed, which may be related to Primary Care and its considerable impacts on hospital morbidity, contributing to a healthy aging and higher life expectancy, as HPCSC are indicators of quality of care, allowing weaknesses to be identified, alerting managers to focuses of needs for intervention.

Finally, the importance of subsidizing policies that strengthen primary care in Brazil and which include programs focused on the social determinants of health is emphasized, as well as the need for the constant monitoring of indicators related to HPCSC, including the spending involved in these procedures.

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Sociodemographic profile of elderly persons with the human immunodeficiency virus in a state in the northeast of Brazil

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Abstract

Objective: To describe the sociodemographic profile of elderly persons with human immunodeficiency virus (HIV) in the state of Alagoas, Brazil. *Method:* An ecological study with a descriptive and quantitative approach was carried out. Data was used from elderly patients with HIV reported in the Notification Disease Information System (or SINAN), from 2012 to 2016. *Results:* A total of 41 cases of HIV, with a continuous progression of cases, predominantly male, with self-described brown skin, low education and reported heterosexual sexual orientation. *Conclusion:* It was found that it is necessary to demystify that only sex workers, drug users and homosexual men are vulnerable to the virus and that the elderly are not susceptible to HIV. In this scenario it is essential that the elderly are inserted in environments that approach the theme openly, free of prejudice, essentially starting from the recognition of sexuality, providing greater security and quality of life.

Keywords: HIV. Health of the Elderly. Epidemiology. Public Health Nursing.

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INTRODUCTION

Aging and longevity are topics of global concern, the concepts or notions of which focus on similar problems throughout the world. Progressive and expressive aging has resulted in the worsening of social and economic inequalities in Brazil. Until the early 1960s the country was considered a nation of young people, but this perspective has changed, and there are currently concerns regarding the elaboration of public policies aimed at the aging population, in order to ensure the comprehensive health care of this group. In this context, debates include themes related to the sex life of such individuals, making the adoption and implementation of protection policies a challenge[1-3].

Drugs that inhibit sexual impotence and favor hormone replacement make older people more sexually active. This is a worrying factor however, as it can make this population more susceptible to sexually transmitted infections (STIs), including the human immunodeficiency virus (HIV). It is noteworthy that, in the cultural context, the idea that the elderly are not vulnerable to sexual diseases is embellished, as these are diseases that belong to other specific groups, and the use of preventive methods is therefore not required[4,5].

Individuals with HIV may progress to Acquired Immunodeficiency Syndrome (AIDS), where their immune system is constantly attacked. In this case, individuals with AIDS present signs and symptoms of the disease characterized by the externalization of opportunistic diseases[6].

One way to slow the chain of virus transmission is by detecting infected (seropositive) people, for which purpose rapid tests (RTs) have been developed. The methodology of such tests allows the detection of antibodies in less than 30 minutes, and they boast low operating costs, are highly sensitive, specific, and simple to apply and interpret[7]. Rapid tests are recommended for the population treated in health services, such as pregnant women; parturients; patients with STI or suspected cases; people diagnosed with active or latent infection tuberculosis (LITB); the prison population; indigenous populations; patients in emergency services (urgency and emergency); homeless populations; drug users; persons at risk of sexual exposure or sexual violence; health professionals accidentally exposed to potentially contaminated biological materials, and source patients[8].

Even following the creation of public policies such as Ministry of Health Ordinance No. 236 dated May 1985, which established the first guidelines for the AIDS Program, as well as resources available to combat HIV, such as the distribution of drugs to already diagnosed individuals, early detection of the disease through RT, and the provision of condoms; in relation to the health of the elderly, the theme of HIV infection is considered taboo or something outside their life context. For some older people, HIV is still a disease of homosexuals, and unrelated to behavioral risk factors such as having sex without a condom[9].

Thus, in the context of aging-related sexuality, there is a progressive increase in the number of cases of STIs in the elderly, especially HIV, justifying the need to identify the sociodemographic profile of such individuals. This information can support the development of health promotion actions, assisting in orientation and information about the disease and its treatments, enabling better therapeutic acceptability, increased quality of life, and combatting the virus transmission chain[10].

Based on this profile, health professionals should look at the sexual aspects that permeate the life of the elderly, making such actions a routine and permanent feature in services that assist this population, considering each meeting as an opportunity to intervene and act in health promotion, considering aspects of sexuality fundamental to the practice of integral care.

Given the above, the present study aimed to describe the sociodemographic profile of elderly persons with human immunodeficiency virus (HIV) in the state of Alagoas, Brazil.

METHOD

An ecological study with a descriptive and quantitative approach was performed. It is ecological

in nature as the 102 municipal regions of the state of Alagoas, Brazil, which are operationalized through the actions of the State Program for the Control of STIs/AIDS of the Disease Information Notification System (or SINAN), were used as units of analysis.

The use of the quantitative method foresees the adoption of a systematic and objective strategy, employing the measurement of pre-established variables, and also enables the use of mechanisms to control the research situation in order to reduce biases and enhance accuracy and validity[11].

The inclusion criteria were data from elderly patients with HIV included in SINAN between 2012 and 2016, and the census sample. This system is available throughout the healthcare network and in all spheres of governance of the Brazilian health sector, within the epidemiological surveillance services, where professionals use the standard forms of the Ministry of Health to provide notification of the incidence of certain diseases. The inclusion of this form in the referred system may be able to produce analyzes and measures of intervention and control.

In order to elaborate the sociodemographic profile, the dependent variable was the number of elderly persons with HIV in Alagoas by age group (60-69; 70-79; 80 years old and over), and the independent variables were: gender, education (illiterate, 1st to 4th grade incomplete elementary school, complete 4th grade of elementary school, complete elementary school, complete high school, complete higher education, ignored), skin color/ethnicity (white, black, yellow (Asian-Brazilian), brown, ignored) and sexual orientation (homosexual, bisexual, heterosexual, ignored).

Descriptive statistics were applied for data analysis, with tabulation in a spreadsheet. The data were presented in table form, with notification of frequency and percentage.

The study began following authorization from the management of the State STI/AIDS program of the Alagoas State Health Department (or SESAU) to access the SESAU-AL SINAN databases. According to Resolution No. 510/2016 of the National Health Council, as this is a public domain system and not subject to the identification of subjects, submission to the Research Ethics Committee, as well as the need for a Free and Informed Consent Form, were waived.

RESULTS

During the analyzed period, 41 cases of HIV were registered, with a continuous increasing progression, as shown in Table 1.

Of this total, 7.3% were white; 19.5% were black; 2.4% yellow or Asian-Brazilian; 61.0% were mixed race and 9.8% did not respond to the question of skin color/ethnicity (Table 2).

Table 3 shows the percentage of individuals with HIV who reported their sexual orientation; in which 51.2% said they were heterosexual, 4.9% homosexual, 4.9% bisexual and 39.0% ignored the question.

It was observed that, according to level of education, there was a predominance of those who are illiterate or who did not report their education, with 29.3% of the population being illiterate and 34.1% ignoring the question (Table 4), representing underreporting.

Table 1. Percentage of HIV in elderly persons, per year, in the state of Alagoas, 2012 to 2016.

Year of Diagnosis	Male	Female	n
2012	1	0	1
2013	2	1	3
2014	6	2	8
2015	10	1	11
2016	11	7	18
Total	30	11	41
F (%)	73.2	26.8	100

Source: SINAN, 2017.

Table 2. Percentage of HIV in the elderly in relation to skin color/ethnicity in the state of Alagoas, 2012 to 2016.

Year of diagnosis	White	Black	Yellow	Brown	Ignored	n
2012	0	1	0	0	0	1
2013	1	1	0	1	0	3
2014	0	2	0	4	2	8
2015	1	2	0	7	1	11
2016	1	2	1	13	1	18
Total	3	8	1	25	4	41
F (%)	7.3	19.5	2.4	61.0	9.8	100

Source: SINAN, 2017.

Table 3. Percentage of HIV in the elderly in relation to sexual orientation in the state of Alagoas, 2012 to 2016.

Sexual orientation	2012	2013	2014	2015	2016	F (%)
Ignored	0	1	3	6	6	16 (39.0)
Homosexual	1	0	1	0	0	2 (4.9)
Bisexual	0	0	1	0	1	2 (4.9)
Heterosexual	0	2	3	5	11	21 (51.2)
Total	1	3	8	11	18	41 (100.0)

Source: SINAN, 2017.

Table 4. Percentage of HIV in the elderly and educational level in the state of Alagoas, 2012 to 2016.

Schooling	2012	2013	2014	2015	2016	F (%)
Ignored	0	1	2	5	6	14 (34.1)
Illiterate	0	1	3	3	5	12 (29.3)
1st to 4th grade of elementary school incomplete	0	1	2	0	4	7 (17.1)
4th grade of elementary school complete	0	0	1	2	1	4 (9.8)
Complete primary education	0	0	0	0	1	1 (2.4)
Complete high school education	0	0	0	0	1	1 (2.4)
Complete higher education	1	0	0	1	0	2 (4.9)
Total	1	3	8	11	18	41 (100.0)

Source: SINAN. 2017.

DISCUSSION

Any reflection on HIV and its relationship with the elderly population involves the articulation between sexuality in such individuals and the cultural, social and economic aspects of this population segment. It is noted that the majority of records on the information system are male, which is consistent with research that assessed the incidence of elderly people with HIV, where men represented 53.8% of the total number of patients[12].

This reality can be attributed to the difficulty men experience when negotiating preventive measures, which is an expression of hegemonic masculinity in the domain of sexuality. In keeping with dominance in this field is the requirement for multiple sexual partnerships, the perception of invulnerability to HIV and other STIs, affirming oneself to be heterosexual and the excessive consumption of alcohol and illicit drugs. Such situations are likely to enhance susceptibility, leaving men with higher rates of HIV infection[13].

Cultural issues also seem to affect this reality, as they accompany the sense of a restricted or mistakenly unnecessary requirement for health professionals to investigate sexually transmitted diseases due to the concept of asexuality in the elderly. However, studies point to an increase in the sexual activity of this group, stating that of 22 men in a studied population, 16 (72.8%) said that they were sexually active and admitted that they had never used condoms[14,15]. Given this scenario it is necessary to demystify the belief that only people belonging to the risk group (sex workers, drug users and homosexual men) are vulnerable to the virus[15,16].

The view that the elderly are not susceptible to the transmission of the virus should be reassessed and effective measures to prevent and break the chain of virus transmission should be developed. In the primary care setting, policies aimed at the elderly are considered, including health indicators for this population, and aspects such as functional capacity, participation and self-satisfaction should be priorities of care, with incentives for activities that promote autonomy and pleasure, including in relation to sexuality[16].

The study also pointed to a growing process of feminization of infection by the virus over the years, with a progression from one case in 2013 to seven in 2016. This makes it clear that the inequality of power between the sexes and lesser female anonymity in sexual and reproductive decisions, including sexual initiation under pressure, unsafe sex, abuse and sexual exploitation, may be triggering factors of the current epidemiological trait[17].

From the female perspective, there is a fear of losing the male provider, especially when doubts are raised about a partner's infidelity, and in such cases, the woman often gives in to the male imposition of having sex without a condom. In addition, studies indicate that most of this population is still uninformed about STIs and their prevention, which contributes to the significant increase in the spread of HIV among the elderly[17,18].

Regarding self-affirmed skin color/ethnicity, the study showed that most elderly persons considered themselves black or brown-skinned (19.5% and 61.0%, respectively) (Table 2). The race variable was introduced in SINAN in 2001 and is currently seen as a determinant of health inequalities in Brazil. Recent survey data show that the HIV epidemic is growing rapidly among the black and brown-skinned population[19].

Literature dealing with HIV/AIDS describes a mortality rate in Brazil based on skin color/ethnicity in the year 2000 of 10.61/100,000 for white women and 21.49/100,000 for black women, and 22.77/100,000 for white men and 41.75/100,000 for black men. These data reflect the same skin color/ethnic disparity as the present study[19].

The black population carries traces of the social marginalization that permeates Brazilian society and actions addressing this population are therefore required. Black Brazilians carry a racial stigma that can affect the treatment aimed at this group, influencing access and opportunities, creating and/or enhancing vulnerabilities by imposing barriers to access to rights or the neglecting of needs of all kinds[20].

The guiding questions of health have long had a serious impact on the black population. The absence,

until now, of a racial and ethnic background category in official statistics on the HIV/AIDS epidemic makes it difficult to identify the expansion of the epidemic in this population segment. However, if the idea of vulnerability is understood as an impossibility of exercising citizenship, it can be said that black people are those who most face problems of access to services at all levels, as this perspective exhibits the social and cultural characteristics that make them more vulnerable[21].

Regarding the sexual orientation of elderly persons with HIV, the present study found a prevalence of heterosexual elderly persons (Table 3). Confirmation of these data breaks some paradigms, among them, the belief that homosexual individuals make up the majority of the infected population[22].

Research carried out at a public hospital for infectious and toxicological diseases in the state capital of Rio Grande do Norte traced the profile of people infected with HIV. It was found that of 331 people, a total of 258, or 78%, considered themselves heterosexuals, confirming a tendency that HIV is not related to sexual orientation, but to the behavior of risk[22].

HIV/AIDS and homosexuality have experienced a conflicting relationship throughout history, since same-sex sexual orientation (male) appeared to reflect on a health situation. Social, cultural, economic, religious and legal transformations has increased the visibility of different identities, such as gay, lesbian, transgender and transvestite. These changes have made the male role the subject of social debate and it can be stated, at this point, that human sexuality and behaviors related to this issue will influence the health-disease process[23].

Historical data has shown a rise in the proportion of cases of transmission in heterosexuals from the early 21st century onwards, when the third decade of the HIV epidemic began. Also at this time, there was greater contamination among lesbian women, with clinical aspects revealing that women who have sex with other women can contract HIV through contact with menstrual blood, vaginal secretions and the use of sex toys[24].

Vulnerability to HIV infection among homosexual women occurs through biological, social, economic, cultural, gender factors and society's consent to violence against women. Another issue is that part of the population believes in the monogamy of their partners, with this conception having a certain repercussion in their serological state[25].

Regarding the educational level of the infected elderly persons in the present study, 29.3% were classified as illiterate (Table 4), highlighting the significance of this factor. Schooling is an effective indicator of the socioeconomic status of an individual and its impact on health. Thus, the lower the educational level of the elderly, the lower their access to information and, consequently, the more vulnerable they will be to HIV/AIDS[12].

In a recent study on the prevalence of HIV in the population at a Health Center in the city of Rio das Ostras, in the state of Rio de Janeiro, the data agreed with the present study, as it showed that 40.9% of the population investigated had a low educational level[26].

Related to this issue is the difficulty that health professionals may experience when providing health education in health, meaning that information pertinent to the form of contagion and prevention measures fails to reach these individuals in a precise manner. Health education is an important tool in health promotion, which requires a combination of educational and environmental support and individual skills that aim to promote the actions and conditions necessary for such promotion[27].

All health professionals provide health education, but nurses have a fundamental role in this scenario, as they act in the health care of the elderly population, and during nursing consultations should go through all aspects related to this age group, including care regarding HIV prevention[28].

Specific campaigns addressing the issue of HIV are needed, as well as a routine aimed at consulting health professionals for the population aged 60 and over. These moments are conducive to HIV counseling and RTs, favoring early diagnosis and effective primary prevention[4].

Possible limitations of the present study are the lack of data on the elderly population in the state, the limited reliability of the situational diagnosis of the disease in this population, and the inability to associate exposure and disease at the individual level. Given this, there is a need to make municipal regions, Basic Health Units and Family Health Units provide notifications of new cases of HIV/AIDS in this population, resulting in a more cohesive promotion of strategies to combat transmission, evolution and mortality.

CONCLUSION

The present study identified that the male gender predominates among elderly people with the HIV virus in the state of Alagoas, who define themselves as brown-skinned and have a low level of education. It is necessary to demystify the belief that only people in the risk group are vulnerable to the virus and that the elderly are not susceptible to HIV.

More investments in health agencies, their professionals and health education practices are therefore suggested. In this scenario, the elderly should be inserted in environments that approach the theme openly, free of prejudice, essentially starting from the recognition of sexuality, providing greater security and quality of life to citizens.

Large-scale educational campaigns can achieve significant results in all sectors of society, portraying the disease as something real, which can potentially be prevented and for which possibilities of care exist, with the responsibility for the health of the population viewed as an individual attitude. This can reduce the connivance of all with the invisible perception of risk and danger of virus contamination.

In this context, it is hoped that the results of the present study may stimulate reflections that encourage changes in health care in all sectors, whether public or private, with the increased awareness and actions of multiprofessional teams in adapting care to the surveillance model of health care, optimizing support, bonding and communication for and with the elderly population and aspects of their sexuality.

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Health education as a strategy for the promotion of the health of the elderly: an integrative review

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Abstract

Objective: To identify the key issues and health education strategies for the health promotion for the elderly. *Method*: An integrative literature review was conducted during the months of March and April 2018, by means of the Virtual Health Library, in the Medical Literature Analysis and Retrieval System Online, Latin American Literature in Health Sciences and the Scientific Electronic Library Online databases. After the search process and the selection of publications, the final sample consisted of 24 articles. *Results*: A total of 16 Brazilian articles, the majority of which were carried out in the southeast and south of the country, were identified, in which the most frequently expressed themes for the health education of the elderly were healthy eating and physical exercise practices. *Conclusion:* The actions of education in health were focused on healthy eating and physical activity, carried out by means of group workshops, seminars and/or lectures, performed, in the majority, by nurses and community health agents who were part of family health teams.

Keywords: Health Promotion. Health Education. Health of the Elderly.

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INTRODUCTION

Health education is understood as an educational process of knowledge construction, aimed at the appropriation of the theme by the population[1]. It refers to a set of practices that contribute to the increase of the individual and collective autonomy of people and the debate with health professionals and managers in order to achieve health care based on the needs of individuals and communities, improving the quality of life and health of the population[2,3].

As an emancipatory pedagogical process, health education favors the development of intellectual autonomy, becoming an imperative tool to promote the improvement of the quality of life and health of the elderly[4,5].

Primary Health Care (PHC), of which the main care scenario is the Family Health Strategy (FHS), is a privileged locus of educational practices in health, and as the integrated work of the team of health professionals, favors and mobilizes efforts to contribute to the maintenance of individual and collective health[6], which can favor critical and transformative awareness, allowing the exercise of citizenship and effecting personal and social changes.

Therefore, primary care health professionals have the important role of promoting health education programs and activities, aimed at the quality of life of individuals and families, and these actions should be integrated into care[7]. To achieve this, such actions should be planned and directed at the appropriate target population, articulated by a multiprofessional team and executed on a permanent basis, considering what the subjects need and want to know to promote their health[8].

The theme in question is highlighted in the research priorities agenda of the Ministry of Health medical opinion report for the year 2018, since it encourages the evaluation of the implementation of health education strategies in the Unified Health System (or SUS); the surveying of innovative, participatory and resolutive methodologies of health education with the elderly; and the assessment of the impact of health education practices with elderly persons in primary care[9].

The importance of the theme is therefore clear, both in terms of the performance of care practices and in a research setting; while it is believed that promoting health education actions with the elderly, with their participation and that of their families and the community, is an effective method for promoting the health and quality of life of this population. Thus, it is necessary to broaden knowledge about this theme.

From this perspective, the present study aimed to identify the main themes and strategies of health education for the promotion of the health of the elderly.

METHOD

An integrative literature review was performed. To construct the study, six fundamental steps were followed: identification of the theme and selection of the research question; establishment of inclusion and exclusion criteria for studies; categorization of studies; evaluation of studies; interpretation of results and synthesis of knowledge[10].

To conduct the research, the following guiding question was elaborated: *What are the main strategies used and the themes approached in health education actions, with a view to health promotion aimed at the elderly population?*

From the guiding question, in order to facilitate the definition of the descriptors, we used the PVO strategy (Population, Variable of interest and Outcome), which defined the study population as "the elderly", the variable of interest as "health education" and the outcome as "health promotion".

The searches were performed between March and April 2018 by two independent evaluators, through the Virtual Health Library, in the Medical Literature Analyzes and Retrieval System Online (MEDLINE), Latin American and Caribbean Saúde (LILACS) and the Scientific Electronic Library Online (SciELO) databases. These choices were justified by their scientific scope in relation to research in the field of health promotion.

For the searches, the following controlled descriptors were selected: "Health of the Elderly",

"Health Education" and "Health Promotion", which were crossed with the help of the Boolean operator AND, using the advanced search method from categorization by title, abstract and subject.

The following inclusion criteria were chosen: studies whose theme was related to health education with the elderly in article format and available for download, in English, Portuguese and Spanish, with a year of publication between 2013 and 2017. This time frame was chosen because Decree No. 8.114, which deals with the National Commitment to Active Aging[11], which includes health education actions, was published in 2013. The following exclusion criteria were selected: studies in the form of dissertations, theses, reflection and literature review articles, documentaries, essays and/or reviews.

The database search revealed 35,211 studies, of which, 2,439 articles were found in LILACS, 32,157 in MEDLINE and 615 in SciELO.

Following the application of the filters, the next step was to select the papers from the reading of titles and abstracts, from which those that did not explicitly fit the scope of this research were excluded. A total of 64 potentially eligible articles were identified were then read in full. At this stage, three repeated articles were excluded, as well as 12 articles which were not suitable for the theme; three literature reviews; three reflection articles and 19 articles that were not available for download, resulting in a total of 24 studies included in the final sample.

The evaluation stage of the studies allowed us to identify that according to the evidence pyramid[12] two studies were classified as being of the second level, or clinical trials; one was third level, which was a cohort study; one was the fourth level, a case-control study; five were level five, characterized as quasi-experimental studies, and 15 had a scientific evidence level of six, which represent descriptive studies.

For data extraction, a form was developed containing bibliometric data about the articles studied, summarized in Chart 1, as well as information regarding the pedagogical strategies used, the professionals involved and the results obtained in health education, which are presented descriptively in the following sections.

RESULTS

Considering the variables selected for the presentation of the articles, Chart 1 summarizes the following studied aspects: authors, year, place, type of study, sample and study objectives.

Chart 1. Description of selected articles by authors, year and location, type of study, sample and study objectives.

Authors	Year and Location	Type of Study and Sample	Objectives of Study
Mendonça et al.[13]	2013, Viçosa, Minas Gerais, Brazil	Experience report/ 20 elderly persons	Report a working experience with the elderly and support a critical-theoretical reflection on the practice of educational workshops as a health education strategy, in the light of Freire's thinking, based on the use of participatory methodologies.
Nogueira et al.[14]	2013, Goiânia, Goias, Brazil	Qualitative research/23 elderly persons and six community health agents	To identify therapeutic factors present in the health promotion group of elderly persons.
Evers et al.[15]	2013, Australia	Cohort/710 elderly persons	Conduct a multifaceted assessment of a social marketing campaign to raise asthma awareness among elderly persons in a regional Australian community.
Bhurosy and Jeewon[16]	2013, Mauritius, East Africa	Experimental model/80 people aged 40 or over	To evaluate the effectiveness of a theory-based educational intervention to improve calcium intake, self-efficacy, and knowledge of older Mauritians.

to be continued

Continuation of Chart 1

Authors	Year and Location	Type of Study and Sample	Objectives of Study
Chung and Chung[17]	2014, Hong Kong	Experimental study/60 elderly persons	Evaluate a three-week program that includes culinary demonstrations with free food samples to motivate older adults to cook more and improve their nutritional status.
Ferreti et al.[18]	2014 Chapecó, Santa Catarina, Brazil	Qualitative research/ seven elderly persons	To verify the impact of a health education program on the knowledge of elderly persons about cardiovascular diseases.
Janini et al.[19]	2015 Rio de Janeiro, Brazil	Qualitative research/83 elderly persons	To analyze the impact of health promotion and education actions in the search for quality of life, autonomy and self-care of the elderly.
Sink et al.[20]	2015, USA	Randomized clinical study/ 1,635 participants	Determine whether a 24-month physical activity program results in better cognitive function, lower risk of mild cognitive impairment (MCI) or dementia, or both, compared to a health education program.
Machado et al.[21]	2015, Minas Gerais, Brazil	Convergence research/21 elderly persons and nine health professionals	Describe the stages of the empowerment process of an elderly group in a rural community.
Almeida et al.[22]	2015, Viçosa, Minas Gerais, Brazil	Intervention study/82 participants	Analyze possible changes that have occurred in anthropometric measurements and levels of functional physical fitness of elderly persons participating in a community intervention project.
Caprara, et al.[23]	2015, Madrid, Spain	Quantitative study/73 participants	Testify to the effectiveness of Vital Aging-Multimedia, a psychoeducational multimedia program designed to promote successful aging.
Sousa and Oliveira[24]	2015, Braga, Portugal	Intervention study/25 elderly persons	Contribute to the active aging of day/social centers for elderly persons, harmoniously developing all its dimensions, aiming to make users autonomous, participatory and active.
Cecílio and Oliveira[25]	2015, Limeira, Sao Paulo, Brazil	Intervention study/23 elderly persons	Promote, through Nutrition Education activities, healthy eating habits in a group of institutionalized elderly persons.
Luten et al.[26]	2015, Groningen, Holland	Quasi-experimental study/ 564 elderly persons	To assess the range and effects of short and medium term intervention (with local media campaign and environmental approaches) on physical activity and healthy eating in elderly persons in a socioeconomically disadvantaged community compared with a control group.
Lucena et al.[27]	2016, João Pessoa, Paraiba, Brazil	Experience report/99 elderly persons	Describe a report of health education practices of a university extension project, encouraging the adoption of preventive measures of self-care in relation to the health of the elderly.
Munhoz et al.[28]	2016, Santa Maria, Rio Grande do Sul, Brazil	Experience report/144 elderly persons	Report the experience of members of the Nursing Tutorial Education Program in the "*Acampavida*" extension project, held annually with elderly persons, through health education activities.

to be continued

Continuation of Chart 1

Authors	Year and Location	Type of Study and Sample	Objectives of Study
Barbosa et al.[29]	2016, Recife, Pernambuco, Brazil	Experience report/30 participants	Report the interdisciplinary experiences in the Family Health Strategy (FHS) with a Group of Elderly persons, through the Education Program for Health Work (or PET-Health) developed at the Federal University of Pernambuco (UFPE).
Nascimento and Ramos[30]	2016, Petrolina, Pernambuco, and Juazeiro, Bahia, Brazil	Experience report/150 elderly persons	Present the set of activities developed weekly by 10 medical students from the Federal University of Vale do São Francisco in Pernambuco with groups of elderly persons from the Active Life Program (ALP) and the Open University for the Elderly (UNATI/Univasf).
Lopes et al. [31]	2016, Florianópolis, Santa Catarina, Brazil	Qualitative research/69 people	Verify the most relevant pedagogical aspects of a physical exercise class for the adoption of and permanence in physical activity programs in the perception of long-lived elderly women.
Sá et al.[32]	2016, Diamantina, Minas Gerais, Brazil	Quantitative research/28 participants	Identify and describe health promotion actions related to the physical activity of elderly persons in basic health units, as well as the perception of those responsible for this practice.
Jih et al.[33]	2016, São Francisco, California, USA	Randomized group study/756 elderly persons	To compare the effects of two types of intervention: lectures and Chinese printed materials versus solely Chinese printed materials on knowledge and adherence to nutrition and physical activity guidelines among older Chinese immigrants in San Francisco, California.
Amthauer and Falk[34]	2017, Porto Alegre, Rio Grande do Sul, Brazil	Qualitative research/16 professionals	Identify the actions and practices performed by health professionals with elderly persons seeking care in a Basic Health Unit
Mendonça et al.[35]	2017, Uberaba, Minas Gerais, Brazil	Action Research / 98 health professionals	To evaluate the development and implementation of a continuing education action directed to primary care professionals on the theme "health education groups with elderly persons".
Santos et al.[36]	2017, Quixadá, Ceará, Brazil	Experience report/22 elderly persons	Report the experience of the perception of students about health education actions aimed at elderly persons of the Remanso da Paz shelter in Quixadá, Ceará.

The themes addressed in the health education actions were varied, however, there was a predominance of discussions about healthy eating [17,20,22,25,26,28,29,33,35] and the practice of physical exercises[20,22,26,28,31,32,34,35]. The other themes included chronic diseasses[18,19,27,36] with emphasis on arterial hypertension[18,27,36]; diabetes *melitus*[18,27,36]; respiratory diseases[15]; sexuality[28,30]; active aging[30]; healthy habits[21,23,35]; medication[13,36]; legal and financial questions[20,28]; and social participation[23,24].

These actions were developed by health professionals, mostly primary care workers; with the participation of community health agents [14,21,34,35], nurses[34,35], nursing technicians[21,32,34], doctors[34] and dental surgeons[35]. Only one article[19] did not specify the professional category.

In many studies, the actions were performed by students and teachers from various undergraduate courses, especially Nursing[13,27,28], followed by

other courses, which appeared less frequently, such as: Medicine[27,30], Physical Education[22,32], Nutrition[22,29], Pharmacy[36], Occupational Therapy[29] and Physiotherapy[32].

In terms of the strategies adopted for the application of health education activities, nine studies used group workshops[13,20-22,27-29,32,34]; five used seminars and/or lectures[17,19,30,33,36]; three made use of expository, dynamic and informal conversations[18,25,30]; two applied dialogued exposition[16,24]; marketing campaigns[15,26] and digital education[23]. Three studies did not mention the strategies adopted[14,31,35].

As a theoretical framework for conducting the studies, two[13,27] were based on the work of Paulo Freire. Many articles, although not mentioning the subject directly, spoke about health education with a participatory and dialogical approach, aiming at the empowerment of the subject, which is consistent with Freirean thinking[18,22,25,28,30,35]. The other references were the National Health Promotion Policy[19], a belief in health model[16], Kurt Lewin's group dynamics[21], the hermeneutic interpretative paradigm[24] and the integrated model of change[26], while ten studies did not mention the use of referentials[15,17,20,23,29,31,34,36].

The actions developed were evaluated positively by both the elderly persons and those who performed the actions in all the studies analyzed. Even those that presented strategies with multimedia or marketing campaigns only, produced more modest impact evaluative results, but still described some benefit in the health promotion of the elderly persons.

DISCUSSION

The data demonstrated the versatility that health education actions present to health professionals as a strategy to promote the health of the elderly population, both in relation to the themes addressed and the strategies used.

The findings highlight the value of health education for this specific population, especially when the exchange of scientific and popular knowledge occurs; with the valorization of mutual knowledge, giving importance to the dialogue and increasing the power of comprehension of the elderly themselves, of others and the world, expanding the comprehension of diverse realities.

Health education for elderly persons is a topic of worldwide interest, since the current demographic and epidemiological changes highlight the need to value actions for this population, focusing on the development of autonomy, independence and improving quality of life through active and healthy aging.

The interest in producing studies on active aging in recent years is explained by the scenario of demographic transition, with an increasing proportion of elderly persons in the global and Brazilian population.

In Brazil, the recognition of this theme as a research priority was stated by the Ministry of Health[4], boosting scientific production in the area, in view of the need to identify and discuss the issues that relate to the new demands of society, as well as seek strategies that stimulate autonomy and improve the quality of life of the geriatric public.

In terms of the themes of educational actions with the elderly public, there was a predominance of topics such as healthy eating and physical activity, corroborated by a study that showed that health promotion was essential at all ages, and that for elderly persons its value is unquestionable, and furthermore that it is essential that elderly people create healthy lifestyle habits, particularly as regards their diet and exercise[24].

Chronic diseases such as hypertension and diabetes were also frequent themes, which may be explained by the higher prevalence of such diseases with advancing age[36], and which therefore require special attention.

In a Brazilian study[35], the choice of topics to be addressed with groups of elderly persons was decided mainly by the needs observed by health professionals, with the most addressed subjects being physical activity (90%), diet (85%) and lifestyle (75%).

This highlights the need to transform the traditional manner of conducting health education groups[35]. It is necessary to go beyond recurrent

biomedical topics such as illness, medications, complications and treatments, so that other topics such as leisure, the exchange of popular experiences and healthy community cooking can be addressed; among the many other possibilities to be applied in a health education group with elderly persons.

Some of the studies[13,14,18,19,22,24,28-30,35] highlighted the importance of valuing the participation of the elderly persons in the actions, in order to seek out the topics of interest, as well as focusing on their previous experiences. When the elderly interact and the educational activity is based on their needs, it becomes more productive and provides more effective responses.

Health promotion presents us with challenges for the health education process, such as more dialogical and reflexive initiatives based on the practical experience of the actors[37]. The problematizing education defended by Paulo Freire is inserted as a reference for educational approaches through participatory strategies.

Some authors[13,35,38] believe that participatory strategies and ludic approaches can contribute to healthy and active aging, as they are real spaces for the individual and collective expression of experiences and exchange of knowledge; as Paulo Freire argues, they become liberating and emancipating educational practices, as they focus on the experiences of the subjects, enabling free expression and addressing subjects of interest without disregarding prior knowledge, leading to the exchange of scientific and popular knowledge, rather than the vertical non-dialectical transmission of information.

Trying to break with the traditional aspect of educational workshops and allow one such program to be organized by its elderly participants was reported in a study, with resultant creativity, interest and commitment among the members, who unanimously elected this workshop as the best of those offered[39].

Literature[21,39] points to the formation of groups and workshops with elderly persons as good strategies for establishing a process of coexistence among those involved, as well as the empowerment of their health, the participation of members, the practical implementation of the learning acquired, and the exchange of experiences and knowledge among the service users and health professionals.-

Of SUS professionals, the family health team nurse is especially responsible for educational actions, regulated by health promotion guidelines[40]; but it is also believed that it is the responsibility of the entire health team to work in an integral manner, focused on prevention and health promotion.

Such professionals are not, however, familiar with medical practices in prevention and health promotion, and thus is not best disposed to work with health education actions[40,41].

This shortcoming emphasizes the importance of Permanent Health Education (PHE) for professionals working in primary care, already evidenced in 2017 by PRO EPS-SUS, established through Ordinance GM/MS No. 3,194, which considered the need to resume funding for and plan PHE actions at state and local levels[42].

This ordinance aimed at financial transfers of funds to municipal districts for PHE actions in their territory aimed to stimulate, monitor and strengthen the professional qualifications of health workers, in order to transform health practices, towards the fulfillment of the fundamental principles of SUS, based on local realities and the collective analysis of work processes.

Thus, the government has realized that valuing the continuing education of health professionals can have returns in the context of improving the health situation of the population. This can be facilitated by the insertion of universities in health education actions in Basic Health Units (BHU), as well as in other places where the elderly are present, such as long-term care institutions.

The Ministry of Health and the Ministry of Education and Culture have been fostering the partnership between professional training institutions and health services, aiming to bring them closer to the SUS and the health needs of the Brazilian population, through programs that integrate higher

education, community-service, as well as initiation schemes in work and research, with the participation of undergraduate students from various courses, teachers from educational institutions and health service professionals[29].

Planning activities with elderly persons in an interdisciplinary manner is challenging for students, as the actions previously lacked a participatory and dynamic user approach, but by adopting these dialogical strategies, behavioral changes in group members were observed, with reported satisfaction from elderly persons, staff and all those involved in the process. It has been verified that the students/teachers worked as facilitators of new possibilities, bringing another perspective to the needs of the group and the practices adopted for the care of geriatric users at the BHU[29].

Despite this expansive process of population aging, the articles showed that studying better ways of implementing health education actions for the elderly public that can contribute to and stimulate self-care, autonomy and the improvement of quality of life are still required[13,15,16,18,21,23,24,26,28].

It is recognized that educational interventions are key elements of health care delivery and that, based on the analysis of health policy experts and government agencies, such actions are cost-effective and have great potential to promote the physical and mental well-being of the elderly population[43].

It is believed that health promotion and disease prevention strategies, associated with better care practices, can contribute to reducing the proportion of frail elderly persons, improving the health conditions of this group and reducing costs to the system; thus, participatory approaches are possibilities for implementing these preventive measures[18].

The importance of actions of wellbeing and their impact on health costs in Brazil were mentioned in one study[32]. The analysis was based on the idea that the increase in the number of patients of various age groups, especially the elderly, led to greater demand for health services, with subsequently increased spending. Thus, prevention was considered the best investment. Strategies should therefore be created to delay illness and disability, aiming to increase the level of independence and autonomy of people.

Further studies need to be conducted to assess the impact of activities aimed at the elderly population, as well as to elucidate the need for new health education strategies guided by themes of interest for the elderly and which can contribute to improving their quality of life. Those that evaluate these actions and their impacts on the elderly population, as well as studies with evidence levels one and two, should also be encouraged.

Limitations of this study include: the failure to conduct an analysis of the effectiveness of the educational actions from the perception of the elderly persons, since the discussions presented are based mostly on the perception of professionals about the actions implemented. Furthermore, the scarcity of studies that discuss the effectiveness and efficiency of these actions for the health sector is also a challenge for scientific research.

CONCLUSION

It can be concluded that health education actions aimed at the elderly are based mainly on the promotion of healthy eating and physical exercise, and are carried out mainly by nurses from family health strategy teams and by community health agents, through group workshops and seminars/lectures.

It was also found that actions to promote wellbeing focused on health education aimed at the elderly population were important strategies used by health professionals and/or university students to promote comprehensive care that favors healthy and active aging.

The innovation of the present study is based on the converging of the relevant thematic areas for research and care for the elderly, enabling readers to deepen their knowledge about the main themes and strategies used, as well as identify gaps for the development of new studies.

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Premature aging in adults with Down syndrome: genetic, cognitive and functional aspects

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Abstract

Objective: To describe genetic aspects and characteristics associated with premature aging in adults with Down syndrome. *Method:* A cross-sectional study was carried out of 28 individuals with Down syndrome, aged between 20 and 54 years old (13 women and 15 men), in a university community genetics program, who were referred by philanthropic institutions which offers support to people with disabilities and their families. The genetic and functional data were recorded in anamnesis forms. *Results:* Karyotype analysis revealed free trisomy 21, with only one hereditary case of translocation between chromosomes 15/21. In the sample group, functional difficulties were observed in locomotion, sedentary lifestyles, behavior disorders, memory loss and depression symptoms, as well as loss of autonomy at more advanced ages. Only three people had reading and writing skills and 16 had good social relationships and friend-making skills. *Conclusion:* The study confirms that premature aging in Down syndrome starts in adulthood, and therapeutic follow-up is recommended with the implementation of interventions to prevent deficits and stimulate cognition, and activities for quality of life.

Keywords: Down Syndrome. Aging Premature. Neurodegerative Process.

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INTRODUCTION

Down syndrome (DS) or chromosome 21 trisomy is the main genetic cause of intellectual disability, which in Brazil occurs in about one in 600 to 800 births[1]. Although there are hereditary cases, chromosomal disorders are most often due to a new mutation, with no chance of recurrence in the same family. Free trisomy of chromosome 21 is the most frequent disorder in the syndrome, occurring in 90 to 95% of cases. The remaining percentage is attributed to trisomy 21 by mosaicism, with normal and trisomic cells, Robertsonian translocations, half of which are hereditary, or to rarer chromosomic rearrangements with chromosome 21.

DS is characterized by a variable degree of intellectual and motor developmental delay, a typical face profile and congenital, cardiac and systemic malformations, with severe or detrimental consequences, although there are differences in clinical signs according to ethnicity[2].

As the individual grows older premature aging is observed, leading to senescence of the organs, immune system, strength and functional capacity. The changes caused by aging may potentiate the effects of trisomy, resulting in an even greater dependence on third parties for the performance of daily activities[3]. Such conditions eventually differentiate the aging process in individuals with and without DS[4]. Premature aging is accompanied by the whitening or loss of hair, hearing difficulties, reduced vision, cataracts, and manifestations of Alzheimer's disease (AD)[5].

Hithersay et al.[6] emphasize the role of AD in the life expectancy of people with DS, noting that this disorder occurs in about 70% of cases and that the mortality rate is about five times higher in those with dementia, whereas in the general population, dementia of either type is recorded on only 18% of death certificates in elderly persons over 65 years of age. This relationship between AD and DS occurs due to the influence of genes located in chromosome 21.

Among the gene products contained in this chromosomal region is APP (amyloid precursor protein), which is associated with poor cell adhesion, neurotoxicity and cell growth, with the early formation of diffuse plaques characteristic of AD. Arking[7] notes that although APP production is greater in DS, different genetic mechanisms appear to control the formation of neuritic plaques both in this syndrome and in AD, reinforcing the view that similar manifestations may be produced by different processes. According to Hopkins[8], the signs and symptoms of DS can be explained by subtle changes in the pace of development induced by chromosomal imbalances, with other genes included in this process, which makes the understanding of premature aging in this syndrome complex.

With advances in medical treatments and early intervention therapies, the mortality rate of the syndrome has been reduced, with significant advances in physical and mental development. On the other hand, there is still a shortage of AD-focused intervention therapies in people with DS[9]. Research involving adults with DS and their interactions is therefore necessary, especially due to the particular health needs of this group[10].

According to Rosa[3], the recognition of premature aging in people with DS by society and public agencies may provide better planning of actions in several areas: preventive and curative medicine, psychology and gerontology, leading to new opportunities for social inclusion.

The etiological relationship of 21 trisomy with premature aging in DS remains unclear, which makes further studies on this topic necessary to support preventive measures and provide greater support to people with the syndrome at this stage of life. Considering the current trend of increased life expectancy in individuals with DS, the present study aimed to describe genetic aspects and characteristics associated with premature aging in Down syndrome.

METHOD

A cross-sectional descriptive study was carried out with a sample of 28 individuals aged between 20 and 54 years, who were treated from 2008 to 2018 at a university community genetics program that studied the karyotype and/or family genetic orientation, and who were invited from three non-profit institutions (named in this study as A, B, and C). We included

all individuals with DS in the adult phase, referred by the partner institutions, based on literature[3] that establishes that is possible to identify characteristics of premature aging in this syndrome from 25 years of age onwards. The most common type of care sought at the aforementioned health service is for children with suspected genetic syndromes, but the search for genetic guidance for adults and the elderly, although less frequent, made the present study possible.

Institution A is a social organization (NGO) and provides educational and psycho-pedagogical services for people with disabilities, while Institution B is a government-run special education center. Institution C, meanwhile, is non-profit and operates near a health center offering housing to people with disabilities who were abandoned by their families.

The participants of this study had the diagnosis of DS confirmed by the study of karyotypes, performed by the usual technique of lymphocyte culture and analysis under microscope following GTG banding, according to the norms recommended by An International System for Human Cytogenomic Nomenclature (ISCN) 2016[11].

Within the protocol of genetic care, anamnesis forms were complete with a record of the family's genetic history and pre, peri and postnatal data. The follow-up period was analyzed based on anamnesis records, with observations recorded in the periodic returns. The bases of interest in the consultation were aspects of overall health, cognition, functionality, behavior and social interaction. To this end, the form used for data collection was supplemented with a questionnaire prepared by the program, regarding the aspects of interest, which was answered by parents/guardians. Data collected on the first visit were described and then tabulated using Graphpad inStat software.

The project was approved by the Ethics Research Committee of the Nursing School of the Universidade Federal da Bahia, under register nº 1.023.774, according to opinion dated April 1, 2015 and was part of a research project on longitudinal study and karyotype/phenotype correlation in genetic syndromes, approved by the Research Ethics Committee, subject to the granting of Free and Informed Consent, in accordance with Resolution 466/12 of the National Health Council[12] and also following the principles of the Helsinki Convention[13] and other international documents.

RESULTS

The summary of data regarding the aging process is presented in Table 1, according to the institutions of origin. Among the patients, the majority (96%) had the most common karyotype, free trisomy 21, except one woman with 15/21 chromosomal translocation, with hereditary transmission in five generations by progenitors with the balanced form of the rearrangement.

The group consisted of 15 men and 13 women, predominantly of low socioeconomic status. Among these, 16 were in the age group between 20 and 30 years, and had developed a generally good social relationship.

There was a loss of skills, especially from the fifth decade of life onwards, in which all individuals of this age group had difficulty and slow motor activities. Functional deficits associated with locomotion, physical inactivity, conduct disorders, memory loss and depression, as well as the loss of autonomy were observed in some of the individuals, starting at 25 years old. Depression symptoms were predominantly manifested by individuals from institution B, while the majority of functional difficulties were found in residents of institution C.

During the study period, five of the individuals died due to cardiorespiratory disorders or due to the aggravation of chronic old age diseases associated with depression, and there was a diagnosis of dementia in two.

Table 1. Down syndrome sample group from three institutions, separated by gender, age, cognitive and functional skills. Data were collected between 2008 and 2017, in the first meeting with each person referred. Salvador, Bahia.

	Institution A n (%)	Institution B n (%)	Institution C n (%)	Total n (%)
Sex				
Female	4 (36.4)	6 (66.7)	3 (37.5)	13 (46.0)
Male	7 (63.6)	3 (33.3)	5 (62.5)	15(53.0)
Age (years)				
20-30	8 (72.7)	5 (55.5)	4 (50.0)	17(60.0)
31-40	1 (9.1)	2 (22.2)	2 (25.0)	5 (18.0)
> 40	2 (18.2)	2 (22.2)	2 (25.0)	6 (21.0)
Cognitive activities				
Mastery of reading and writing	-	2 (22.2)	1 (12.5)	3 (11.0)
Ease of making friends	8 (71.7)	4 (44.4)	4 (50.0)	16 (57.0)
Autonomy in activities of daily living	-	1 (11.1)	-	1 (3.6)
Functional characteristics				
Speech difficulties	4 (36.4)	3 (33.3)	-	7 (25.0)
Difficulties in locomotion	2 (18.2)	2 (22.2)	2 (25.0)	6 (22.0)
Cognitive and chronic diseases	3 (27.3)	-	2 (25.0)	5 (18.0)
Memory loss	-	-	3 (32.5)	3 (11.0)
Often sick	-	-	1 (12.5)	1 (3.6)
Depression Symptoms	-	5 (55.5)	4 (50.0)	9 (32.0)

DISCUSSION

The karyotype results showed a higher prevalence of free trisomy 21 and a low frequency of the unbalanced translocation of this chromosome, in line with literature[14].

The peculiarities related to the increasing number of people with DS who reach adulthood are not limited to biological issues, but also involve other dimensions of development[15], such as emotional and social issues, since such changes in the adult phase of people with DS are commonly associated with neurodegeneration processes[16]. The relationships of friendship predominantly observed in individuals attending educational centers support the view that inclusion in the school environment is an important premise for the construction of identity and social relationships. People with intellectual disabilities are able to maintain lasting bonds and the main places where this type of relationship occurs are educational support centers[17], which highlights the importance of this type of support for development in DS.

The sample group included all adults with DS referred to the program, representing a convenience sample, due to the low demand among adults and elderly people with DS to attend the program, as the majority of care for the syndrome occurs in the early years of childhood. The sample resulted in adults who, at the first meeting, were aged between 20 and 54 years old, similar to previous studies[18]. There were no differences in the severity of manifestations between men and women, however they were more evident at older ages.

The present study supports the fact that there is early deterioration in the aging process in individuals with DS, observing, for example, that three (11%) of the individuals had symptoms of memory loss, and that according to family information, these symptoms started to appear after the age of 25. Head et al.[19] highlight the consequences of chromosome 21 trisomy on the development of AD neuropathology, associated with overexpression of the amyloid precursor protein (APP) gene, precursor of β-amyloid peptide (Aβ) leading to early-onset amyloid plaque

formation, neurofibrillary tangles formation, cerebrovascular pathology, white matter pathology, oxidative damage, neuroinflammation and neuron loss. Nichols[20] highlights the changes associated with AD, such as the phosphorylation and aggregation of the TAU protein, and notes that the action of this protein on the neurodegenerative processes that may affect those with DS is due to the action of the DYRK1A gene involved in hyperphosphorylation, which may lead to neurofibrillary degeneration, making studies of the regulatory enzymes of these processes fundamental for therapeutic purposes.

Each of the institutions that indicated the participants in this study for genetic care had different characteristics. Institutions A and B serve people with disabilities who are assisted by their families and provide educational activities for these individuals and support (lectures, training) for their families. Institution C assists people with disabilities who have been abandoned by their families, and has no program to encourage school education, although the individuals attend special schools. It can be seen, then, that those with DS from each institution have different realities, which are reflected in their relational, emotional and psychological characteristics.

The highest indicators of functional/emotional and psychiatric deficits were observed in institution C, where two (25.0%) individuals had walking difficulties; three (37.5%) memory loss; one (12.5%) often fell ill; two (25.0%) had cognitive or chronic diseases and four (50.0%) had symptoms of depression. These individuals had no contact with their families and some experienced situations of abandonment. According to Viana and Oliveira[21] it is essential to recognize the role of the family as a therapeutic strategy for the development of people with DS. It is also observed that some of the characteristics presented may be related to the subjective conditions of each individual, such as personality and social stimuli. It was also observed that five (56.0%) of the individuals who presented symptoms of depression came from institution B, which provides support to families, highlighting the multifactorial character of the pathology, influenced by several environmental factors.

Nichols[20] preventively proposes therapeutic measures such as the protection of mitochondrial decline from oxidative stress with antioxidants, sleep regulation, dietary monitoring and vitamin supplementation, among others. Fonseca et al.[10], considering the occurrence of AD in this syndrome, emphasize the importance of treatments, pharmacological or not, in reducing cognitive and functional losses, attenuating clinical signs. Health care for adults and elderly people with DS is a matter of priority and should be aimed at maintaining a healthy lifestyle (diet, sleep hygiene and exercise) and developing autonomy for activities of daily living, highlighting measures of self-care, socialization, social and economic inclusion[1].

From the standpoint of advances in genetics in the treatment of DS, hopes arise with the possibility of the therapeutic application of methodologies derived from the use of the genomic editing tool known as (CRISPR-Cas9), a class of RNA-guided endonucleases known as Cas9, which are extracted from the adaptive immune system of CRISPR microorganisms (clustered regularly interspaced short palindromic repeats), which can be easily directed to virtually any genomic location of choice by a short RNA guide[22]. The use of this tool can lead to the silencing of harmful effect genes, such as those associated with early dementia. This methodology has prospects for evolution, but its long-term effects are still poorly understood and many studies are required before its use as a new therapy.

CONCLUSION

The analysis of the aging process of adults and the elderly with Down syndrome, performed in this study, allowed the association of specific manifestations with the increased expression of chromosome 21 genes, resulting from chromosomal trisomy. The authors believe that new information on the evolution of dementia disorder in Down syndrome, as well as the implementation of compensatory responses that may benefit nervous system functioning, may provide opportunities to develop interventions aimed at delaying or suppressing the manifestation of this disorder.

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Effectiveness of a multiple intervention programme for the prevention of falls in older adults persons from a University of the Third Age

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Abstract

Objective: To evaluate the effectiveness of a multiple intervention programme for the prevention of falls in older adults from a University of the Third Age (U3A). *Method*: A quasi-experimental, non-controlled, longitudinal and quantitative study was performed. 69 older adults were allocated into three groups: Control (CG), Physical Exercise (PEG) and Multiple Intervention (MIG). The instruments/tests used were: sociodemographic questionnaire, Geriatric Depression Scale (15-items), Mini-Mental State Examination, Timed-Up and Go (TUG), Sit-to-Stand and Hand-Grip Strength, Falls Efficacy Scale-International and Falls Risk Awareness Questionnaire (FRAQ).The PEG and MIG groups underwent physical training (walking, muscular resistance, and balance) for 16 weeks (2x/week, 60 min/session). In the same period, the MIG also participated in educational sessions (1x/week, 60min/session). Covariance analysis was used for group comparisons. The effect size of the interventions was also calculated. The level of significance was set at $p<0.05$. *Results:* 51 older adults (67±6.2 years and 76.3% women), of whom 15 were in the CG, 20 in the PEG and 16 in the MIG, concluded the study. TUG time in both intervention groups was reduced, but FRAQ score improved in the MIG only. Both interventions had a small effect on TUG time, while multiple intervention had a large effect on FRAQ. *Conclusion:* Multiple intervention brought additional benefits to the older adults from this U3A. In addition to improving balance, the older adults who underwent the multiple intervention increased their knowledge about risk factors for falls.

Keywords: Health of the Elderly. Accident Prevention. Accidental Falls. Exercise Movement Techniques. Physical Fitness. Health Education.

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INTRODUCTION

Falls in the older adults are a major public policy concern, mainly due to the negative outcomes and high health spending associated with their consequences[1,2]. In Brazil, the prevalence of falls among community-dwelling older adults is approximately 25%, and is higher among women and older individuals[3]. Since falls have multifactorial characteristics, i.e., several risk factors may be involved in a single event[1], it is key that preventive programs include different types of intervention[4].

Preventive interventions can be administered alone or in combination. The latter can be designed and offered individually based on the assessment of risk factors for each older adults (multifactorial intervention) or generalized and similar for all participants (multiple intervention)[4]. Scientific evidence suggests that multifactorial intervention and physical exercise (a single intervention) are the most effective in reducing falls, while the latter seems to have the greatest effect in reducing risk[4,5]. It is recommended that interventions involving physical training include balance and muscular endurance exercises, either for the older adults in general or for those at risk of falls[5].

Among the combined interventions, multifactorial interventions also seem to be the most effective in reducing falls, followed by multiple actions that combine physical exercises with educational activities or environmental modifications[6]. Therefore, multifactorial intervention should be the first option in offering this type of service to the older adults[6]. As multifactorial interventions are complex and require the involvement of more professionals[4,7], offering them more to the wider population is often costly and infeasible.

Although multiple interventions are not as effective as multifactorial interventions in preventing falls[6], Goodwin et al.[8] showed that, compared to a control situation, multiple intervention was also able to reduce the number of older adults who fell and the rate of falls, and physical exercise is an important component in achieving such results[4]. Other approaches widely used in multiple interventions include drug optimization, environmental modifications, and educational interventions[7]. In terms of educational interventions, their role in preventing falls is not yet fully established[4]. However, Schepens et al.[9] suggest that they may contribute to improving the knowledge of the older adults about risk factors and, consequently, to the adoption of preventive behaviors.

Given the above, the present study aimed to evaluate the effectiveness of physical training, combined (multiple intervention) or not (isolated intervention) with educational intervention, on the physical-functional performance, self-efficacy and perception of risk factors for falls in older adults participants of an Open University for the Third Age (or U3A).

METHOD

A quasi-experimental, non-controlled longitudinal and quantitative study was carried out at the U3A of the School of Arts, Sciences and Humanities of the Universidade de São Paulo (or EACH | USP). Characterized as a continuing education program for refreshing and acquiring new knowledge, this U3A receives about 300 older adults every six months, who can enroll for free in some of the regular subjects of the University's undergraduate courses, didactic-cultural activities and physical-sports activities. For the present study, we recruited older adults enrolled in the sport-physical activity entitled "Get Balanced" from February 2017 to December 2018.

The sample size calculation was performed using the G*Power software (version 3.1.9.4) using the intragroup comparison method (repeated measures) based on the values of the Timed Up and Go test (TUG) [7.3 (± 1.0) seconds] and Sit-To-Stand test (STS) [14.6 (± 2.0) seconds], previously reported in the literature for older adults participants of the U3A[10]. Considering a type I error of 5% and type II error of 20%, i.e. 80% sample power, 57 individuals (19 per group) would be needed to detect 10% intragroup differences in both tests. In order to reduce the effects of possible losses, a margin of 20% was added to the sample calculation, leading to a final amount of 23 people per group.

Ninety-five older adults men and women enrolled in the U3A volunteered to participate in the study and were selected according to the following inclusion criteria: 60 years of age or older, good health, and medical clearance for performing physical exercises. The study excluded older adults people who presented any health problem that contraindicate the participation in group physical exercises, such as those with diseases and/or limiting chronic conditions (cardiorespiratory diseases, neurological diseases, diagnosed vestibular disorders, musculoskeletal disorders and diagnosed cognitive impairment). The older adults with poor vision, a history of recurrent falls (more than two events in 12 months) and who used walking aids were also excluded from the study. After applying these criteria, 69 older adults were included and allocated by convenience in three experimental groups: Control (CG, n=23), Physical Exercise (PEG, n=25) and Multiple Intervention (MIG, n=21).

The older adults placed in the CG were instructed to maintain their routine activities and not initiate any kind of physical training while participating in the study. At the end of the 16-week follow-up period, the CG older adults were invited to participate in the same physical training program offered to the other groups. The older adults from the PEG underwent a multimodal physical training protocol, consisting of resistance, aerobic endurance/walking and balance exercises, twice a week with 60 minutes each session for 16 weeks. The older adults from the MIG were submitted to the same physical training protocol offered to the PEG (twice a week, 60 minutes/ session for 16 weeks), which was combined with an educational intervention protocol for fall prevention (once a week, 60 minutes/ session for 16 weeks).

The educational intervention was conducted in order to increase the knowledge of the older adults about risk factors and the prevention of falls. Each session was divided into two parts: lecture (30 minutes) and coordinated discussion to share experiences and clarify the doubts of participants (30 minutes). The topics covered in the educational sessions included important information for fall prevention, such as fall definition, risk factors and major preventive interventions. A detailed description of the physical training protocols and educational intervention can be seen in Chart 1.

Chart 1. Description of the characteristics of the multimodal physical training and educational intervention protocols used in the study. São Paulo, 2018.

Characteristics	Protocols	
	Multimodal Physical Training	Educational Intervention
Experimental Group	Physical Exercise (PEG) and Multiple Intervention (MIG)	Multiple Intervention (MIG)
Local	Sports gymnasium (more specifically, sports court, bodily activity room and surroundings).	Meeting room equipped with two rectangular tables and chairs.
Materials	Chairs, anklets (1 to 3 kg), steps, poles, balls of various sizes, mats, cones and balance discs.	Microcomputer and video projector.

to be continued

Continuation of Chart 1

Characteristics	Protocols	
	Multimodal Physical Training	Educational Intervention
Activities and Exercises	(1) aerobic endurance: indoor (outdoor) or outdoor (campus) walking; (2) resistance: lower limb exercises performed in sitting (chair) and/or standing position (plantar flexion and ankle dorsiflexion, knee flexion and extension, hip flexion, hip abduction and squatting /sitting and rising from the chair); (3) balance: exercises involving static and dynamic postures (single-legged support, tandem, cone zigzag, toe-walking, heel-walking, lateral-walking, obstacle-walking and ludic activities*).	Each session was divided into two parts: 1) lecture (30 minutes) and 2) coordinated discussion for sharing experiences and clarifying questions from participants (30 minutes). The themes developed during the intervention included: falls (definition, consequences, risk behaviors and prevention); diseases and changes in health (major diseases that predispose the individual to falls and how to prevent them); extrinsic factors (such as improving the home environment, better footwear and foot care); reducing the risk of falling (most recommended physical exercise); and other factors influencing falls (drug interactions, diet, cognition and fear of falling).
Frequency	Twice per week.	Once a week.
Duration	60 min/session (i.e. 20 min/ session for each multimodal training component).	60 min / session (i.e. 30 min / session for lecture and 30 min / session for discussion).
Volume and Intensity	(1) moderate-intense walking, according to the subjective perception of effort; (2) two to three sets of 10 to 15 repetitions, with a load of 1 to 3 kg (anklet) and rest interval of one minute. Volume and load increments were performed when volunteers rated the intensity of effort as mild; (3) increased difficulty individually, from reductions in upper limb support, reductions in support base, inclusion of unstable surfaces and association with cognitive tasks (verbal fluency, mental calculations and immediate memory).	Not applicable.

*Every 15 days the balance exercises were replaced by ludic activities involving body displacement and other motor and/or cognitive skills (examples: adapted volleyball, dodgeball, adapted tic-tac-toe and body perception/expression activities).

Data were collected by a team of researchers (graduate students and academics) who were previously trained and familiar with the tests and measuring instruments. The data were collected through the completion of a form containing sociodemographic information (age, gender, marital status and education), anthropometric data (weight, height and body mass index (BMI)) and history of falls in the last 12 months. Weight and height were measured with the aid of a mechanical scale and a wall stadiometer, respectively. The ratio between weight (in kilograms, kg) and height squared (in meters, m) was used to calculate BMI (kg/m^2). To better characterize the sample, depressive symptoms and cognitive impairment were assessed respectively using the 15-item Geriatric Depression Scale (GDS) and Mini Mental State Exam (MMSE), using versions adapted and validated for the Brazilian population in previous studies[11-13].

The 15-item GDS is widely used to screen depressive symptoms in the older adults. For the Brazilian population, the 5/6 score (not case/case) showed good sensitivity (81%) and specificity (71%) for the diagnosis of depression, as well as presenting satisfactory reliability for clinical use[11,12].

The MMSE is a cognitive screening instrument that assesses five areas of cognition: orientation; registration; attention and calculation; recall and language. Although the MMSE is widely used in Brazil, there are still differences regarding cutoff scores and some of its psychometric characteristics[14]. The present study used the version suggested by Brucki et al.[13].

The outcome variables were TUG, handgrip strength (HGS), and STS scores, as well as scores in the Falls Efficacy Scale-International (FES-I) and Falls Risk Awareness Questionnaire (FRAQ).

The TUG test was used to assess mobility and balance. This test measures the time taken to get up from a chair with arms, walk three meters forward, turn around, walk back, and sit down in the chair[15]. For older adults Brazilians, times longer than 12.47 seconds (usual speed) indicate a higher risk of falls[16]. The volunteers were allowed to take the course once prior to timing to familiarize them with the test. The older adults were then instructed to move as quickly as possible, provided that their safety was not endangered. The test was performed three times, with the average time spent in all attempts used in the analyzes, provided that the variability between the measurements was less than 10%. Measures with variance greater than 10% were not used in the final mean calculation.

HGS was measured using a hydraulic dynamometer (SH 5001, SAEHAN Corp, Korea) which has two parallel handles which are adjustable according to the dimensions of the hands. This equipment measures the force produced by a maximum isometric contraction, which is recorded in kilograms-force (kgf) or pounds. The maximal HGS of the dominant limb was evaluated in the orthostatic posture, with the elbow flexed at 90º and the other joints (shoulder and wrist) in neutral positions. Three measurements were performed and their mean was used in data analysis[17].

The 5-repetition STS was used to assess lower limb muscle strength[18]. For the test, a standard chair (seat height 43 cm) without arms and a stopwatch were used. The older adults were instructed to get up and sit five times in a chair as quickly as possible without the help of the upper limbs, which remained crossed in front of the body while performing the movement. The test began from the seated posture on the chair with the back resting on the backrest and ended when the volunteer reached this same position after getting up from the chair five times. The time taken for an attempt was used in the analyzes.

The FES-I is a self-efficacy scale that assesses the confidence of the older adults in performing daily activities without falling. Therefore, it has also been used as a measure of fear of falls[19]. The Brazilian version has good psychometric characteristics, with satisfactory internal consistency and reliability, with a score ≥23 points associated with a history of sporadic falls[20].

FRAQ assesses the perception of the older adults regarding the risk of falls[21]. The FRAQ score ranges from 0 to 32 points, with no cutoff established in literature. However, the higher the score, the better the older adults awareness of risk factors and fall prevention. In the FRAQ cross-cultural adaptation study for the Brazilian older adults, Lopes and Trelha[21] also observed excellent reliability and internal consistency for this instrument.

Categorical variables are expressed as absolute (n) and relative (%) frequencies, and the differences between the three groups were evaluated using Pearson's chi-square and Fisher's exact tests..

For the continuous variables, an exploratory data analysis was initially performed, including measures of normality (Shapiro-Wilk test), data distribution (Asymmetry and Kurtosis) and homogeneity of variances (Levene test). Once the normality of the data was verified, the mean, standard deviation and 95% confidence interval of the mean of all the continuous variables were calculated. For variables related to sample characterization (age, weight, height, BMI, GDS and MMSE), the differences between groups were tested using analysis of variance (ANOVA) for independent samples. For the outcome variables (TUG, HGS, STS, FES-I and FRAQ), the effects of group, time and interaction were tested by means of repeated measures covariance (ANCOVA), considering BMI as a covariate in comparisons. In case of significance, the Bonferroni and t-Student post hoc tests were used to detect inter and intragroup differences, respectively.

The effect size of the interventions for outcome variables was also calculated using the Hedges test (g), and their values were classified as: insignificant (<0.19); small (0.20-0.49); medium (0.50-0.79); large (0.80-1.29) and very large (>1.30). For all statistical analyzes, the significance level was set at $p < 0.05$.

The present study complied with Resolution nº 466/2012 of the National Health Council and was approved by the EACH|USP Ethics Committee for Research involving human beings (opinion nº 1.427.294 and CAAE 51671215.6.0000.5390). After being informed about the research procedures and ethical aspects, all participants signed a Free and Informed Consent Form.

RESULTS

Of the 69 older adults included in the study, 51 completed all stages of the research. The final number of participants in the CG, PEG and MIG groups was 15, 20 and 16, respectively. The main reasons related to sample loss included not returning for reevaluation, personal problems, abandonment of activities and non-adherence to the interventions performed, i.e., a frequency below 75%.

The sociodemographic data, anthropometric characteristics, history of falls, GDS and MMSE performance of the three groups are presented in Table 1. The groups did not differ for most of these variables except for weight [$F_{(2.48)} = 6.34$; $p=0.00$] and BMI [$F_{(2.48)} = 6.45$; $p=0.00$]. The MIG group had a higher weight than the PEG ($p=0.00$) and a higher BMI than the other groups (vs. CG, $p=0.04$ and vs. PEG, $p=0.00$). Thus, BMI was used as a covariate in analyzes involving outcome variables. In all groups there was a higher prevalence of young older adults (mean age 67±6.2 years), women and participants with nine or more years of study. Additionally, all groups performed well in the GDS and MMSE, with no statistical differences among them.

The comparisons between groups for the outcome variables are presented in Table 2. Regarding the physical-functional performance tests, interaction between group and time was observed. [$F_{(2.47)}=5.02$; $p=0.01$] for TUG performance. In the intragroup analysis both groups submitted to physical training showed significant reduction in the time of this test (FEG, $p=0.02$ and MIG, $p=0.03$). The HGS showed the effect of time [$F_{(1,47)} = 8.80$; $p=0.00$], but no statistical differences were found in the intragroup comparisons. ($p>0.05$).

The analyzes also showed interaction between group and time [$F_{(2.46)}=8.69$; $p=0.01$] for FRAQ, with an increase in score only for the MIG group ($p=0.00$). However, no effect was observed for STS performance and FES-I score.

Analyzes of the effect size of interventions are presented in Table 3. Both interventions had a small but significant effect on TUG time (FEG, g= -0.25 and MIG, g= -0.38). Although the covariance analysis did not show statistical significance for the STS test, the control situation had a significant and medium effect (g= 0.54) on reducing performance, while the effects of both interventions were insignificant. Multiple intervention had a large effect (g= 1.19) on the FRAQ score. Finally, the effects of interventions on HGS and FES-I were mostly negligible.

Table 1. Sociodemographic characteristics, anthropometric measurements, history of falls, depressive symptoms and cognitive performance of the control (CG), physical exercise (PEG) and multiple intervention (MIG) groups. São Paulo, 2018.

Variables	Control Group (n=15)	Physical Exercise Group (n=20)	Multiple Intervention Group (n=16)	*p*- value
Age (years)				
Mean (standard deviation)	67.1 (±6.28)	67.3 (±5.56)	68.1 (±6.82)	0.88
95% CI	63.7–70.6	64.7–69.9	69.2–71.8	
Sex, n (%)				
Female	10 (66.7)	17 (85.0)	12 (75.0)	0.44
Male	5 (33.3)	3 (15.0)	4 (25.0)	
Marital Status, n (%)				
Married / civil partnership	6 (40.0)	9 (45.0)	7 (43.8)	
Single	6 (40.0)	3 (15.0)	2 (12.5)	0.41
Widowed	2 (13.3)	5 (25.0)	6 (37.5)	
Divorced / Separated	1 (6.7)	3 (15.0)	1 (6.2)	
Schooling (years), n (%)				
1-4	2 (13.3)	3 (15.0)	2 (12.5)	
5-8	3 (20.0)	5 (25.0)	2 (12.5)	0.90
≥9	10 (67.0)	12 (60.0)	12 (75.0)	
Height (m)				
Mean (standard deviation)	1.61 (±0.95)	1.58 (±0.49)	1.61 (±0.86)	0.42
95% CI	1.56–1.67	1.56–1.61	1.56–1.66	
Weight (kg)				
Mean (standard deviation)	71.0 (±10.4)	67.0 (±8.69)*	80.0 (±13.6)	**0.00**
95% CI	65.1–76.7	62.7–70.8	72.4–86.9	
BMI (kg / m2)				
Mean (standard deviation)	27.4 (±3.80)*	26.4 (±2.57)*	30.6 (±4.31)	**0.00**
95% CI	24.3–29.6	25.2–27.6	28.3–32.9	
Fall history, n (%)				
Yes	4 (26.7)	2 (10.0)	5 (31.6)	0.26
No	11 (73.3)	18 (90.0)	11 (78.4)	
GDS (score)				
Mean (standard deviation)	1.93 (±1.59)	1.80 (±2.28)	2.06 (±1.98)	0.98
95% CI	1.01–2.85	0.73–2.87	2.06–3.12	
MMSE (score)				
Mean (standard deviation)	26.4 (±2.56)	25.6 (±2.32)	26.6 (±2.13)	0.35
95% CI	24.9–27.9	25.6–27.7	25.4–27.7	

CI = confidence interval; BMI = body mass index; GDS = geriatric depression scale; MMSE = Mini Mental State Examination; *$p<0.05$ *vs.* MIG.

Table 2. Comparison between control (CG), exercise (FEG), and multiple intervention (MIG) groups for mobility, handgrip strength, lower limb strength, self-efficacy, and perception of risk factors for falls. São Paulo, 2018.

Variables	Control Group (n=15)		Physical Exercise Group (n=20)		Multiple Intervention Group (n=16)		*p*-value		
	Pre	Post	Pre	Post	Pre	Post	G	T	GxT
TUG (sec)									
Mean (sd)	7.57 (±0.82)	7.77 (±1.06)	7.64 (±1.42)	7.26 (±1.02)*	7.72 (±1.07)	7.32 (±0.90)*	0.82	0.10	0.01
CI 95%	7.12–8.03	7.18–8.36	6.98–8.31	6.79–7.75	7.15–8.29	6.84–7.80			
HGS (kgf)									
Mean (sd)	27.1 (±8.04)	26.7 (±9.67)	23.3 (±3.84)	24.9 (±3.97)	24.7 (±7.74)	25.5 (±6.99)	0.48	0.00	0.13
CI 95%	22.7–31.6	21.3–32.1	21.6–25.2	23.1–26.8	20.6–28.9	21.8–29.3			
STS (sec)									
Mean (sd)	11.5 (±2.17)	12.6 (1.43)	12.7 (±4.04)	12.5 (2.18)	12.7 (±2.72)	12.6 (1.92)	0.68	0.29	0.19
CI 95%	10.3–12.7	11.8–13.4	10.8–14.6	11.5–13.5	11.3–14.2	11.6–13.6			
FES-I (score)									
Mean (sd)	22.6 (±3.76)	24.5 (6.19)	24.2 (±6.22)	25.4 (7.53)	24.7 (±6.23)	24.6 (6.51)	0.65	0.32	0.51
CI 95%	20.4–24.7	20.9–28.1	21.3–27.1	21.9–28.9	21.4–28.1	21.1–28.1			
FRAQ (score)									
Mean (sd)	22.7 (±2.87)	24.3 (±2.76)	23.1 (±3.79)	23.2 (±3.27)	20.4 (±4.33)	25.8 (±4.49)*	0.95	0.44	0.01
CI 95%	21.1–24.4	22.7–25.9	21.3–24.9	21.7–24.8	18.1–22.7	23.4–28.2			

G = group effect; T = effect of time; GxT = interaction between group and time effects; sd = standard deviation; CI = confidence interval; TUG = Timed Up and Go; HS = hand grip strength; CS = chair stand; FES-I = Falls Efficacy Scale International; FRAQ = Falls Risk Awareness Questionnaire; *p<0.05 vs. basal situation within the same group.

Table 3. Analysis of the effect size of the interventions (pre vs. post) for the control (CG), exercise (PEG) and multiple intervention (MIG) groups for mobility, handgrip strength, lower limb strength, self-efficacy, and perception about risk factors for falls. São Paulo, 2018.

Variables	Hedges g	Confidence 95%		Student's t	df	*p*- value	CLES	ES Classification
		CI Lower	CI Upper					
TUG (sec)								
CG	0.19	-0.14	0.54	1.27	14	0.22	55.6	Insignificant
PEG	-0.25	-0.70	-0.06	-2.46	19	**0.02**	57.0	Small
MIG	-0.38	-0.76	-0.04	-2.38	15	**0.03**	60.7	Small
HGS (kgf)								
CG	-0.11	-0.87	0.07	-1.81	14	0.09	53.1	Insignificant
PEG	0.19	-2.38	5.58	0.84	19	0.41	55.4	Insignificant
MIG	0.10	-1.00	2.60	0.36	15	0.36	52.8	Insignificant
STS (sec)								
CG	0.54	0.20	2.00	2.61	14	**0.02**	64.9	Medium
PEG	-0.04	-1.37	0.97	-0.36	19	0.73	51.2	Insignificant
MIG	-0.04	-1.01	0.81	-0.23	15	0.82	51.2	Insignificant

to be continued

Continuation of Table 3

Variables	Hedges g	Confidence 95%		Student's t	df	*p*- value	CLES	ES Classification
		CI Lower	CI Upper					
FES-I (score)								
CG	0.33	-0.68	4.48	1.58	14	0.14	59.3	Small
PEG	0.17	-2.56	4.96	0.67	19	0.51	54.8	Insignificant
MIG	-0.02	-2.55	2.35	-0.09	15	0.93	53.8	Insignificant
FRAQ (score)								
CG	0.55	-0.84	4.04	1.41	14	0.18	65.2	Medium
PEG	0.03	-1.07	1.27	0.18	19	0.86	50.9	Insignificant
MIG	1.19	3.27	7.53	5.41	15	**0.00**	80.2	Large

CI= confidence interval; df= degree of freedom; CLES= common language effect size; TUG= *Timed Up and Go*; HS= handgrip strength; CS= chair stand test; FES-I= *Falls Efficacy Scale International*; FRAQ= *Falls Risk Awareness Questionnaire*.

DISCUSSION

Scientific evidence suggests that multimodal physical training has several health benefits for the older adults [22], and is also the most recommended in the prevention of falls as an single intervention[4]. Although the effects of this type of training are well established, its magnitude varies widely between studies. According to the systematic review by Bouaziz et al.[22], the gains from multimodal training in muscle strength and mobility ranged from 1.4 to 95% and 5.3 to 88.9%, respectively. These differences may be related to several factors, including the characteristics of the subjects involved, the tests used and the physical training program itself.

In the present study an improvement of approximately 5% in mobility was observed in both groups undergoing physical training which, although small, was statistically significant. On the other hand, no changes were observed in performance in muscle strength tests after the follow-up period. It is important to remember that the older adults included in this study came from an U3A and, therefore, have some particular characteristics compared to older adults recruited from other types of services and locations. A previous study within the same U3A showed that its participants are relatively young (mean age 67±6.2 years), have a high level of education (eight years or more of study) and are physically active[23], corroborating the characteristics of the older adults in this research. Additionally, older adults participants of U3As tend to present good physical and functional performance[10,23] and therefore, a low risk of falls.

Due to the predictive power for negative outcomes, physical-functional tests have been widely investigated in literature. Regarding the risk of future falls, a meta-analysis study suggested cutoff values for different tests/scales[24], with older adults with TUG and STS times longer than 11 and 12 seconds, respectively, considered at risk. In the same study, FES-I scores greater than 24 were also indicative of a risk of future falls. For Brazilian community-dwelling older adults, Alexandre et al.[16] showed that TUG values greater than 12.47 seconds are predictive of falls, with a sensitivity of 73.7% and a specificity of 65.8%. In the present study, all the groups had lower TUG values than those suggested for the risk of falls, regardless of whether international [24] or Brazilian[16] reference values are applied. If compared with the study by Lusardi et al.[24], STS and FES-I values were borderline for risk of falls in all groups and therefore should not be disregarded.

The importance of maintaining good physical performance in old age has been demonstrated by several studies[25-28]. Den Ouden et al.[25], in a 10-year prospective study, observed that muscle strength, associated with number of chronic diseases, age, sex (female) and socioeconomic status, was a determining factor for dependence on daily living activities in community-dwelling older adults. Similarly, Dodds et al.[26] evaluated the influence of different factors in determining future disability in middle-aged

individuals. The variables that best fit the model were sex (female), the presence of knee osteoarthritis, use of two or more medications, being a smoker, having a high BMI and poor performance in the HGS, STS and balance tests.

The present study also revealed that early physical-functional performance tests, i.e., in middle age, increased the discriminative power of at-risk subjects in 16 years of follow-up[16]. These findings underscore the importance of encouraging older people to participate in multimodal physical training programs, regardless of their physical condition. Above average physical performance can act as a "physical reserve," allowing older people to respond adequately to stressful events[27].

The benefits of physical training alone in psychological variables, such as fear of falls, for example, are controversial. According to Whipple et al.[28], multiple interventions are most effective in reducing the fear of falls, especially when involving multimodal physical training and cognitive behavioral intervention. Freiberger et al.[29] conducted a randomized clinical trial to evaluate the effect of three different interventions on older adults with a history of falls and fear of falls. All interventions consisted of exercises of muscular resistance and balance, and were differentiated with a third component: a) strength and balance: intensity of the exercises progressively increased, b) fitness: addition of aerobic endurance and c) multiple intervention: addition of education on risk factors for falls and cognitive behavioral training. The authors observed improved lower limb mobility and strength (except for the multiple intervention group) after six months of follow-up. However, no change was observed for measures related to knowledge of risk factors and fear of falls. In contrast, Siegrist et al.[30] found positive effects on balance and fear of falling in older adults in primary care after 16 weeks of multiple intervention (physical exercise combined with educational activities). As in the study by Freiberger et al.[29], there was no improvement in fear of falls (FES-I) in the present work. On the other hand, the multiple intervention group showed greater knowledge about the risk factors of falls than the other groups after the intervention, contrary to the results of these authors[29].

As well as other risk factors for falls recognized in literature, Moreira et al.[31] showed that poor knowledge about risk factors (assessed by the FRAQ) was also associated with the history of falls in community-dwelling older adults. The authors observed that physical-functional performance and perception of risk factors were different between older adults with and without history of falls, regardless of age. Older adults with greater knowledge about risk factors and no history of falls also had better physical-functional and cognitive performance. According to Chehuen Neto et al.[32], the older adults generally has little knowledge about falls, and does not recognize themselves as a vulnerable group. In this study, an inverse association was also observed between the perception of risk and the presence of household risk factors, suggesting lower exposure to risk of older adults with greater knowledge about falls.

In a systematic review, Campbell and Robertson[33] observed that for older adults in the community, isolated interventions are as effective as combined interventions. Factors contributing to the lack of additional effects of combined interventions include the poor adherence of the older adults, difficulties in implementing programs for the general population, and lack of recognition of the importance of programs for the older adults. According to Hill et al.[34], the older adults do not believe that such an approach can reduce falls and therefore strategies aimed at raising awareness that falls can be preventable rather than unpredictable, thus contradicting the idea that nothing can be done in terms of falls, may be a facilitating measure for adherence to prevention programs and, consequently, for the prevention of future events. In this sense, Schepens et al.[9] found positive effects of educational methods for the prevention of falls, and improved knowledge of the older adults regarding risk and preventive behavior. The present study partly agrees with these authors[9], since the multiple intervention group, which participated in the educational activities, had increased knowledge about risk factors. However, the impact of these activities on preventive behavior has not been evaluated.

Finally, the present study has some limitations that should be pointed out. Initially, the study was designed as a randomized clinical trial, also

involving a group submitted only to an educational intervention. However, the older adults allocated in this group had low adherence to the proposed activities, making it clear to the researchers that the greatest interest of the older adults was to participate in physical training groups.

Another important limitation concerns the study sample. Older adults participants in U3As are very active and, therefore, perform well in physical and functional tests. In combination with poorly sensitive testing for younger, highly-performing older adults, the results of the interventions may have been underestimated. According to Bergquist et al.[35], most physical-functional tests have a ceiling effect on younger, more active older people, making early identification of declines difficult. The Community Balance and Mobility scale seems to be a more sensitive option for this group, although it has not yet been validated for the Brazilian population. Finally, due to the involvement in different activities within the U3A, the influence of other activities on the variables studied can also not be excluded, thus characterizing a significant study bias.

CONCLUSION

The multiple intervention, involving physical exercises and educational activities, brought additional benefits to the older adults participants of the Open University for the Third Age studied. In addition to improved balance, older adults in the multiple intervention group showed greater knowledge about risk factors for falls after the follow-up period, which may be helpful in implementing strategies for reducing risk behaviors in daily life.

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Perceptions of the elderly on aging and violence in intrafamily relationships

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Abstract

Objective: To identify the different perceptions of the aging process and violence in intrafamilial relations of elderly participants of a social and coexistence group. *Method*: An exploratory and descriptive qualitative study was performed through the application of a sociodemographic questionnaire and a semi-structured interview, with seven elderly people participating in the Coexistence and Strengthening of Bonds social group. The results of the discourses were assessed through thematic content analysis. *Results*: The extraction into thematic units allowed the elaboration of two intertwined categories: *self-perception of the process of intrafamily aging* and *violence in the eyes of the elderly*. *Conclusion*: The elderly reported that the family is responsible for providing care, appreciation and understanding, and that the aging process brings new possibilities for coexistence, but it is also accompanied by weaknesses and limitations. They also indicated subtle practices of psychological, financial, and abandonment violence, making them impotent, ashamed, and fearful to adopt effective initiatives to restore cordial, ethical, and harmonious family relationships.

Keywords: Aging. Violence. Family. Health of the Elderly.

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INTRODUCTION

The growing process of population aging in various parts of the world is a demographic phenomenon that has repercussions for various dimensions of the social and individual sphere. Aging is a dynamic process, permeated by biological, physical, psychological, environmental, cultural and social modifications[1]. In addition, "these multiple factors associated with the aging process interact and regulate both typical and atypical functioning of the aging individual"[2].

The concept of aging is dynamic. For Mucida[3], "social discourse minimizes its complexity from denominations associated with the years lived by the person, social security contributions, years worked, the third age, among others". The author refers to the different ways of aging and the various perceptions of the process experienced by the individual, such as changes in image, in the body and in social ties that impact considerably on feelings.

The aging process of the population presents changes in the configuration of the elderly and their relationship with other people, both in the family and social environments. In this context, factors such as identity crisis, role changes and the impact of retirement stand out, in addition to the various losses experienced and a reduced social life. Health problems, coping in the sphere of public policy, the training of professionals to care for older people, among other aspects, are becoming more frequent[2].

In this context, an important debate to be addressed concerns the various forms of violence against the elderly, the most common of which are physical; psychological; sexual; financial and economic; neglect and abandonment[4,5]. Among those mentioned, intrafamily violence is gradually getting worse, with repercussions for people's lives[1]. The elderly can become victims of violence when they are dependent on their families in a range of aspects. Up to four generations are known to reside in the same household. Thus, facing the different demands associated with the presence of elderly people in the same family is a challenge, as there is practically no succession planning and little knowledge about the aging process in rural areas[6].

Regardless of what is advocated by legislation[7], it is within the family that affective bonds are established, and which is one of the main sources of protection and care for the elderly. The quality of the relationship between the elderly and their families depends on several factors, as Lafin[8] points out: gender, housing, personal history and physical and mental health. It is understood that the more serious the problems, such as rejection and violence, the more difficult are the relationships and the ability to deal with weaknesses on the part of the elderly and their families[9].

Violence against the elderly presents itself as a social, economic, cultural, health and family problem. For Rocha et al.,[10] the neglect involved in the various forms of violence against the elderly is invisible and silent, in the physical, mental, financial and self-neglect spheres, treating them as if they were "disposable". Therefore, the first reactions of elderly victims of domestic violence are fear, shame and guilt, as they realize the failure of family relationships. Saidel and Campos[11] state that the victims seek to omit and even accept practices of violence as natural, "as if the elderly were to blame for the situation in which they find themselves".

For Minayo[12], violence in Brazil has historically been structured into nuclei: structural (inequality, poverty, deprivation, discrimination), institutional (inefficient public policies and rational/legal domination) and interpersonal (forms of communication and everyday relations of indifference). Consequently, many elderly persons are victims of these forms of violence, especially interpersonal violence, which erodes and produces suffering in the process of living and aging in intrafamily living. According to Beauvoir[13], there is silent, subtle, hidden and stereotyped violence towards old age, considered normal by contemporary society.

The present study aimed to identify the different perceptions of the aging process and violence in the intrafamily relationships of elderly participants of an activity and social group.

METHOD

An exploratory and descriptive, qualitative research study was conducted in August 2016, in the interior of the state of Rio Grande do Sul, Brazil. According to data from the Brazilian Institute of Geography and Statistics (IBGE), this municipal district had a population of 2,196 people. Of this total, 364 were 60 years of age or older, making up 16.5% of the population[14].

The study was conducted in a Coexistence and Strengthening of Bonds social group, linked to the Social Assistance Reference Center (or CRAS). This group consisted of 80 participants, who met once a month for study, debate and leisure. To achieve the objective of the study, seven people were selected, who had signs of recurrent intrafamilial violence and who had already been visited and monitored by the social services, with improvements in the family relationship.

A sociodemographic questionnaire (age, gender, income, marital status, home, retired and if lives with family) and semi-structured interview were used for data collection. The guiding questions for the interviews were: *How did you imagine your life at this stage? What is violence for you? How would you describe your relationship with your family? How would you describe your day to day life with your family?*

The inclusion criteria were: having previous knowledge of the work and care performed by the CRAS technical team and having suffered some kind of violence by family members in the last two years.

The interviews were conducted in a location defined by the participants, who mostly opted for their homes, had an average duration of 70 minutes, and were audio recorded and then transcribed. The information was synthesized by Bardin's content analysis[15], by means of a skim reading, rereading, identification of repetitive positions, constants and the like; and then corroborated with the literature on the subject, mainly the Manual to Confront Violence Against the Elderly[12].

Finally, the discourses were grouped into categories by units of meeting. The elderly were named with the letter P for participant, followed by sequential numbering: P1 to P7.

The study was approved by the Ethics Research Committee of the Universidade de Passo Fundo, Rio Grande do Sul, under opinion nº 1.661.297. All participants signed a Free and Informed Consent Form (FICF).

RESULTS AND DISCUSSION

The ages of the participants ranged from 64 to 77 years, six were married with children, retired and resided in their own home or with family. Four lived in the rural area and three in the urban area of the municipal district. The average monthly income of respondents was one minimum wage. Based on the results of the interviews and following content analysis, two categories emerged: *Self-perception of the intrafamily aging process* and *Violence in the eyes of the elderly.*

Self-perception of the intrafamily aging process

The aging process occurs in various ways, with each individual perceiving their aging in a particular and individual way. According to Mucida[3], there is no old age per se, but different ways "in which it presents itself." For elderly people living in a small town in the interior of Rio Grande do Sul, Brazil, of rural origin and characteristics, such perceptions are even more distinct. Culture, identity, education, family relationships and religiosity affect the way of being and seeing in the world.

The participants confirmed these different ways of seeing the world. P1 expressed himself in a positive manner, reporting that he had always seen himself as a doting grandfather. He revealed that he had not been as affectionate with his own children as he has with his grandchildren. This statement may be an indication that the elderly seek to compensate for the probable lack of love felt by their own children, as "it is really nice to be a grandfather and have them [grandchildren] around" (P1).

The role of the family is fundamental at any stage of life and becomes relevant during two distinct

periods: in childhood and adolescence and in old age. When analyzing the family institution, it appears to present constant structural transformations, such as the reorganization of the responsibilities of primary providers based on care needs, in the case of the elderly[4-6,13,16].

The aging process and advanced age emerged in the discourse of the participants, with P2, P3, P4 and P5 demonstrating that time, age, autonomy and independence are intrinsically connected to the historical and cultural context, revealing contradictory feelings, such as fear of loneliness, insecurity, dependence and the projection of aging with more dignity and happiness. Regarding this issue, one of the participants said:

> "I couldn't wait to reach old age, so I would have fun, I would go out, I would be happier. [But] I'm always alone. I have my husband, but he works a lot, away from home". (P4)

The study developed by Menezes et al.[17], with 20 participants over 60 years of age, found that "the elderly are increasingly active and participative in today's society", making them, despite the difficulties of life, happier "at this stage of life." For Minayo[12], character and lifestyle help the elderly to overcome existential contingencies and have self-esteem, confidence and self-care. This helps promote dignity in old age by sharing the belief in building a better society for all with adults and young people.

The participants also revealed that the aging process was rewarding, with participation in social groups. This space of social insertion and sociability was an alternative to escaping loneliness, the absence of children (P5, P7) and overcoming obstacles with partners, as attested in two statements:

> "I always imagined that I was going to take part in the seniors group, and I couldn't wait to turn 55 so I could go, talk, have fun". (P6)

> "I have no sons or grandsons living with me. My husband drank a lot. I was suffering, I had very serious depression, for no reason. It was because I was alone". (P4)

Most of the older people who participate in social groups are women. Even before the age of 60, many are determined and intent on joining a group because they are welcomed, listened to and gain a new space to develop self-care. These reciprocal exchanges contributed to the intertwining of thoughts and new life projects, accompanied by listening, respect, dignity, new learning and the synthesizing of new meanings for their existence. Thus, they break with the patterns of domination to which they were probably submitted in life, an attitude capable of generating autonomy, independence and strengthening[9]. The group also represents a motivational space for facing daily difficulties, exchanging experiences and seeking understanding of oneself and others[1,2,5].

It is important to present the results of the study by the anthropologist Leo Simmons, cited by Minayo[12], regarding the life expectancy of elderly people from 71 indigenous societies, summarized in the following statements: Live as long as possible, concluding life with dignity and without suffering, in need of care due to the progressive decrease of your capabilities, as well as being able to participate in community decisions and having access to "social achievements and prerogatives such as properties, authority and respect".

Violence in the eyes of the elderly

The participants reported their perceptions and understandings of violence, according to their experiences. Among the forms of violence that emerged explicitly and implicitly are psychological and financial.

P1 and P2 reported that they had two daughters and that the family experience generated suffering, causing psychological violence. Even trying to minimize such hostile relationships, they revealed helplessness due to enmity among their daughters, absence, separation, and little money from one of them:

> "One thing has upset me already, but I never took it seriously. My daughters never answered me, they always respected me a lot. [...]. I miss her. My

> daughter was widowed and had no money because her late husband spent it on parties, drink, and a car. And now she has nothing. She has only the house and her husband never paid INSS. She has no pension and she doesn't get along with her sister. [...]. We can't always call because everything is so expensive" (P1).

> "We live in the basement of one of the daughters and I would be so happy if they were both close, living harmoniously, [but I'm] living and fighting to have my daughters here" (P2).

Violence against the elderly presents itself as a social, economic, cultural, health and family problem. For Minayo[12] there are three major prejudices that generate violence against the elderly: disease, decay and the understanding of their condition as a problem. "In fact these three negative myths are intertwined and potentiate violence." For Beauvoir[13], considering the elderly person as inactive and passive, especially deprived of liberty, is a form of violence.

There are several forms of aggression against the elderly, the most frequent of which are physical, financial, psychological, sexual, neglect and abandonment, especially psychological aggression, as it causes insecurity and fear for the elderly[13,15,16]. Saidel and Campos[11] describe long-term psychic suffering "as like a chronic condition," followed by exhaustion, tiredness, and intolerance. An existence marked by such conflicts on a daily basis involves the living and aging of the elderly person as a whole, as a body, community and environment, and in the biological, social, psychic and spiritual dimensions, with all their multidimensionalities[1,2,9,12]. Thus, P4 conceives violence in an extreme manner. He claims he was never a victim, but mentions and positions himself in relation to money as follows:

> "I don't like violence, nor even talking about it, I can't sleep when I think about it. Violence for me is killing, stealing, beating. She says her husband respects her, and even when he got drunk he never said anything. [But] in terms of my money, sometimes they ask me for it (the children), and I give it to them, but because I want to, they never made me give them money" (P4).

From the same perspective, participant P5 stated that she had never suffered violence. She had six children, one of whom was deceased. She says she has lived with one son and her daughter-in-law for five years (then she paused). However, she revealed that in the early days, when the couple had a small baby, the daughter-in-law would not let her pick her up. Only when her son came home from work did he "take the baby and put her on my lap; she wouldn't give it to me but now she's got better, but when she makes mate tea she won't offer me one if her husband isn't around" (P5).

This same interviewee also said that her daughter-in-law did not allow her to prepare meals and "she would not let me do anything". But now, recently, she lets her cook and do her own laundry, apart from the "bedclothes, that's right, they're the ones who wash me". This change in her daughter-in-law's behavior occurred after the "CRAS social worker held a meeting with them". The elderly woman believed that the improvement was due to the "social worker talking to them and telling them how it is". The social worker helped establish an understanding of what seemed to be exploitative. According to the elderly women, the money she offered, she gave "to them with pleasure [..]. I gave R$500 to buy food, of the rest I spend a lot on doctors and medicine. She (daughter-in-law) never judged me for not doing things, she gets everything ready in the sink and I cook. But she has changed a lot" (P5).

Tavares et al.[18] describes how many of these relationships are not established in a peaceful and harmonious manner, "such as in the case of retired elderly persons who are exploited and subjected to violence or are abandoned by their families." In this sense, among the main results in the study, it was found that: a) 80% of the elderly were responsible for at least half of their family's income; b) family dependence is related to problems such as unemployment, low pay, unplanned pregnancy, divorce and other events; c) due to their pensions, they assume new roles in the family; d) contributing to the material maintenance of their families is considered an obligation for the elderly, as a show of gratitude for the care received.

Based on the reports of the participants, there is a perception of the role reversal of the elderly in relation to their children. Instead of being cared for, it is the elderly who continue to care for their children and grandchildren. Therefore, the bonds of affection, love and care fall short of the expectations of the elderly parents. For Mucida[3], when the health of the elderly person requires care, there is an inversion of the caregiver and the care recipient. One of the causes of this lies in the absence of cordial relationships and indifference between parents and children during life and the "tendency for children to be absent when the elderly depend on them". In this sense, according to Minayo[12], in intrafamily living there are many prejudices, manifested in expressions such as: "they are a burden"; "they are unproductive"; "they are sick"; "they spend a lot"; "the resources for their retirement would be better spent if they went to young people".

For P6, violence is an evil. He initially stated that he did not give his son money but paid his bills. He describes how "then I had to sell a small piece of land to pay one of my son's bills at the bank, [...] if he didn't pay, he could have lost everything". The old man paid the debt and the son did not return the money. But "today, he doesn't ask for money, I give him a little money to pay for the water and the electricity, since he lives with me. At home I help do the laundry, make lunch and take care my grandson".

For Santos-Orlandi et al.[16], in Brazil and other countries, it has become common for the elderly to take care of their grandchildren, due to their children's financial difficulties. However, this seemingly charitable practice is accompanied by depressive signs; isolation; physical and mental suffering; cognitive changes; arterial hypertension; weight loss; physical inactivity; fatigue; low grip strength; slow gait, "negatively impacting the caregiver's quality of life". Moreover, there is a fear among children that grandparents will interfere too much in the education of their grandchildren. However, this financial dependence is increasingly frequent and recurrent. In the same study, "most of the older caregivers were female" and belonged to the 60 to 69 years old age group".

Another aspect of violence emerged in the discourse of P7. She revealed that her husband is an alcoholic and sought help from social services. She tried to persuade her husband to seek support from an alcoholic support group, but he didn't accept it, because "I don't want him to die. He is a family man, we did everything, [...] he had lost his head. But in my prayers, [...] I got everything I wanted, and he became a family man again overnight." With professional help, her husband stopped drinking and she says that if "he had gone to the alcoholics, he would have hated me and his children." The interviewee is also responsible for paying for the monthly shopping to support the family and her husband pays for water and electricity, and the money left over from them both is deposited in the bank. She has five children, but only one, the youngest, lives with his parents. As he was getting married, they were transferring the property to him because "he will take care of us. They are building a house near us".

In the situations reported, it is clear that the elderly feel insecure and afraid of abandonment or violence. For Saidel and Campos[11], "guilt and anguish and even stress, aggression and sadness" are recurrent situations of violence in the lives of elderly family members. And the financial situation of families, as well as the transfer of land from parent to child, often does not occur in a fair, ethical and friendly manner. Sharing "the same roof as your father" and taking over "the role after [...] the physical strength of the parents is exhausted, [as] they concede the care of the establishment to their children", requires adaptation and resilience and can be frustrating, "creating conflicts that are difficult to resolve"[6].

The study by Honnef et al.[19], with 16 rural elderly persons from two municipal districts in Rio Grande do Sul, through interviews, showed that domestic violence is a complex social representation, with unequal relationships between men and women, affected by the "sexual division of labor, physical and psychological violence against women as a means of maintaining male dominance over them". Moreover, it is evident that many elderly persons feel abandoned and their financial resources are used by their children.

The aging process transforms daily life, family ties and the future of the elderly. In new family configurations, subtle forms of indifference and disrespect may occur implicitly. This is the case of P1 and P2, who lived in a house and did not intend to leave. The youngest daughter proposed to "take responsibility for" her parents but put them out of their home. P1 revealed that now children generally,

> "Don't pay much attention to their parents, because we don't speak nicely, we are simple and all this generates violence. I treat it all as a joke, I don't care anymore, it goes in one ear and out the other. If I keep everything, I'll end up suffering much more".

The study by Guedes et al.[20] showed that the relationship between gender, age and social conditions are determining factors in the experience of physical and psychological violence with the elderly, mainly practiced by family members. Thus, according to Minayo[12], one of the causes of the highest incidence of violence against the elderly is that 90% of them live in the family environment.

It is noteworthy that intrafamily violence involving the elderly is a recurrent, hidden and silent problem[9,21,22]. Therefore, further studies and an expansion of the sample of rural elderly persons are required to understand the issue systematically and propose alternatives to overcome the problem in a family, social and institutional context.

CONCLUSION

The results of the study show that the elderly conceived the process of aging in intrafamily living as positive and rewarding, with the possibility of playing with their grandchildren and participating in social groups, as a form of social insertion and sociability to overcome the loneliness of the absence of their children. They also mentioned that time, age, autonomy and independence are intrinsically connected to the historical and cultural context and may, on the one hand, reveal contradictory feelings, such as fear of loneliness, insecurity, fragility and dependence and, on the other, the projection of aging with more dignity and happiness. Regarding family experiences, they reported that the family is responsible for caring for, valuing and understanding the elderly and also indicated subtle and implicit practices of psychological, financial and abandonment, often feeling powerless and ashamed to take effective initiatives aimed at restoring cordial, ethical and harmonious family relationships.

The study also permitted an insight into the problem of domestic violence from the perspective of the elderly, who are often victims of aggression. One of the ways that the elderly find to open up, unburden themselves and find possible alternatives to the suffering they experience is in social and welcome groups.

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Depressive symptoms in older adults in basic health care

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Abstract

Objective: To identify depressive symptoms in older adults treated in primary care. *Method:* A descriptive-exploratory cross-sectional quantitative study was conducted with 260 older adults registered with Family Health Units in João Pessoa, Paraíba, Brazil. A sociodemographic instrument and the Geriatric Abridged Depression Scale (GDS-15) were applied. Descriptive analysis summarized the variables through percentages and number of participants. *Results:* There was a prevalence of older adults aged 60-70 years (n=154; 59.2%), who were female (n=186; 71.5%) and had a low educational level (n=89; 34.2%). The GDS-15 revealed that 195 (75.0%) of the older adults had no depressive symptoms. It was observed that 219 (84.2%) older adults were satisfied with their lives, 198 (76.1%) felt happy most of the time, 194 (74.6%) were in a good mood most of the time, 236 (90.8%) reported feeling hope in their lives and 248 (95.4%) mentioned feeling that it was wonderful to be alive. In addition, 135 (51.9%) older adults preferred to go out rather than stay at home, 180 (69.2%) felt full of energy, and 226 (86.9%) considered themselves useful people, although 112 older adults (43.0%) had interrupted many of their activities and 141 (54.2%) feared that something bad would happen. *Conclusion:* Primary Health Care is responsible for the screening of depressive symptoms in older adults to implement actions to protect and promote the health of this population. It is a guiding strategy of the care process, aimed at stimulating active aging and autonomy, as well as the prevention of health problems. This study contributes to reflections on the importance of public policies and good practices in the care of older adults.

Keywords: Geriatric Psychiatry. Public Health. Primary Health Care. Mental Health. Depression.

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INTRODUCTION

Depression is highly significant contemporary social problem, and an issue that must be discussed and reflected upon from different conceptual perspectives in order to obtain a broader knowledge and understanding that can guide decision making in clinical practice.

Depression is conceptualized by the World Health Organization[1] as a common mental disorder characterized by sadness, loss of motivation, lack of pleasure and oscillations between feelings of guilt and low self-esteem. In addition to sleep or appetite disorders, it causes social and psychological harm, affecting autonomy, freedom and lifestyle, and is related to the aggravation of chronic diseases and impairments to the physical and mental performance and social life of the individual[2]. Behavioral changes may be the first sign of a possible diagnosis of affective disorders[3].

The aging process is a set of several interrelated physiological, morphological, biochemical and emotional changes, which are progressive and gradual and marked by motor and sensory losses, and which make individuals more vulnerable and susceptible to diseases, causing damage to their functionality[4]. Decline in physical health is considered the main risk factor for depression, and is related to disability and greater dependence[5].

Depression is one of the most prevalent chronic diseases in old age, and is related to increased morbidity and mortality, deficits in self-care and low adherence to treatments. It becomes a public health problem due to its individual, family and social repercussions, which include, in addition to financial costs, the use of health services and the decrease in quality of life[6]. However, older adults can perceive themselves as healthy and socially active when they can fulfill their expectations and plans through daily activities, building positive attitudes and images about old age[7].

Based on the above, it appears that aging is a natural process of the life cycle, which is both complex and multifaceted. At the same time it is considered to be a period of loss, and a moment of discovery, opportunity and change towards an active and healthy aging. However, respect and care should be encouraged, according to the demands and needs of older adults. The present study therefore aimed to identify depressive symptoms in older adults being treated in primary care.

METHOD

An observational, descriptive-exploratory, cross-sectional study with a quantitative approach was carried out, following the guidelines proposed by the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) document. It was implemented in Family Health Units (FHU) attached to Health District II in the city of João Pessoa, Paraíba, Brazil, from August to December 2017.

Sample size calculation was performed using the R software package, with a 5% margin of error, a 95% reliability that the margin was not exceeded and an expected prevalence of 50%, in order to obtain a value that maximized the sample size, based on a registered population in these units of 394 older adults. The final sample comprised 260 such adults.

The inclusion criteria were: older adults registered in the health units surveyed, regardless of gender. The exclusion criteria were any physical or mental conditions that made it difficult to understand the research instruments, a situation subjectively assessed by the research team throughout the interview.

The sample was selected at random and for convenience, with the selection of the older adults based on the medical records of the families registered in the health units, and subsequent recruitment through prior contact with the community health agents who organized the home visits for the carrying out of the research.

Data collection was preceded by the training of the research team through study meetings and discussions on the theme and instruments, as well as the simulation of the application of instruments among the participants. However, supervision by the advisor professor was required during the first two data collections.

A sociodemographic questionnaire, developed by the research team, was used to characterize the profile of the participants, as well as the Abbreviated Geriatric Depression Scale (GDS-15). These instruments were applied among the participants by three research students, with an approximate duration of 40 minutes. A friendly and conducive space for reception and conversation and was provided, and the sessions were carried out when all the patients were receiving treatment. Most of the older adults were accompanied by a family member or caregiver during the survey, and these individuals were told that they could not interfere with the interview.

The Abbreviated Geriatric Depression Scale (GDS-15), validated in Brazil, was used in the study. This tool investigates the presence of depressive symptoms and the worsening of symptoms in older adults, and consists of 15 questions with binary answers (yes or no). The scores produced range from 0 to 5, classifying the older adults as "no depressive symptoms", and 6 points and above, meaning "some depressive symptoms", with 5 considered the cutoff point[8].

The sociodemographic data were tabulated and analyzed using the Statistical Package for Social Science (SPSS), version 21.0, using descriptive statistics tools.

The study complied with the ethical principles of Resolution nº 466/2012 of the National Health Council[9], and was approved by the Ethics Committee for Research Involving Human Beings under opinion nº 2.190.153.

RESULTS

Most of the older adults were aged between 60 and 70 years old (n=154; 59.2%), female (n=186; 71.5%) and had low education levels (n=89; 34.2%) (Table 1).

The results from the analysis based on the Geriatric Depression Scale (GDS-15) showed that 195 (75.0%) older adults were classified as having "no depressive symptoms" (Table 2). However, 25 (9.6%) older adults with 5 points in the GDS-15 were identified, a score considered to be the cut-off point for this scale. This is of clinical significance as these individuals can be considered to be borderline between the absence and presence of depressive symptoms.

The analysis of the GDS-15 variables shows that 219 (84.2%) older adults said they were satisfied with their life, 193 (74.2%) did not find their life empty, 170 (65.4%) did not frequently get bored and 194 (74.6%) were in good spirits most of the time. However, 141 (54.2%) older people feared that something bad would happen to them (Table 3).

Table 1. Sociodemographic characteristics of the older adults (N=260). João Pessoa, Paraíba, 2017.

Variables	n (%)
Sex	
Male	74 (28.5)
Female	186 (71.5)
Age (years)	
60 to 70	154 (59.2)
71 to 80	75 (28.8)
81 to 90	26 (10.0)
91 or more	5 (2.0)
Schooling (years of study)	
No schooling	21 (8.1)
1 to 5	89 (34.2)
6 to 10	59 (22.7)
≥11	67 (25.8)
Did not respond	24 (9.2)

Table 2. Depressive symptoms identified based on the Abbreviated Geriatric Depression Scale (GDS-15) (N=260). João Pessoa, Paraíba, 2017.

GDS-15 Points	n (%)
0 to 5: no depressive symptoms	195 (75.0)
≥ 6 or more: depressive symptoms	65 (25.0)
Total	260 (100.0)

Table 3. Distribution of responses of older adults to the Abbreviated Geriatric Depression Scale (GDS-15) (N=260). João Pessoa, Paraiba, 2017.

Variable	Yes n (%)	No n (%)
1.Are you satisfied with your life?	219 (84.2)	41 (15.8)
2.Have you dropped many of your activities?	112 (43.1)	148 (56.9)
3.Do you feel that your life is empty?	67 (25.8)	193 (74.2)
4.Do you often get bored?	90 (34.6)	170 (65.4)
5.Are you in good spirits most of the time?	194 (74.6)	66 (25.4)
6.Are you afraid that something bad is going to happen to you?	141 (54.2)	119 (45.8)
7.Do you feel happy most of the time?	198 (76.1)	62 (23.8)
8.Do you often feel helpless?	39 (15.0)	221 (85.0)
9.Do you prefer to stay at home, rather than going out?	125 (48.1)	135 (51.9)
10.Do you feel you have more problems with memory than most people?	52 (20.0)	208 (80.0)
11.Do you feel it is wonderful to be alive?	248 (95.4)	12 (4.6)
12.Do you feel worthless?	34 (13.1)	226 (86.9)
13.Do you feel full of energy?	180 (69.2)	80 (30.8)
14.Do you feel that your situation is hopeless?	24 (9.2)	236 (90.8)
15. Do you think that most people are better off than you are?	67 (25.8)	193 (74.2)

It was observed that 198 (76.1%) older adults were happy most of the time, 39 (15.0%) felt helpless and 248 (95.4%) said they thought it was wonderful to be alive. In addition, 135 (51.9%) older adults preferred to stay at home, 180 (69.2%) felt energetic and 226 (86.9%) considered themselves useful, but 112 (43.0) %) such adults had dropped many of their activities.

DISCUSSION

The sociodemographic characteristics identified in this study corroborate the findings of another study[10]. The results showed a higher prevalence of older women, a phenomenon known as the feminization of old age, which occurs due to the longer life expectancy of women, related to lower exposure to risk and greater health care and services in Basic Health Units (BHU)[11].

Studies indicate that low levels of education are related to the occurrence of depressive symptoms in older adults, promoting reflections on the relationship between schooling and the ability to cope with depressive symptoms[12,13], guiding care actions aimed at the empowerment of these adults and co-responsibility for their health care.

Similarly, a study showed a difference in depressive symptoms depending on sex, with a higher prevalence of depressive symptoms in women[14]. Understanding the gender-related peculiarities of older adults may support specific care actions for this population.

The present study showed that the older adults were both satisfied with their lives and happy, illustrating that happiness is an important indicator of well-being, which may be a protective factor against depressive symptoms. However, a study conducted in Portugal with 119 older adults, 65.5% of whom were women and 34.5% of whom were men, with an average age of 78 years, identified another reality, composed of older people who were dissatisfied with their lives and described themselves as sad and anxious, aspects that were related to harm to their interpersonal, family and social relationships, quality of life and impairments of physical, mental and functional capacity[3].

Feeling energetic can contribute to the acquisition of healthy habits, such as regular exercise, which promotes beneficial effects such as stress relief, due to the increased production of endorphins that act on nerve connections to control the internal environment and responses to the environment, increasing the ability to cope with environmental stress[15]. In addition, it is considered an aspect of active and healthy aging and part of the pursuit of improvements in overall health and protection against cognitive impairment[16].

Almost all of the older adults in the study said that they felt it was *wonderful* to be alive, and that they felt useful and hopeful; attributes that enable activities that promote socialization and interpersonal relationships are important for quality of life and better mental health[17]. Such thoughts are essential individual tools for coping with depressive symptoms during any life cycle, especially during the aging process.

Some older adults in this study reported concern with memory problems, which represents another important aspect to be investigated by the primary care team, guiding actions to prevent depressive symptoms and promote mental health care[18].

In this sense, investigations into the context in which older adults are inserted, their lifestyles and health-promoting behaviors are indispensable for the promotion of comprehensive care for this population. These aspects are considered attributes for physical and mental well-being, contributing to life satisfaction and engagement in activities aimed at a better quality of life, and which can delay or prevent the onset of depressive symptoms[19].

The limitations of the present study include the research design, as a cross-sectional study reveals only a specific aspect of the reality investigated, as well as the difficulty in recruiting and accessing the older adults in their homes.

Based on the above, the main contributions of this study to geriatrics and gerontology are that it promotes reflections on the screening and monitoring of depressive symptoms in older adults, demonstrating that primary health care is an important scenario of care. Knowledge of the life context of older adults promotes a deeper understanding of aspects that permeate their lives, as well as their perception of factors related to depressive symptoms. Teaching and research also represent care strategies, based on the production of scientific evidence that can guide actions that promote and protect the health of older adults and their families, as well as specific referrals based on the findings.

CONCLUSION

The study identified the occurrence of depressive symptoms in older adults registered in family health units. The abbreviated geriatric depression scale showed that the older adults were satisfied with their own lives and that this satisfaction is related to healthy living, the practice of varied activities, leisure and an active memory. In addition, the older adults were found to be happy, participative, active and happy, who felt useful and among whom high spirits contributed to a feeling of hope.

An active life affects the quality of life and social life of an individual and contributes to the improvement of mental capacity. The present study identified the importance of implementing public policies and practices that promote well-being and healthy aging, as well as the screening and monitoring of depressive symptoms in older adults.

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Coaching as a strategy for the health promotion of the elderly: a systematic review

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Rose Mari Bennemann[3]

Abstract

Objective: To evaluate the effect of the application of coaching on the health promotion of the elderly. *Method:* A systematic review was performed in the PubMed, MEDLINE and SciELO databases. The selection of articles followed the PRISMA guidelines, and the articles were published from 2008 to July 2018. The following descriptors were used: aged (*idoso, anciano*), elderly (*idoso, anciano*), coaching (*tutoria, tutoría*), mentoring (*tutoria, tutoría*) and health promotion (*promoção da saúde, promoción de la salud*). Boolean operators were used for all databases: (coaching OR mentoring) AND (health promotion) AND (aged OR elderly); (*idoso*) AND (*tutoria* OR coaching) AND (*promoção da saúde*); (*anciano*) AND (tutoría OR coaching) AND (promoción de la salud). *Results:* The final analysis included three articles. These evaluated coaching tools for changes in lifestyle and the reduction of health risks for the elderly. The results were positive, with a significant improvement in the quality of life (mental and physical), health status, goal attainment, self-efficacy and increased immunization of the evaluated elderly persons. *Conclusion:* The use of coaching in health promotion in elderly is still incipient, however, based on the results, health coaching proved to be an effective strategy to enable the elderly to reach the maximum potential of self-management in health.

Keywords: Health of the Elderly. Coaching. Health Promotion. Quality of Life.

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INTRODUCTION

Coaching is an important strategy for encouraging personal development, and is a major driving force of responsibility, organization, quality of care, support and the affirmation of human potential. Its essence is the development of skills to achieve goals. Thus, coaching contributes to the sustainability of an organization and the growth of the individual, allowing managers to realize that constructive and proactive change generates emotionally intelligent leaders who seek improvement and the ability to overcome problems, promoting productivity and, consequently, quality of life[1].

The development of coaching has been exponential around the world, with the emergence of diverse schools, various lines of thought, different views, approaches and applications for varied markets and publics[2]. One of the modalities of coaching is health coaching, which is a health intervention aimed at helping the individual to set goals that promote health, such as changes in behavior and lifestyle to reduce health risks and improve quality of life[3]. In other words, health coaching helps patients find the motivation to initiate and maintain change by offering a variety of perspectives, and the recognition that various factors contribute to achieving goals[4].

Some studies[5-7] that have evaluated health coaching identified positive results regarding behavior and lifestyle changes such as increased physical activity, improved nutrition and the improved management of chronic diseases.

Each year nearly 58 million individuals reach the age of 60, so the aging of the world's population cannot be ignored, as it poses challenges to public health, particularly in health promotion[8]. The postponement of chronic illness and the effective management of existing diseases and disabilities among the elderly are important if a positive impact on the quality of life of this age group is to be achieved.

Based on the above, the present study aimed to evaluate, through a systematic review, the effect of the application of coaching on health promotion in older individuals.

METHOD

The selection of articles included in this systematic review followed the guidelines of the Preferred Reporting Items for Systematic Reviews and Meta-Analyzes (PRISMA)[9]. The guiding question for the search was: *What effect does coaching have on the health promotion of the elderly?*

The PubMed database of the National Library of Medicine, Medical Literature Analysis and Retrieval System Online (MEDLINE) and the Scientific Electronic Library Online (SciELO) were used for the article search, which was carried out in July 2018, seeking articles published in Portuguese, Spanish and English between 2008 and July 2018. The Health Science Descriptors(or DeCS) were used, together with their equivalents in English from the Medical Subject Headings – MeSH list: aged (*idoso, anciano*); elderly (*idoso, anciano*); coaching (*tutoria, tutoría*); mentoring (*tutoria, tutoría*) and health promotion (*promoção da saúde, promoción de la salud*). Boolean operators were applied in all the databases: (coaching OR mentoring) AND (health promotion) AND (aged OR elderly); (*idoso*) AND (*tutoria* OR coaching) AND (*promoção da saúde*) and (*anciano*) AND (*tutoría* OR coaching) AND (*promoción de la salud*).

As eligibility criteria the review included articles that were available free and in full; which employed health coaching, regardless of the tool and delivery method (in person, by telephone or via the internet); conducted with older adults (age ≥60 years); and which evaluated the effect of the application of coaching on the promotion of health among the elderly. Duplicate articles were excluded, as well as those unavailable online; abstracts and reviews.

For the selection and evaluation of articles, an instrument was developed containing the following variables: authorship; year; country of publication; type of study; number of participants; age range; statistic; intervention period; objectives; type of coaching delivery; coaching tool used and results achieved.

Four phases were selected for article selection: 1) identification of articles in the databases; 2) screening for inclusion and exclusion of studies by reading of the titles and abstracts; 3) full reading of the selected articles; 4) final selection of articles that met the systematic review eligibility criteria.

The articles identified by the search strategy were independently evaluated by two researchers.

RESULTS

The search resulted in 317 publications, 178 (56.2%) in PubMED, 139 (43.8%) in MEDLINE and zero (0%) in SciELO. From the titles and abstracts of the articles, 42 articles met the eligibility criteria, of which 21 were removed as they were duplicates, i.e. articles found in the MEDLINE database were also indexed in PubMED (Figure 1).

After reading the full texts of the 21 pre-selected articles, 18 studies were excluded: ten for including participants under 60 years of age, six for describing future or ongoing research protocols and two which did not fully address the objectives of the review (Table 1). In the end, three studies met the eligibility criteria and comprised the results of this review (Chart 2) years.

Chart 2 describes the articles selected and included in the review. The selected articles were published in years 2016 (n=1) and 2017 (n=2). The countries in which the surveys were conducted were: the Netherlands, South Korea, and the USA. The average age of the older adults ranged from 64.7 to 80.9 years. The studies were developed as randomized controlled trials, with the presence of intervention and control groups. The number of participants ranged from 90 to 18,107. The t and Chi-square tests were mainly used for statistical analysis.

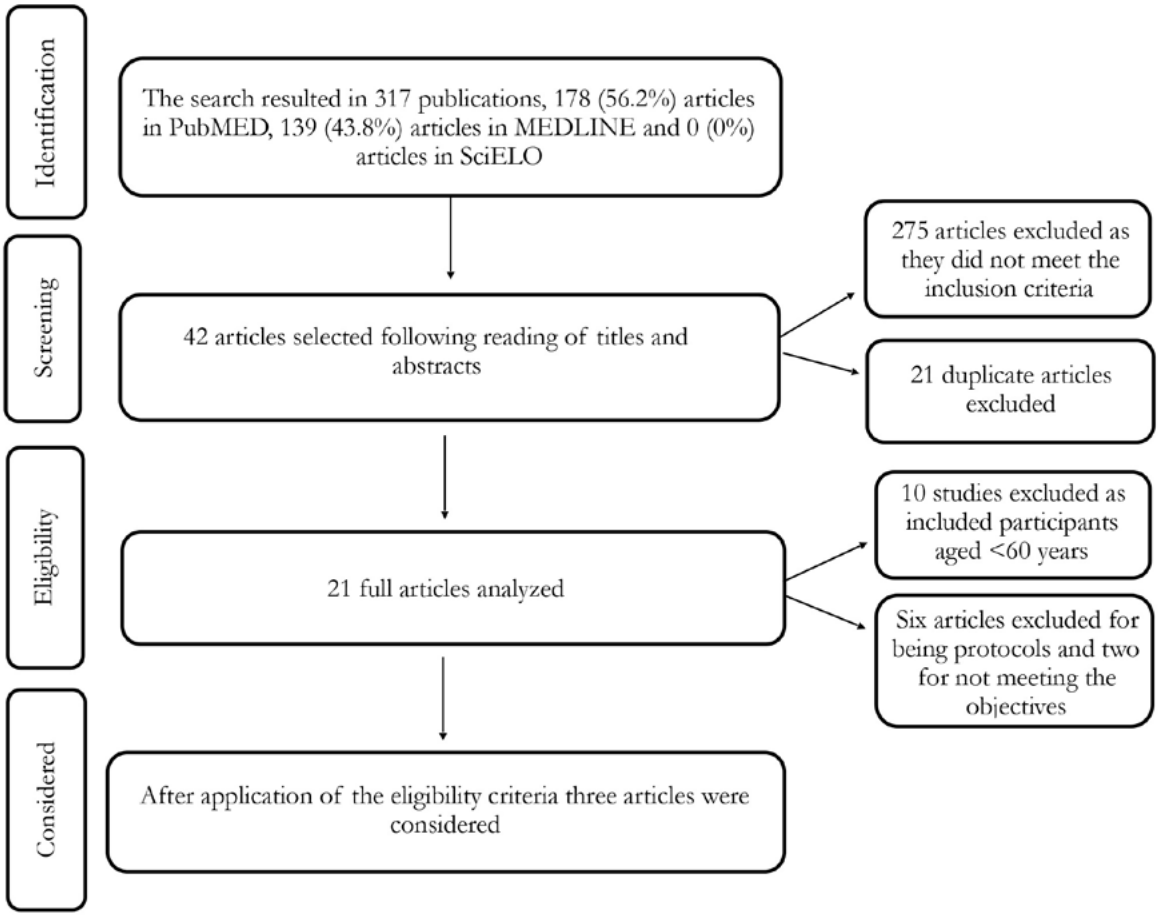

Figure 1. Flowchart of article selection. Maringá, Paraná, 2018.

Chart 1. Description of pre-selected articles subsequently excluded from the review. Maringá, Paraná, 2018.

Author, year, country of publication	Number of participants, age group, delivery method	Intervention period, objectives	Exclusion, reason
Clark et al., 2011, USA[10]	N= 470 Patients ≥65 years Telephone coaching	Intervention: 48 months. Evaluate an intervention (SENIOR II Project) to promote the maintenance of both exercise and healthy eating in the elderly.	Article removed from review as described in progress or future research protocol.
Long et al., 2012, USA[11]	Group 1: control n= 39; 60 (±4) years Group 2: telephone monitoring n= 39; 60 (±5) years Group 3: financial intervention n= 40; 59 (±5) years Telephone coaching	Intervention: six months. Assess whether mentors or financial incentives help African American veterans improve their glycated hemoglobin (HbA1c) levels.	Article removed from review as included participants aged younger than 60 years.
Patja et al., 2012, Finland[12]	DM2 Intervention group: n= 770; 64.6 (±9.4) years Control group: n= 359; 65.6 (±9.5) years CAD intervention group: n= 172; 65.4 (±9.4) years Control group: n=97; 66.0 (±8.6) years CHF intervention group: n=92; 67.3 (±7.9) years Control group: n=45; 62.4 (±7.7) years Telephone coaching	Intervention: 12 months. To evaluate the health effect of C on clinical outcomes (risk determinants) in three patient groups: CHF, CAD and DM2.	Article removed from review as included participants aged younger than 60 years.
Sahlen et al., 2013, Sweden[13]	N= 1.509 Intervention group: n= 1,132 Control group: n= 377 Age between 60 and 75 years Coaching in person and by telephone	Intervention: 18 months. Assess whether health C, in terms of motivational interviewing and a range of activities, will contribute to positive lifestyle and health changes among older people at risk for cardiovascular disease, diabetes or mild depression.	Article removed from review as described in progress or future research protocol.
van Nimwegen et al., 2013, Netherlands[14]	Intervention group: n= 299; 65.1 (±7.9) years Control group: n= 287; 65.9 (±7.2) years Face to face coaching	Intervention: 24 months. To evaluate whether a multifaceted behavioral change program (ParkFit specifically designed to achieve a lasting increase in physical activity levels, with coaches using motivational strategies) increases physical activity in sedentary Parkinson's disease patients.	Article removed from review as included participants aged younger than 60 years.

to be continued

Continuation of Chart 1

Author, year, country of publication	Number of participants, age group, delivery method	Intervention period, objectives	Exclusion, reason
Veroff et al., 2013, USA[15]	N= 24,167 Intervention group: n= 13,901 Control group: n= 10,266 Average age ≥49 years Telephone coaching	Intervention: six months. To assess IVR, which included the ability of individuals at high risk for spinal and knee surgery to connect directly with the Health Coach (AutoDialogW) compared to a Control group.	Article removed from review as included participants aged younger than 60 years.
Tabak et al., 2014, Netherlands[16]	Intervention group: n= 15; 64.1 (±9.0) years Control group: n= 14; 62.8 (±7.4) years Online coaching	Intervention: nine months. Evaluate a technology-supported care program that supports the treatment of COPD patients through self-treatment and promotion of an active lifestyle through real-time C and home exercise using a web portal.	Article removed from review as included participants aged younger than 60 years.
Clare et al., 2015, UK[17]	Intervention group: n= 24 Control group: n= 24 Average age ≥ 65 years Face to face and telephone coaching	Intervention: 12 months. Evaluate a goal-setting intervention aimed at promoting cognitive enhancement, physical activity, improving mental and physical fitness, diet and health.	Article removed as did not consider the objectives of the review in their entirety.
Karhula et al., 2015, Finland[18]	Cardiac patients: n= 246; 69.1 (±9.1) years Diabetes patients: n= 225; 66.2 (±8.6) years Telephone coaching	Intervention: 12 months. To evaluate whether a cell phone based health C program could be used to improve the health-related quality of life of patients with type 2 diabetes and heart disease patients.	Article removed from review as included participants aged younger than 60 years.
Pavel et al., 2015, USA[19]	N= 33 elderly persons; 80.3 (±9.4) years Face to face and online coaching	Describe the structure of the Health C platform prototype and address aspects of the components needed to support its functions.	Article removed as did not consider the objectives of the review in their entirety.
Tiedemann et al., 2015, Australia[20]	Intervention group: n= 65 Control group: n= 65 patients ≥60 years Face to face, internet and telephone coaching	Intervention: 12 months. C in health that aims to evaluate personalized physical activity and fall prevention intervention in the elderly.	Article removed from review as described in progress or future research protocol.
Young et al., 2015, USA[21]	N= 15 28 to 74 years Face to face coaching	Intervention: three months. Examine the feasibility and effectiveness of a student-oriented wellness program for people with disabilities.	Article removed from review as included participants aged younger than 60 years.

to be continued

Continuation of Chart 1

Author, year, country of publication	Number of participants, age group, delivery method	Intervention period, objectives	Exclusion, reason
Cadmus-Bertram et al., 2016, USA[5]	Intervention group: n= 71; 60.0 (±6.3) years Control group: n= 34; 60.8 (±6.2) years Telephone coaching	Intervention: 12 months. Evaluate an intervention that trained women at high risk of developing breast cancer to use a self-monitoring and telephone C site to increase physical activity and lose weight.	Article removed from review as included participants aged younger than 60 years.
Thomson et al., 2016, USA[22]	N= 1.070 Average age≥21 years Telephone coaching	Intervention: 24 months. To evaluate the hypothesis that a 24-month lifestyle intervention will significantly increase progression-free survival following cancer therapy for stage II-IV ovarian cancer.	Article removed from review as described in progress or future research protocol.
Tiedemann, et al., 2016, Australia[23]	N= 600 (60 Groups) Physical activity and fall prevention intervention (30 Groups) Healthy diet intervention (30 Groups) Individuals aged ≥60 years Telephone coaching	Intervention: 12 months. The main objective of this study was to evaluate the effect of an intervention for the promotion of physical activity combined with the prevention of objectively measured and self-reported falls compared with dietary programs among established groups of community-dwelling people ≥ 60 years of age.	Article removed from review as described in progress or future research protocol.
Early et al., 2017, England[24]	Group 1 – more advanced COPD Intervention group: n= 11; 66.36 (±12.33) years Group 2 – less advanced COPD Intervention group: n= 8; 60.63 (±9.47) years Face to face. internet and phone coaching	Intervention: three months. Evaluate the feasibility of an internet-based health promotion program, the Preventive Plan (TPP), along with nursing coaching for home-based COPD self-management focusing on patient activation and self-management benefits.	Article removed from review as included participants aged younger than 60 years.
Vanroy et al., 2017, Belgium[25]	Intervention group: n= 25; 65.3 (±8.1) years Control group: n= 21; 59.4 (±8.2) years Face to face coaching	Intervention: six months. To evaluate the short- and long-term health and behavior-related effects of a physical activity intervention support program in type 2 diabetes mellitus patients.	Article removed from review as included participants aged younger than 60 years.
Rich et al., 2018, USA[26]	N= 408 Age ≥50years Face to face coaching	Intervention: 24 months. Describe the intervention protocol and study design for the Peer Empowerment Program 4 Physical Activity (PEP4PA, coaching)).	Article removed from review as described in progress or future research protocol.

C: coaching; CHF: congestive heart failure; CAD: coronary artery disease; DM2: type 2 diabetes mellitus; COPD: chronic obstructive pulmonary disease; IVR: interactive voice response.

Chart 2. Description of articles selected and included in the review. Maringá, Paraná, 2018.

Author, year and country of publication	Number of participants, age group, delivery method	Intervention period, objectives	Coaching tool	Results
Broekhuizen et al., 2016, Netherlands[6]	Controlled and randomized control study N= 235 Intervention group: n= 119; 64.7 (±3.0) years Control group: n= 116; 64.9 (±2.8) years T-test for independent samples. Mann-Whitney and linear regression tests Online coaching	Intervention: three months. Evaluate an intervention based on a physical activity program available on the internet, DirectLife (C program), aimed at increasing physical activity to improve the quality of life of inactive older adults.	Program with a personal coach, which provides regular email updates of physical activity and advice on how to increase such activity.	The use of the physical activity program available on the internet, DirectLife (C program), significantly improved quality of life, especially the emotional health of older participants in the Intervention group compared to older adults in the Control group.
Park et al., 2017, South Korea[7]	Controlled and randomized trial N= 90 Intervention group: n= 43; 80.91 (±7.65) years Control group: n= 47; 80.19 (±7.53) years T test. Chi-squared and ANOVA Face to face coaching	Intervention: two months. To evaluate the effect of a self-management and C in health (HCSMP-NHR) program designed for older people with chronic conditions and mild to moderate cognitive impairment living in nursing homes.	Goal-based counselling.	HCSMP-NHR improved the self-efficacy, achievement of goals, health status and quality of life of older people with chronic conditions and mild to moderate cognitive impairment.
Zimmerman et al., 2017, USA[27]	Randomized control study N= 18,107 ≥65 years, with average age of 74.2 years 25 primary care clinics stratified by city, Pittsburgh n= 19 clinics and Houston n= 6 clinics Chi-squared and Hazard ratio Face to face and telephone coaching	Intervention: 24 months. To evaluate the effectiveness of an evidence-based guide, the 4 Pillars ™ Immunization Toolkit (education and coaching), to increase pneumococcal vaccination in the elderly.	Face to face C advocating the importance of immunization for the team. Phone C to ensure that the chosen strategies were being implemented and to work with team motivation.	Intervention and control groups increased PPSV vaccination rates in in the elderly. In the pre and post study, the use of the 4 Pillars ™ Immunization Kit significantly improved vaccination with PPSV and PCV compared to practices in the maintenance phase of the study.

PPSV: 23-valent polysaccharide pneumococcal vaccine; PCV: pneumococcal conjugate vaccine; C: coaching.

Of the three articles selected, two applied face to face coaching[7,27], one of which combined face to face coaching with telephone coaching[27], and one article applied only online coaching[6]. The intervention period ranged from two to 24 months. In terms of objectives, the studies sought to evaluate coaching tools for lifestyle changes and health risk reduction.

The results achieved in the studies were positive, with a significant improvement in quality of life (mental and physical)[6,7]; health status[7]; achieving goals[7]; self-efficacy[7] and increased immunization[27] of the elderly persons evaluated.

DISCUSSION

There are few articles that evaluate the effect of coaching on health promotion, hampering a robust analysis of the effect of coaching on health promotion among the elderly. Most studies analyzed in their entirety (n=21) at the eligibility stage were excluded (n=10) as they included older and middle-aged individuals in the groups evaluated (intervention and control), which may mean the results are unreliable, as the elderly have their own characteristics resulting from the aging process. In addition, six studies were from future or ongoing study protocols.

It was also observed that although the studies reported the use of coaching for health promotion, there is great difficulty on the part of the authors when it comes to understanding the term "health coaching". In general, the understanding of coaching observed was focused on the action of a health professional who combines information and health education to encourage the individual to initiate and maintain behavioral changes associated with health. This procedure, however, relates to the application of mentoring rather than coaching. The former involves the transmission of instructions from an individual who has knowledge of a specific domain to a less experienced individual, and does not require mentor coaching skills[28]. Coaching, on the other hand, is a process in which the coach (the one who leads the process) facilitates the learning of an individual without, however, having knowledge of the area of learning of such individual, that is, the coach only needs to have experience in the process of learning facilitation and performance enhancement[29]. Coaching is a process of human development that involves the use of structured, focused interactions and strategies, as well as appropriate tools and techniques to bring about desirable change for the benefit of the individual.[30]

The lack of understanding and inadequate use of these techniques may be related to the scarcity in literature of information about the specifications needed for coach training. There are some basic requirements for working in this area, such as: obtaining a coaching development training certificate; have gone through a specific coaching process; have carried out work on one's own; provide adequate vocational training; remain under constant supervision in one's activities as a coach[29]. Other limitations of health coaching studies are associated with the lack of clarification about the characteristics of health coaching (strategies, practices, delivery methods); what is the exact role of the coach (educator, facilitator, navigator, partner); what training is required to act as a coach and what type of training would enable such professionals to perform competently in the health coaching process[31].

The difficulty in defining the coach's duties, as well as their academic training or the training methodology verified in the studies, made selection difficult and restricted the results to a few articles. It was a challenging task, given the variety of concepts used, the diversity of approaches, as well as the scarcity of studies focused on the theme.

The evidence of the selected articles[6,7,27] in the present review that met the eligibility criteria suggests that coaching is a viable strategy for improving health, self-management, adherence to health promotion activities and, consequently, to improving the quality of life of the elderly. Programs that enable the elderly to self-manage their symptoms and treatments based on lifestyle changes are essential for a healthy life[32]. Self-management improves problem solving, the maintenance of exercise, medication use, and communication skills.[33]

The coaching methodology presents beneficial results that lead to behavioral and lifestyle changes, such as increased physical activity, improved nutrition

and self-esteem[34-36], reinforcing that this technique can be used as a strategy for health promotion, aimed at such promotion and an improved quality of life.

Thus, research evaluating the effects of coaching on health promotion in the elderly needs to be further explored, as the world's older population is expanding rapidly. This is a challenge for the health care needs of these individuals, as aging is a multifactorial process that promotes anatomical and functional changes in the body. Such changes usually result in the onset of chronic diseases; functional disability; the need for care; reduced mobility; depression; isolation and loneliness, which can negatively influence the quality of life of the older adult[37].

Under chronic conditions, the commitment to self-care and the ability to adhere to long-term recommendations is of utmost importance. In this sense, health coaching motivates individuals to initiate and maintain change, and to recognize factors that contribute to achieving their goals[4]. Health coaching is an effective strategy for older people to prevent a disease from getting worse and for improving their lifestyle[38].

Limitations of the present study include its design, as the eligibility criterion meant that only free full text studies in the searched databases were evaluated, the sample size obtained (three articles) and the individualistic approach, as observed in one of the selected studies, in which the participation of the older adults was voluntary, which may have contributed to the representation of participants who were highly motivated towards lifestyle-related changes. Similarly, the restricted selection of internet-enabled elderly persons led to a sample with a relatively high educational level; as a consequence, the application of the results of this study to the general elderly population is limited[6].

CONCLUSION

Although the studies produced promising results, suggesting that health coaching brings about changes in the disease management and lifestyle of the elderly, the application of the methodology in health promotion for older individuals is still incipient. The sense of partnership between patients and health professionals promoted through the coaching methodology, either face to face, online or by phone, can be a tool used to promote the health of the elderly.

The importance of further studies that evaluate the coaching methodology in the health promotion of elderly persons in the areas involved, such as those related to physical, mental and social aspects, is emphasized. Such studies are important for the planning of strategies that aim to implement actions for the promotion of the health of the elderly, contributing to geriatric and gerontological research and practice.

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Oxidative stress among informal caregivers

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Abstract

Objective: to evaluate oxidative stress and non-enzymatic antioxidant defenses in informal caregivers, and correlations with anxiety, health satisfaction and quality of life. *Method:* a case-control analytical study was performed, where the case was represented by the main informal caregiver and the control was paired with individuals with identical characteristics to the case, but who were not informal caregivers. The following instruments were used: a sociodemographic questionnaire, the Beck anxiety scale and the WHOQoL-Bref. Oxidative stress was measured through blood by analysis of the Ferric Reducing Ability of Plasma (FRAP) and Thiobarbituric Acid Reactive Substances (TBARS) markets. *Results:* most informal caregivers were females. There was no difference in the degree of anxiety between the Case and Control groups. Among informal caregivers, 9.4% said they were very dissatisfied and 53.1% dissatisfied with their health. Most caregivers (43.8%) rated their quality of life as poor and 12.5% as very poor, while most controls rated it as good (68.8%). The TBARS and FRAP values were lower in the Case group than in the Control group. *Conclusion:* The informal caregivers, who were mostly women, defined themselves as dissatisfied or very dissatisfied with their health. Nevertheless, they did

Keywords: Caregivers. Oxidative Stress. Quality of Life. Anxiety.

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not manifest a higher degree of anxiety in comparison with the control population. In addition, they presented a lower degree of oxidative stress than the non-caregiving participants, perhaps due to a greater mobilization of the non-enzymatic antioxidant defenses present in the body.

INTRODUCTION

Free radicals are continuously formed in the human body as a result of aerobic metabolism or by the action of enzymatic systems such as NAD(P)H oxidases, catalases and nitric oxide synthases. In small concentrations these substances, play important physiological roles in intracellular and intercellular signaling and hormone production.

However, when the production of free radicals exceeds the capacity of antioxidant systems, a pathophysiological condition called oxidative stress occurs. So that free radical concentrations do not become elevated, the human body possesses enzymatic and non-enzymatic antioxidant systems capable of eliminating them[1-4]. These mechanisms are important since excess free radicals react with proteins, lipids, carbohydrates and DNA, leading to many diseases prevalent in aging[5]. The products generated by the reaction of free radicals with these cellular constituents, including lipoperoxides, are considered important biomarkers of oxidative stress[6]. The redox balance can also be estimated by determining the ability of the plasma to reduce ferric ion, which reflects the action of the non-enzymatic antioxidant defenses present in this biological fluid[7].

Oxidative stress can be aggravated by exposure to environmental agents such as pollution and cigarette smoke which contain free radicals, or by the consumption of alcohol and drugs that increase the endogenous production of these substances[8,9]. Sedentary individuals are more likely to have higher levels of oxidative stress, as they do not properly develop their antioxidant defenses[4]. Oxidative stress is also higher in individuals subjected to mental stress and psychiatric illness, although the causal relationship between these pathophysiological conditions is still poorly known[9]. Thus, the mitigation of oxidative stress involves a balanced diet, physical activity, reduced alcohol and tobacco consumption, reduced mental stress, and improved environmental conditions.

Informal caregivers, as they dedicate themselves exclusively to others, can experience significant changes in their lifestyle and habits. Thus, they may neglect their diet or daily practice of physical activity and, therefore, may present a higher degree of oxidative stress. Informal caregivers may also have a higher degree of mental stress and anxiety. In fact, it is estimated that around 90% of the world's population may be affected by mental stress, which may be considered the most worrying factor of the modern age[10].

Situations that threaten the physical and emotional security of the individual, in the short and long term, involving their reputation and self-esteem, are among the factors that most trigger stress situations[11]. In this sense, some scales are useful, such as the Beck anxiety scale[12] and the WHO (World Health Organization) quality of life scale[13] to investigate stress in day to day life[14].

With population aging, there is a tendency for the number of older adults to depend partially or totally on care. It is increasingly common for someone to take on the role of informal caregiver of such older people, usually a family member. This leads to changes or redefinitions of the roles of one or more family members. These caregivers assume the responsibility of caring, most often without technical preparation, for up to 24 hours a day. Thus, the caregiver "gives up most of their daily life, mainly abdicating leisure and paid work, which significantly changes their life dynamics and the dynamics of family life"[14].

The act of caring represents a challenge to the caregiver, as it causes physical and emotional exhaustion and overload, as well as financial costs, added to the risks of mental and physical illness. Caring is an act of bondage because the caregiver offers the best of his or her talents to others[15]. Caregivers commonly manifest extreme tiredness; general fatigue; pains; physical and emotional exhaustion and overload; loss of resistance; nervousness;

irritability; anxiety; insomnia; depression, among other symptoms. This indicates that, in most cases, caring for others implies neglecting oneself, which directly impacts the caregiver's quality of life[16,17].

The informal caregiver is one who cares voluntarily, usually represented by a family member, and may also be a friend or neighbor[18]. In Brazil, it is more common for the family to assume the role of caring[19]. Caring for an older family member is a subjective experience. Daily care becomes a challenge where, suddenly and often without knowledge and/or support, this family member now takes on a new role, becoming a caregiver[20].

In this context, a new sphere to be encompassed by health services has emerged: home care. This is because families increasingly need to play the role of caregivers, both in order to maintain a sick family member or older adult in the family environment and to better manage resources that are often limited and prevent the hiring of a professional care provider[21].

In this sense, the aim of the present study was to evaluate oxidative stress and non-enzymatic antioxidant defenses in informal caregivers, comparing the data obtained with non-caregivers, and correlating the results with degree of anxiety, health satisfaction and quality of life.

METHOD

A case-control analytical study was performed, where the cases were represented by primary informal caregivers, matched with individuals with identical gender and age characteristics who were not informal caregivers as controls.

The study was conducted in partnership with the Interdisciplinary Home Hospitalization Program (or PROIID) of the city of Marília, in the state of São Paulo, Brazil. This program accompanies patients and family members who, although they no longer need intensive in-hospital care, require care and guidance to improve their health-disease process, as well as restore their physical, emotional and mental integrity. The program is a partnership between the Clinical Hospital and the Municipal Health Department.

Informal caregivers who performed this role fully for six months or more, referred to as "cases", were included in the study. These caregivers were selected through direct contact between the principal researcher and the relevant PROIID nurse. In this contact, the users of the program who were dependent on care were identified, with the subsequent need for an informal caregiver for a minimum of 12 hours per day, referred to in literature as a primary caregiver. These were selected after consulting the PROIID database. For the control, pairs with the same characteristics, such as age and gender, but who did not currently perform the role of caregiver, or who had not performed it for at least one year, were selected. The cases and the controls were matched one to one. All subjects involved in the study were over 18 years of age.

Individuals who agreed to participate were initially asked if they had been diagnosed with systemic arterial hypertension, diabetes *mellitus*, and dyslipidemia, as well as whether they were smokers or alcoholics. Active smokers and alcoholics were excluded from both groups due to the recognized influence of these factors on the oxidative stress assessment parameters used. Survey participants were advised not to consume processed foods and not to drink alcohol for three days prior to blood collection.

The data was collected from July to November 2018, exclusively by the principal researcher. The Beck anxiety scale[12] and the World Health Organization Quality of Life Questionnaire (WHOQOL-bref) were applied[13].

The Beck's anxiety scale consists of 21 multiple choice questions and measures the individual's degree of anxiety, which may be mild, moderate or severe. It provides a score ranging from 0 to 63, with the degree of anxiety is proportional to the score[12]. The WHOQOL-bref, meanwhile, is a WHO-validated instrument to measure quality of life, divided into domains, namely: physical, psychological, social relations and environment[22]. Both instruments were applied individually.

Next, blood samples were collected from the participants to obtain plasma. These collections were made in the morning, between 8 am and 10 am. Blood samples were collected in an EDTA tube and refrigerated at the Pharmacology Laboratory of

the Marilia Medical School (Famema) within one hour. In the laboratory, the samples were centrifuged for 10 minutes at 4ºC, with rotation of 3000 rpm in a Hermle centrifuge. After centrifugation, the plasma was collected by pipette and transferred to another tube, where it was stored at -80ºC for further analysis of plasma lipoperoxide concentration by the Thiobarbituric Acid Reactive Substances (TBARS)[6] technique. These samples were also used to determine the ability of plasma to reduce ferric ion by the Ferric-Reducing Ability of Plasma (FRAP) technique[7].

Sample size calculation was performed using the G*Power software program, version 3.1.9.2 (Franz Faul, Universität Kiel, Germany) to analyze oxidative stress in a case-control study using the Student t-test for independent samples.

Data normality distribution was verified by the Kolmogorov-Smirnov test. For comparison between two independent groups, the Student's t-test for unpaired samples or the nonparametric Mann-Whitney test were performed. To analyze the frequency distribution between the categories of qualitative variables, the Chi-square test for proportion was used. To analyze the relationship between two qualitative variables, the Chi-square test for proportion was applied. For all analyzes the SPSS software version 19.0 for windows was used, adopting a significance level of 5%.

The study was submitted to the Famema Research Ethics Committee, and was approved on December 14, 2017, under Opinion No. 2,439,044. Participants signed a Free and Informed Consent Form (FICF) to participate in this study, in compliance with National Health Council Resolution No. 466/2012.

RESULTS

There was no initial significant difference between the case and control groups regarding the distribution of the variables gender, diabetes mellitus, dyslipidemia, systemic arterial hypertension, age group and sedentary lifestyle (Table 1).

Table 1. Absolute (n) and relative (%) frequency distribution of sample characteristics between case and control groups. Marília, São Paulo, 2018.

Variables	Groups		*p*
	Case (n=32) n (%)	Control (n=32) n (%)	
Sex			
Female	28 (87.5)	28 (87.5)	0.646
Male	4 (12.5)	4 (12.5)	
Diabetes mellitus			
Present	7 (21.9)	4 (12.5)	0.324
Absent	25 (78.1)	28 (87.5)	
Dyslipidemia			
Present	5 (15.6)	8 (25.0)	0.355
Absent	27 (84.4)	24 (75.0)	
Arterial hypertension			
Present	12 (37.5)	10 (31.3)	0.602
Absent	20 (62.5)	22 (68.8)	
Age range (years)			
<60	20 (62.5)	22 (68.8)	0.602
≥60	12 (37.5)	10 (31.3)	
Sedentary lifestyle			
Yes	27 (84.4)	24 (75.0)	0.355
No	5 (15.6)	8 (25.0)	

p calculated by the chi-square association test.

The group of caregivers was made up of family members, predominantly female, especially daughters and wives (Table 2). For each participant in the case group, there was a same-sex participant, not belonging to the same family, in the control group.

The data obtained also show that there was no statistical difference in the degree of anxiety between individuals who performed the informal caregiver role and those who did not. Most individuals in the case group had minimal anxiety in comparison with control. Regarding satisfaction with health, no individual in the control group expressed dissatisfaction, while 9.4% of informal caregivers expressed such an opinion by answering the specific health-related question in the WHOQOL-bref. The alarming fact about this issue is that most caregivers, i.e. 17 (53.1%) participants, were dissatisfied with their health. Most caregivers (43.8%) rated their quality of life as poor, while most controls (68.8%) rated it as good (Table 3).

Table 2. Absolute (n) and relative (%) frequency distribution of caregiver kinship in case group. Marília, São Paulo, 2018.

Kinship	n (%)	*p*-value
Wife	8 (25.0)	
Daughter	19 (59.4)	
Sister	1 (3.1)	0.0001*
Husband	4 (12.5)	
Total	32 (100.0)	

* Significant difference (p≤0,0001) in the distribution of kinship proportion in the caregiver sample by the chi-square association test.

Table 3. Analysis of the association of cases and controls in the qualitative variables degree of anxiety, health satisfaction and quality of life. Marilia, São Paulo, 2018.

Variables	Groups		*p*
	Case n (%)	Control n (%)	
Anxiety Degree (Beck Scale)			
Minimum	18 (56.3)	15 (46.9)	
Mild	5 (15.6)	12 (37.5)	0.170
Moderate	8 (25.0)	4 (12.5)	
Severe	1 (3.1)	1 (3.1)	
Health satisfaction (questionnaire WHOQOL-bref)			
Very unsatisfied	3 (9.4)	0 (0.0)	
Dissatisfied	17 (53.1)	7 (21.9)	
Dissatisfied/Satisfied	8 (25.0)	9 (28.1)	0.003*
Pleased	4 (12.5)	12 (37.5)	
Very satisfied	0 (0.0)	4 (12.5)	
Quality of life (questionnaire WHOQOL-bref)			
Very poor	4 (12.5)	1 (3.1)	
Poor	14 (43.8)	3 (9.4)	
Poor/Good	7 (21.9)	2 (6.3)	0.0001*
Good	7 (21.9)	22 (68.8)	
Excellent	0 (0.0)	4 (12.5)	

* Significant difference (p-value ≤0.05) by Chi-square test.

The data obtained also showed differences between the groups in relation to TBARS values. Participants in the case group were found to have lower TBARS values compared to those in the control group. In contrast, FRAP values were lower in the case group than in the control group (Table 4).

Table 4. FRAP and TBARS values obtained in control and case groups. Marília, São Paulo, 2018.

Variables	Groups		*p*-value
	Case (n=32)	Control (n=32)	
	Mean (standard-deviation)	Mean (standard-deviation)	
TBARS (mg/mol)	18.70 (±19.56)	41.98 (±27.31)	0.0001**
FRAP (mg/mol)	1.09 (±0.23)	1.36 (±0.20)	0.0001*

* Significant difference (p≤0.0001) between groups by Student's t-test for independent samples; ** significant difference (p≤0.0001) between groups by the nonparametric Mann-Whitney test.

DISCUSSION

In the present study, it was observed that due to performing the role of informal caregiver, the population included in the case group was predominantly composed of women, all of whom are family members of the care recipient[23,24]. These data are in line with literature that indicates that women predominantly assume the role of caregiver throughout the world, reflecting a culture rooted in the idea that caring is part of the female reality[25]. It should be considered that the caregiver is the main target of family tension caused by the stress and tiredness involved in care. Thus, due to the global increase in life expectancy, families must be socially and economically prepared to understand and support the role of the informal caregiver[26]. These caregivers, predominantly women, are also responsible for the link between the health team and the patient[27], and are thus an essential figure for the success of home care.

During data collection, it was common for the participant caregivers to report disturbed sleep patterns, as they often needed to wake up several times during the night to check the condition of the individual under their care (unquantified data). These caregivers complained that this compromised their daily activities. Another problem is a sedentary lifestyle, which was frequently found among the participants in both the case and control groups. In addition, there was a frequent complaint among informal caregivers about a lack of leisure opportunities, as they had no one to leave the care-dependent family member with during the time spent on this purpose.

Another highly relevant factor, related to the link between women and the work of informal caregivers, is the misunderstanding, on the part of society in general, that caring is female in nature. In fact, care-related work represents an imposition on women. This understanding stems from the historic organization of the family in Brazil and in other countries, in which women were given all the domestic responsibilities, including looking after the recipient of care. According to Guedes[24], during their productive lives, women are more likely to give up their careers, including because of maternity care. Thus, this removal from the labor market is prolonged through the continuation of the role of caregiver for a family member. In addition, the labor laws in force in Brazil, with inflexible hours that do not consider double shifts, make it difficult to reinsert these caregivers in the labor market after the period dedicated to care, leading them unemployed.

Several instruments aimed at assessing quality of life have been described and validated in literature, of which the WHOQOL-bref, used in the present study, is one of the most important. In the data collected by this instrument lower scores were identified in the *psychological* and *interpersonal relationships* domains, which are indicated in literature as being some of the main burdens of performing the role of informal caregiver. Caring results in physical, psychological and social burden. This is not only due to caregiving, which is important in itself, but is aggravated by the

fact that the caregivers, mostly women, accumulate extra duties related to household chores. This further increases the physical and social burden of the informal caregiver[28].

It is noteworthy that about 10% of caregivers surveyed said they were *very dissatisfied* with their health and more than half said they were *dissatisfied*. These data are reinforced by a previous study in which a direct relationship was detected between negative self-rated health and increased burden imposed by the act of caring, as well as reduced happiness perceived by the caregiver[29]. Other authors have also observed an association between self-rated health and well-being[26,30]. According to these authors, health is a multidimensional factor and psychological well-being can influence it. This proposition is based on the WHO concept that health does not only involve the absence of disease, but is the result of the sum of physical, psychological and social well-being. In addition, in this study, health-related quality of life was a predictive factor for increased psychological well-being.

Regarding the self-assessment of overall quality of life, it is noteworthy that 43.8% of caregivers rated their quality of life as poor and 12.5% said it was very poor. Factors related to burden in care work and health conditions are those that most significantly affect the self-assessment of quality of life of caregivers.

When assessing the TBARS of informal caregivers, a somewhat unexpected panorama was observed. This is because, despite declaring themselves dissatisfied with their health and classifying their quality of life as poor, informal caregivers had lower TBARS values than those observed in the control group. As already mentioned, TBARS is a parameter that indicates the degree of oxidative stress, as it quantifies the lipoperoxidation end products[6]. Thus, it can be said that despite the life and health conditions to which informal caregivers are subjected, they present a lower degree of oxidative stress. In this sense, it should be emphasized that chronic oxidative stress may be the genesis of several highly prevalent and often severe chronic degenerative diseases[2,8]. Indeed, these data are somewhat reassuring, as they suggest that the risk of illness in these caregivers surveyed is not elevated by oxidative stress.

These data, however, reveal the complexity of oxidative balance in humans and the challenge of studying it in such a dynamic condition as the daily life of an informal caregiver. If on the one hand informal caregivers are dissatisfied with their health and realize that their quality of life is inadequate, on the other hand they may be less exposed to several factors that are highly pro-oxidative. To illustrate this reality, it is worth noting that informal caregivers also did not exhibit a higher degree of anxiety than the control group. This is not to say that the living conditions of an informal caregiver are unhealthy, but does warn of the possible existence of other factors that can mitigate oxidative stress in these individuals. Identifying these factors and how they relate to oxidative balance is a challenge that emerged from the present study.

In this sense, it is worth noting that the difference in the degree of stress observed between the case and control groups is unlikely to be related to the prevalence of diabetes mellitus, dyslipidemia and systemic arterial hypertension in the groups. This is because, although these diseases are closely related to oxidative stress[31,32], there were no differences in the prevalence of the same between the case and control groups. There were also no differences between the groups regarding age and physical inactivity, factors that are also known to aggravate oxidative stress[2,31].

As mentioned, oxidative stress is a result of the imbalance between oxidant production and antioxidant defenses. This imbalance can result, on the one hand, from the excessive production of free radicals and/or the high uptake of free radicals from the environment, and, on the other, from a lower ability to eradicate the same by the antioxidant defenses present in the body[2]. Thus, when assessing oxidative stress, special attention should be paid to the body's antioxidant defenses. In this sense, the present study also evaluated the capacity of the non-enzymatic antioxidant defenses present in the plasma of the individuals studied, using the FRAP technique. In fact, the antioxidant capacity measured by FRAP reflects the sum of the antioxidant actions of various components of biological fluids, including uric acid and ascorbic acid, which exert approximately 60% and 20% of the evaluated antioxidant capacity, respectively. FRAP also influences the presence

of vitamin E, bilirubin and albumin[7]. Given these considerations, the importance of a balanced diet for the proper functioning of these antioxidant defenses present in plasma is evident. It is interesting to note that the informal caregivers had reduced FRAP values, in comparison with the control group. This indicates that, in these individuals, the reduction of oxidative stress, characterized by the reduction in TBARS values, may have occurred due to the higher consumption of non-enzymatic antioxidant defenses, as measured by FRAP. However, why this mobilization of antioxidant defenses is greater in informal caregivers, to the point of perhaps reducing the degree of oxidative stress in these individuals, remains unknown.

CONCLUSION

Based on the data of the present study, it can be concluded that the informal caregivers were predominantly women from the family circle of the individual under care. This is explained by a culture that is rooted in the idea that caring is part of the female reality. These caregivers mostly define themselves as dissatisfied or very dissatisfied with their health, and more than half of them rate their quality of life as poor or very poor. Nevertheless, these caregivers did not show a higher degree of anxiety in relation to the population that did not perform care-related tasks.

Finally, the informal caregivers exhibited a lower degree of oxidative stress than the non-caregivers, perhaps due to the greater mobilization of non-enzymatic antioxidant defenses present in the body. These data suggest that the risk of illness among these caregivers due to oxidative stress does not appear to be high. This is not to say that the living conditions of informal caregivers are unhealthy, but does warn of the possible existence of other factors that may mitigate oxidative stress in these individuals.

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Analysis of quality of life and associated factors in a group of elderly persons with supplemental health plans in the city of São Paulo, Brazil

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Abstract

Objective: To measure the Quality of Life (QoL) and associated factors in a group of elderly persons receiving care through a health plan operator in the city of São Paulo, Brazil. *Method:* A cross-sectional study was carried out with 169 elderly persons enrolled in a health plan and who were participants in a program to promote health and prevent risks and diseases. The Bref and Old versions of the World Health Organization Quality of Life (WHOQOL) instruments were adopted for the evaluation of the QoL of the elderly. After descriptive analysis, a comparative analysis was performed through the Student's t-tests and ANOVA. The Brown-Forsythe test was applied for situations in which no homogeneity was found and the Tukey test for multiple comparisons was applied. *Results:* The highest mean QoL values were found in the *Psychological* [72.1 (±14.3)] and *Environment* [68 (±15.4)] and *Intimacy* [72.5 (±20.8)] domains, while the worst results were found in the *Physical* [64.3 (±18)] domain and in the *Death and Dying* facet [61.2 (±23.2)]. In this group, factors such as obesity, neoplasia and previous hospitalizations were negatively associated with QoL, whereas young elderly, female, widows, carriers of chronic non-communicable diseases and those limited to two morbidities, who practiced physical activity and had clinical care provided by a reference physician had a positive influence. *Conclusion:* The findings of this research showed high levels of satisfaction with health and QoL, in addition to raising relevant discussions about predictors that influence the QoL of the elderly receiving care from the supplementary sector. It also emphasizes the need for new strategies of action to ensure improvements in the health care of the elderly.

Keywords: Health of the Elderly. Quality of Life. Population Dynamics. Health Promotion. Prepaid Health Plans.

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INTRODUCTION

According to the 2010 Brazilian Institute of Geography and Statistics (or IBGE) census, the elderly population and life expectancy have been growing significantly in Brazil[1]. However, increased life expectancy is not necessarily associated with improved quality of life (QoL). The latter is conceptualized by the World Health Organization (WHO) as "the individual's perception of their position in life in the context of the culture and value systems in which they live and in relation to their goals, expectations, standards and concerns". It is a polysemic definition, the components of which may vary from researcher to researcher[2].

The evaluation of the QoL of the elderly covers several aspects, such as: functional capacity; socioeconomic level; psychological state; social interaction; intellectual activity; self-care; family support; sociocultural, ethical and religious values; the process of death and dying; lifestyle; satisfaction with job and/or activities of daily living; the environment in which one lives and which one frequents. It is known that the changes caused by the physiological and pathological process of aging tally with a reduction in the QoL of this group, justifying the relevance of studies that support strategies and actions aimed at prevention and the maintenance of active aging[3].

Currently, the supplementary health sector in Brazil assists in the health needs of approximately 30% of the country's population, of which about 14% are elderly, and is characterized by offering prepaid health plans or health insurance. These services offer the same coverage as the public sector, but have their own networks of clinics, laboratories and hospitals throughout the country. It is also noted that the elderly population that receives care from the supplementary health sector has different demographic and socioeconomic conditions in relation to income, access, education and age than the majority of the elderly Brazilian population[4].

There are few Brazilian studies focused on this sector, and for some years the country's government has been encouraging public policies aimed at this population segment and contributing to changes in the service provision model of health plan operators (HPO), which still focus their health care on illness. Thus, since 2005, the Brazilian government has been discussing programs that meet the health specificities of the elderly they serve with companies that sell health plans. The intention is to transform this model into one centered on the person and the integrated health care of the individual, with progressive implementations of health promotion and risk and disease prevention actions[5-7].

These actions, carried out in the form of programs, seek to stimulate self-care, emphasizing health education, with the main objective of preventing both the emergence of non-communicable chronic diseases (NCDs) and the triggering of such illnesses. However, there has been little progress in this field, mainly due to poor knowledge about the health of those receiving care from HPO[5-7].

The aim of the present study was to measure the quality of life and the main factors associated with the same in a group of elderly persons participating in the chronic disease prevention program of a health insurance company, in the city of São Paulo, in the state of the same name, in Brazil.

METHOD

A quantitative, descriptive, exploratory and cross-sectional study was conducted between December 2017 and August 2018 by applying the instruments to people aged 60 years of age and over, receiving care from a HPO and who participated in a program for the prevention of NCDs and their complications, in the city of Sao Paulo, Brazil.

The program to which this group of elderly participants in this study is linked is offered by the HPO and is carried out and coordinated by a multidisciplinary team, ensuring the continuous accompanying, evaluation and monitoring of participants through health indicators. The clinical management of the elderly receiving care is carried out through monthly telephone monitoring and home visits, during which the clinical status of the individuals is assessed[6,7].

Entry and adherence to this program are spontaneous, and there is a requirement of having

at least one NCD diagnosed by a doctor. There is no time limit set on remaining in the program.

The sample size of the present study was calculated within the total of the 301 elderly participants of the program. Applying the Central Limit Theorem, a sampling error of 5% and a confidence interval of 95% were considered, resulting in a representative sample of 169 elderly persons, randomly drawn from the participants of the described program. The only exclusion criterion adopted was the medical diagnosis of neuropsychiatric diseases that could prevent the elderly persons from answering the questions of the instruments, which require self-completion.

The instruments used were: a structured questionnaire to collect sociodemographic variables and health status data and the World Health Organization Quality of Life-Bref (WHOQOL-Bref) and the World Health Organization Quality of Life Assessment for Older Adults (WHOQOL-Old) instruments to measure the QoL of the elderly participants[8,9].

The structured questionnaire was designed by the researchers and addressed the sociodemographic characteristics of the researched elderly, such as: age; sex; marital and occupational status; and questions regarding health status such as: sedentary lifestyle, characterized by the absence of supervised physical activity; obesity measured by body mass index (BMI), according to the cutoff levels for age[10]; presence of degenerative chronic diseases under treatment at the time of the interview; date of last medical appointment; if the elderly had a specific referring physician and the presence or absence of hospitalizations in the previous year.

The QoL of the elderly was measured using the WHOQoL-Bref and WHQOL-Old instruments, both developed by The WHOQOL Group in 1998 and cross-culturally adapted for Brazil in 2000[8,11]. These instruments were tested in previous studies and presented satisfactory psychometric properties in the investigation of QoL in Brazilian elderly persons.

The WHOQOL-Bref, an abbreviated form of the WHOQOL-100, is composed of 26 questions, two general, related to QoL and overall health and 24 that make up the four domains: a) Physical; b) Environment; c) Psychological; and d) Social Relationships. It is used in conjunction with the WHOQOL-Old module, which consists of 24 questions assigned to six facets: a) Functioning of the Senses; b) Autonomy; c) Past Activities, d) Present and Future; e) Death and dying; and f) intimacy. The WHOQOL-Old is a specific instrument for the assessment of QoL in the elderly and should be applied in conjunction with the WHOQOL-Bref[9].

Data was collected through home visits, previously scheduled by telephone, with the contact information of the participants provided by the HPO. During the contact, the purpose of the research was explained to the elderly, making it clear that their participation was voluntary and that their non-acceptance would not interfere with the care provided by the health plan. Following this stage, the information obtained through the visits was submitted to review and codification. The collected data were stored in electronic medical records and later transferred and stored in the study database. If inconsistent data were found between the databases, corrections were made by consulting the original interview.

The answers obtained through the self-applicable instruments were consolidated with their respective syntax, with the WHOQOL-Bref domains and WHOQOL-Old facets analyzed separately. The scores were calculated using a syntax developed and recommended by The WHOQOL Group, for the *Statistical Package for Social Sciences* (SPSS®) software package. In general, each domain/facet was represented in percentage scores from zero to 100, with the highest value corresponding to a better perception of QoL[12].

Data analysis followed descriptive statistics. For the comparison between the domains/facets of the WHOQOL instruments and the variables of the two groups, presented above, the Student t test was applied. In the comparison between variables with three or more groups, analysis of variance (ANOVA) was performed. For situations where no homogeneity was found, adjustment was performed using the Brown-Forsythe Test. In multiple comparisons, the Tukey test was applied.

All results were analyzed by the SPSS software, and a criterion for determining statistical significance of 5% (p<0.05) was adopted.

The research project was approved by the Ethics Research Committee of the Pontifícia Universidade Católica de São Paulo (PUC-SP), under opinion n° 2.284.626, following the regulations of National Health Council Resolution n° 466/2012. The elderly were only contacted once this approval was obtained.

RESULTS

The sample of this study consisted of 169 elderly persons, most of whom were male (n=87; 51.5%), had a mean age of 71.6 (±8.0) years, were married and retired, as shown in Table 1. Regarding the clinical conditions and lifestyle of the elderly, the most prevalent NCD was systemic arterial hypertension, followed by type 2 diabetes mellitus. The elderly were largely sedentary, with a mean number of comorbidities of 2.4 (±1.2) NCDs, ranging from one to five diseases. It was also observed that most were assisted on a consistent basis by the same referral physician, with consultations in the previous six months. Several had a previous history of hospitalization, with more than two hospitalizations per year.

In QoL measurement, the WHOQOL-Bref domains with the highest scores were *Psychological* [M=72.1 (±14.3)] and *Environment* [M=68.0 (±15.4)], while the lowest score was *Physical* [M=64.3 (±18.0)], as shown in Table 2.

The evaluation of the two general and initial questions determined that 75% (n=127) of the elderly rated their QoL as good or very good and 63.6% (n=108) stated that they were satisfied with their health.

Regarding the WHOQOL-Old, as shown in Table 3, the facets with the best scores were: *Intimacy* [M=72.5(±20.8)] and *Sensory Functioning* [M=70.3(±20.3)], while the worst was *Death and Dying* [M=61.2(±23.2)]. The total score of the WHOQOL-Bref was higher than that of the WHOQOL-Old.

Table 1. Sociodemographic and clinical characteristics of an elderly group (N=169) receiving care from a health plan operator. São Paulo, 2018.

Variables	n (%)
Sex	
Male	87 (51.5)
Female	82 (48.5)
Age (years)	
60-70	82 (48.5)
≥71	87 (51.5)
Marital Status	
Married	109 (64.5)
Widower	36 (21.3)
Not married	21 (12.4)
Others	03 (1.8)
Occupational status	
Retired	128 (75.7)
Active	25 (14.8)
Pensioner	14 (8.3)
Economic dependent	02 (1.2)
Chronic Non-Communicative Disease	
Arterial hypertension	119 (70.4)
Diabetes *mellitus*	63 (37.3)
Cancer	42 (24.9)
Depression	13 (7.7)
Chronic pain	06 (3.6)
Obesity	42 (24.9)

to be continued

Continuation of Table 4

Variables	n (%)
Sedentarism	91 (53.8)
Comorbidities	
0-2	90 (53.2)
≥3	79 (46.7)
Has referral physician	159 (94.1)
Last doctor's appointment	
Less than six months	149 (88.2)
Between six months and one year	20 (11.8)
Hospitalization	
Never been hospitalized	61 (36.1)
Been hospitalized	108 (63.9)
Up to twice in the last year	65 (38.5)
Interned more than twice in the last year	104 (61.5)

Table 2. WHOQOL-Bref instrument scores in the group of elderly persons (N=169) receiving care from a health plan operator. São Paulo, 2018.

Domains	Mean (standard deviation)	Median	Minimum-Maximum
Physical	64.3 (±18.0)	64.3	14.3-100
Psychological	72.1 (±14.3)	75.0	25.0-100
Social relationships	67.4 (±18.8)	66.7	16.7-100
Environment	68.0 (±15.4)	68.8	31.3-100
Q1 *	75.0 (±18.4)	75.0	25.0-100
Q2 **	63.6 (±24.3)	75.0	0.0-100
Total score	67.93 (±13.5)	70.19	37.50-98.08

*Q1= WHOQOL-Bref question 1 – *How would you rate your quality of life?* **Q2= WHOQOL-Bref question 2 – *How satisfied are you with your health*?

Table 3. WHOQOL-Old instrument scores in the group of elderly persons (N=169) receiving care from a health plan operator. São Paulo, 2018.

Facets	Mean (standard-deviation)	Median	Minimum-Maximum
Sensory Functioning	70.3 (±20.3)	75.0	25.0-100
Autonomy	65.1 (±17.7)	68.8	12.5-100
Past, Present and Future Activities	66.4 (15.6)	68.8	25.0-100
Social Participation	63.8 (17.2)	68.8	18.8-100
Death and dying	61.2 (23.2)	62.5	0.0-100
Intimacy	72.5 (20.8)	75.0	0.0-100
Total score	66.5 (±11.1)	66.7	34.4-88.5

It was observed that the lowest scores were among (a) elderly persons with neoplasia in the *Social Relations* domain (p=0.042); (b) obese elderly persons in the *Social Participation* facet (p=0.025) and (c) elderly persons with previous hospitalizations in the *Physical* (p=0.001), *Psychological* (p=0.042), *Social Relations* (p=0.07) domains, total score (p=0.007) and the *Autonomy* (p=0.020), *Past, Present and Future Activities* (p=0.001), *Social Participation* (p<0.001) and *Intimacy* (p<0.001) facets, and the WHOQOL-Old total score (p<0.001).

In contrast, some factors were found with the highest scores in certain domains/facets such as: (a) female gender and the *Environment* domain (p=0.009), and the *Sensory Functioning* (p<0.001) and *Intimacy* (p=0.027) facets; (b) age range up to 70 years and the *Physical* domain (p=0.001); (c) widowers and the *Autonomy* facet (p=0.040); (d) non-retired elderly persons and the *Sensory Function* facet (p=0.010); (e) elderly persons with less than two comorbidities and the *Physical* domain (p=0.046); (f) those with hypertension and WHOQOL-Old total score (p=0.045); (g) not having depression and the *Psychological* (p<0.001), *Social Relations* (p<0.001), *Environment* (p=0.005) domains, WHOQOL-Bref total score (p<0.001), the *Past, Present and Future Activities* (p<0.001), *Social Participation* (p=0.002), and *Intimacy* (p=0.004) facets and WHOQOL-Old total score (p=0.020); (h) practice of physical activity practice and the *Physical* domain (p=0.004), the *Past, Present and Future Activities* facet (p=0.007) and WHOQOL-Old total score (p=0.026); (i) being treated by a referral physician and the *Physical* domain (p=0.002).

DISCUSSION

The elderly group surveyed was characterized by a slight predominance of male elderly persons, which differs from most groups presented in literature, where there are a majority of women in this type of program, especially in the southeast region of Brazil. Regarding the sociodemographic characteristics of the elderly linked to the Brazilian supplementary health sector, the largest coverage is concentrated in those who are married, retired and aged over 70 years, especially 80 and over, data which corroborated those found in this research[6,7,13,14].

Noncommunicable diseases and injuries (NCDs) - which encompass NCDs and violence and accidents - currently represent the major cause of demand for health services, morbidity and mortality, disability and a decrease in the QoL of the world's elderly population, accounting for 81.2% of deaths in the city of São Paulo, a proportion that has been growing every year[15-17].

NCDs or chronic degenerative diseases represent a group of diseases with a multiplicity of risk factors, the etiology of which is not fully elucidated, which develop for many years, are asymptomatic, capable of generating irreversible injuries and complications that determine varying degrees of disability and even death. Among the NCDs, which are responsible for up to 75% of São Paulo deaths, conditions such as cardiocirculatory, neoplastic and metabolic diseases stand out[14]. In the present study, a predominance of hypertension was observed, followed by diabetes mellitus, neoplasms and obesity, similar to the distribution shown in the literature, in studies with similar groups[7,16,17].

It is also known that the longer the elderly live, the greater are the number of chronic conditions and their prevalence, giving rise to the presence of comorbidities – the concomitant occurrence of two or more diseases in the same individual – a factor directly related to greater functional disability[18,19]. In the researched group, the prevalence of multiple comorbidities is notable, which, combined with the high average age, may demonstrate a higher risk of loss of autonomy and independence for these people, as highlighted in the literature[7,14,18].

It is noteworthy that these elderly persons, who are treated by a referral physician, with a predominance of consultations less than six months prior to the study, corroborate the importance of educational programs to improve adherence to treatment. Even so, more than half of the group had been hospitalized at least once in their lifetime, and nearly 62% of the elderly surveyed had been hospitalized more than twice in the last year, even though they have had regularly health appointments, a fact of concern to researchers, and which is notable in relation to the literature.

Regarding QoL, the WHOQOL-Bref domains in which the elderly people had the highest score and,

consequently, the highest level of satisfaction, were the *Psychological*, followed by the *Environment*, which differs from other studies with Brazilian elderly persons, which found higher average scores in the *Social Relationships* domain[19-23].

The performance of this group in the *Psychological* domain shows how satisfied they are regarding issues related to feelings, self-esteem, appearance, memory, concentration, spirituality and personal beliefs, in contrast to other previously studied groups that suffer from the process of adapting to senescence[21].

The *Environment* domain evaluates the environment in which the elderly are inserted, encompassing aspects related to housing conditions; socialization; transport; physical safety; recreation; financial resources and protection. It is noteworthy that in most Brazilian studies found and conducted with the elderly, this domain usually has lower scores, impairing the assessment of QoL, a finding contrary to that which was observed in the present study[20,23,24]. The fact that the elderly surveyed live in a large city and have different income and access characteristics, as already mentioned, may explain the strong performance of this group in the *Environment* domain.

In contrast, the worst performance was noted in the *Physical* domain, which also diverges from literature. It is believed that the fact that there are elderly people in the group who, in addition to already having a NCD, have comorbidities and high levels of previous hospitalizations, may explain this finding, since these are conditions that may limit their performance of activities of daily living with an impact on QoL[18,22].

Regarding the two general questions of WHOQOL-Bref, it was found that most of the elderly were satisfied or very satisfied with their health, also presenting a good perception of overall QoL. This result shows that most of the elderly in this group have a positive perception of their QoL and their health condition, up to the time of the interview.

The analysis of the facets of the WHOQOL-Old instrument found a higher mean score in the *Intimacy* facet and a lower mean score for *Death and Dying*. It is noteworthy that, although the results found in this study are compatible with those found in other studies conducted with elderly patients with NCDs, the average scores obtained by the elderly in this group are higher than those described in the literature[21,23]. The strong performance in the *Intimacy* facet can be explained by satisfaction with their coexistence and intimate relationships with their partners and those around them, given the predominance of married elderly persons living with their families. On the other hand, it is noted that there is a difficulty in accepting the process of death and dying in this group.

When analyzing which sociodemographic and clinical aspects are significantly associated with the QoL of the elderly in this study, some differences were observed in relation to other Brazilian studies aimed at measuring this construct in the elderly[2,3,18-20,24].

Regarding gender, women in the surveyed group performed better than men in the *Environment* domain, the *Sensory Functioning* and the *Intimacy* facets, while widowed elderly performed better in the *Autonomy* facet. Both findings differ from the literature. Most studies find that women are more dissatisfied with their QoL in these domains, mainly related to the influences of psychosocial factors derived from the traditional role of women, highly present in the cohort of people today considered elderly[18,24]. It is noteworthy that the women in the researched group have their own characteristics that differentiate them from the majority of the Brazilian female elderly population: 52 (63%) had a high educational level, with complete high school or higher educations, which is not characteristically observed in Brazilian elderly women. This condition may have influenced these results[1].

Elderly persons who live without a partner and who have suffered significant losses during life tend to have less contact with family and friends, a low frequency of help received and provided, and resilience is not always observed in the process of loss and control of their autonomy, as found in this study group[18,24].

The data for the relationship between young elderly persons, under 70 years old, and the *Physical* domain was not reported by other studies[3,20]. This finding can be attributed to the lower number of comorbidities

and the degree of preservation of autonomy among these elderly persons, when compared to the older elderly persons in the group. The same applies to the relationship between non-retired elderly persons and the *Sensory Functioning* facet.

It can be inferred that for this group of elderly persons, widowhood, age and work seem to be protective factors that positively influence QoL, along with having less than two comorbidities, not having depression and being treated by a referral physician. The presence of chronic conditions, especially NCDs significantly affect the QoL of the elderly, but when these are diagnosed early, properly treated and preventive measures are instituted, with the encouragement of self-care and the prevention of systemic complications resulting from these diseases, the independence and autonomy of the elderly are preserved[18-20,24].

It is also noteworthy that higher levels of continuity of care, in any setting, with any group of people, involving both primary care physicians and specialists, are associated with lower rates of mortality. Continuity of care is associated with people with a physician who is more aware of such issues, the individualization of care received by the individual and the understanding of their needs, which may explain the finding in the present study[25].

In this study, there was also a positive influence between the regular practice of physical activities and QoL. As reported in other studies, it is known that physical activity is a measure that can delay functional losses and prevent possible negative and unwanted outcomes[2,20].

In this study, the presence of cancer and obesity were two characteristics negatively associated with both facets and domains related to social participation, bonds and affections, highlighting the difficulty of this group in participating in social activities and the need for affective support for these people.

The presence of a previous history of hospitalization was another association that affected, greatly and negatively, the QoL of these elderly people. During hospitalization, the elderly may evolve through a loss of functionality, also conceptualized as a hospital acquired infection (HAI), due to numerous factors: progression of the clinical condition; underlying previous diseases; the procedures to which they are submitted; difficulty in adapting to aging and frailty[26]. But in the hospital environment, loneliness, fear of death and other psychosocial issues also influence the elderly not only during the act, but even after discharge, as shown by the responses of this group.

The presence of a previous history of hospitalization was found. The results obtained in this study show significant factors in the assessment of QoL of a group of elderly persons receiving care from the Brazilian supplementary health sector, in the city of São Paulo, regarding sociodemographic, clinical and lifestyle aspects. However, these results should be interpreted with caution due to the particularities of the study group. In addition, the cross-sectional design of the study does not allow causal relationships to be established. Another limitation relates to the characteristics of the WHOQOL instruments used, as they are self-reporting instruments, and therefore subject to response bias.

CONCLUSION

The researched group had the best quality of life in the *Psychological* and *Environment* domains and in the *Intimacy* and *Sensory Functioning* facets. The group reported a high level of satisfaction with their health and overall quality of life. On the other hand, the elderly had a worse perception in the *Physical* domain and in the *Death and Dying* facet.

It was also noted that the female gender, widowhood, age, work, having less than two comorbidities, not having depression, being treated by a referral physician and practicing physical activity seem to be protective factors that positively influence the quality of life of this group. However, previous hospitalizations and the presence of obesity and cancer generate stress factors, negatively influencing the quality of life of this group of people.

It must be emphasized that the results of this study should be used and interpreted with caution, as they portray a differentiated group in terms of income,

education, access to health services and treatment and who live in a more accessible environment.

The results of the present study raise important discussions about predictors that influence the quality of life of the elderly receiving care through the supplementary health sector and indicate the need for policies and action strategies that ensure improvements in care for the elderly in all their specificities and diversity.

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Relationship of ventilatory inefficiency and low cardiorespiratory fitness in the elderly: a retrospective observational study

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Abstract

Objectives: To check if ventilatory inefficiency is related to low cardiorespiratory fitness in the elderly and to identify the variable(s) of the cardiopulmonary exercise test (CPET) best suited to determining this relationship. *Methods:* A retrospective analysis of 1357 CPETs was performed. Sixty-one subjects over 60 years old with a ventilatory efficiency slope (VE/VCO_2) index >35 were selected and divided into two groups: low cardiorespiratory fitness (VO2<80% predicted) (n=22) and normal cardiorespiratory fitness (VO2>80% predicted) (n=39) and were compared with a control group of healthy elderly persons with normal cardiorespiratory fitness and VE/VCO_2 slope index <35 (n=16), matched by gender, weight, height, and age. *Results:* Oxygen consumption had a low correlation with VE/VCO_2 slope (r= -0.35, p<0.01), a moderate correlation with the cardiorespiratory optimal point (COP) (r= -0.59, p<0.001) and a strong correlation with oxygen uptake efficiency Slope (OUES) =0.92, p<0.0001). In relation to the ROC curve, the VE/VCO_2 slope presented an area under the curve of 0.65, but without statistical significance (p> 0.05); the COP showed an area under the curve of 0.84 (p <0.0001) and the OUES presented an area under the curve of 0.81 (p<0.0001). *Conclusion:* Ventilatory inefficiency is related to poor cardiorespiratory fitness in the elderly. The COP and OUES were more accurate at predicting low cardiorespiratory fitness.

Keywords: Efficiency. Pulmonary Ventilation. Ventilation-Perfusion Ratio. Cardiorespiratory Fitness. Exercise Test.

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INTRODUCTION

With senility, the respiratory system undergoes anatomical and physiological changes that directly impact the ventilation/pulmonary perfusion relationship. The pulmonary parenchyma loses its structural support[1]. Changes in the connective tissue increase chest stiffness and reduce the elastic component of the lungs, directly influencing respiratory mechanics[2]. There is also an increase in physiological dead space, which promotes an increase in "ventilatory waste".

Ventilatory inefficiency arises when the parts of the respiratory system responsible for gas exchange do not function properly[3]. This malfunction can be caused either by changes in pulmonary circulation (perfusion disorders) or by changes in the airways and alveoli (ventilation disorders), alone or in combination, causing a failure in the ventilation/perfusion ratio.

The integrated assessment of cardiorespiratory responses during exercise provides important information on ventilatory efficiency[4]. The Cardiopulmonary Exercise Test (CPET) enables this analysis and provides several variables[5]. Classically the most used variable for analysis of ventilatory efficiency is the variation of ventilation through changes in carbon dioxide production (VE/VCO_2 slope)[6], which can be considered the gold standard for this type of assessment in pathological situations[9]. Other variables are used for this analysis, such as the variation in oxygen consumption efficiency - Oxygen Uptake Efficiency Slope (OUES)[7,8] and the Cardiorespiratory Optimal Point (COP)[10] (a better ventilation/oxygen consumption relationship), and are also highly relevant.

Currently, cardiorespiratory fitness is considered a vital sign[11] and, in pathological models, ventilatory inefficiency is related to low values of cardiorespiratory fitness (oxygen consumption)[12]. With advancing age, a physiological reduction of maximal oxygen consumption is expected, but relatively common pathological situations in the elderly (chronic obstructive pulmonary disease and heart failure) promote a greater reduction of oxygen consumption[13,14].

Due to the physiological changes of the aging process in the respiratory system, this study aimed to verify if ventilatory inefficiency is related to poor cardiorespiratory fitness in the elderly. The secondary objective was to identify which CPET variables were most effective at determining this relationship.

METHODS

A cross-sectional study based on a retrospective analysis of 1357 CPETs was carried out. All CPETs were performed by a single examiner with expertise in the examination. The analysis was performed using data obtained from a cardiopulmonary assessment clinic from April 2012 to August 2016.

Therefore, exams that met the following inclusion criteria were selected: age over 60 years; VE/VCO_2 slope >35 and absence of locomotor limitations that hindered the test. The VE/VCO_2 slope variable was used for screening of the elderly as it is a gold standard measure of ventilatory efficiency. Examinations of people who presented any report of locomotor limitation were excluded from the analysis.

Sixty-one elderly individuals were divided into two groups: low cardiorespiratory fitness (VO_2<80% of predicted)[15] (n=22) and normal cardiorespiratory fitness (VO_2>80% of predicted) (n=39) and were compared with a group of healthy elderly persons with normal cardiorespiratory fitness and VE/VCO_2 slope <35 (n=16), matched for gender, weight, height and age. The elderly selected were asked about their history (self-reported) of cardiopulmonary diseases (eg: chronic obstructive pulmonary disease, pulmonary fibrosis, heart failure, pulmonary hypertension…) and underwent an anthropometric assessment followed by the Cardiopulmonary Exercise Test.

The technical procedures followed the guidelines of the American Thoracic Society/American College of Chest Physicians[16] for cycle ergometer testing. The examinations were performed on an electromagnetic braking cycle ergometer (Inbrasport CG-04 model; INBRAMED, Porto Alegre, Brazil). Each individual performed a ramp protocol up to the maximum tolerance limit, starting with

no load and with an individually selected load increment rate (5-20 W/min). Subjects were strongly encouraged to reach their maximum effort through verbal stimuli. For gas analysis a VO2000 model analyzer (MedGraphics, St. Paul, USA) was used, calibrated before each examination according to the manufacturer's instructions. Data were collected through the (ErgoMet 13 model software (HW, Belo Horizonte, Brazil).

The reports of cardiopulmonary diseases was recorded in absolute and percentage values. Through the CPET data, the following variables were analyzed: respiratory workload (RW), oxygen consumption (VO_2), maximum ventilation (VE), oxygen pulse (PuO_2), heart rate (HR), ventilatory oxygen and carbon dioxide equivalents (VE/VO_2 and VE/VCO_2), ventilatory efficiency index (VE/VCO_2 slope), cardiorespiratory optimal point (COP) and oxygen uptake efficiency slope (OUES). Data were collected every 10 seconds of the ramp protocol. After collection, the data were adjusted by a filter (mean of seven points) to avoid noise.

The normality and homogeneity of the sample were analyzed by the Shapiro-Wilk and Levene tests, respectively. To evaluate the differences between the measures, one-way ANOVA with Tukey post hoc was used. Inter and intra group differences were analyzed by two-way ANOVA with Tukey post hoc. The correlation of variables was tested using Pearson and Spearman correlations. The sensitivity and specificity of the variables for determining low cardiorespiratory fitness were observed by receiver operating characteristic (ROC) curve analysis. Statistical significance was accepted with a value of $p<0.05$.

The study complied with the norms of National Health Council resolution 466/12, and was submitted to an ethics research committee under opinion number 2.319.091.

RESULTS

The elderly evaluated had a mean age of 68±6 years. A total of 95% (21 of 22) of the elderly in the low cardiorespiratory fitness group and 8% (three of 39) of those in the normal cardiorespiratory fitness group reported the presence of cardiopulmonary disease. The matching variables: age, weight, height, body mass index and sex presented similar values in relation to the three groups ($p>0.05$) (Table 1). The group with low cardiorespiratory fitness presented lower values of oxygen consumption, oxygen pulse and workload ($p<0.01$). The normal cardiorespiratory fitness group had a higher maximum ventilation than the other groups ($p<0.01$). Heart rate at peak exercise did not differ in the three groups ($p>0.05$) (Table 2).

Table 1. Anthropometric characteristics of individuals studied (N=77). João Pessoa, Paraíba, 2016.

	Low Fitness (n=22) Mean ± sd	Normal Fitness (n=39) Mean ± sd	Control (n=16) Mean ± sd	*p* value
Age (years)	71 ± 7	68 ± 5	68 ± 6	>0.05
Weight (kg)	74 ± 17	70 ± 13	68 ± 9	>0.05
Height (cm)	161 ± 7	161 ± 8	162 ± 7	>0.05
BMI	28 ± 6	27 ± 5	26 ± 2	>0.05
Sex (M/F)	12(51%) / 10(49%)	19(48%) / 20(52%)	7(49%) / 9(51%)	-

BMI: body mass index. $p>0.05$ intergroup comparison. ANOVA *one-way with* Tukey *post hoc.*

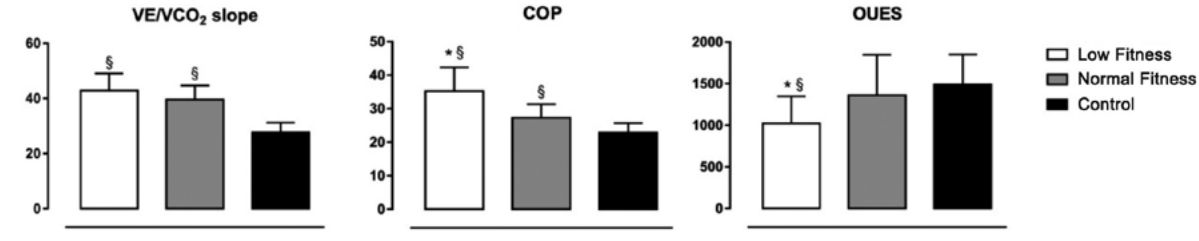
Table 2. Basic exercise data. João Pessoa, Paraíba, 2016.

	Low Fitness (n = 22) Mean ± sd	Normal Fitness (n = 39) Mean ± sd	Control (n = 16) Mean ± sd	*p* value
Oxygen consumption (L/min)	0.86 ± 0.3[a]	1.36 ± 0.4	1.39 ± 0.3	<0.01
Oxygen consumption (% pred)	59 ± 10[a]	101 ± 15	101 ± 11	<0.01
Oxygen pulse (mL/sis/min)	6 ± 2[a]	10 ± 2	10 ± 2	<0.01
Oxygen pulse (% pred)	64 ± 9[a]	110 ± 18	107 ± 16	<0.01
Maximum ventilation (L/min)	39 ±13	53 ± 17[b]	44 ± 10	<0.01
Workload (w)	75 ± 37[a]	115 ± 47	113 ± 37	<0.01
HR peak effort (b/min)	134 ± 17	137 ± 14	140 ± 13	>0.05

HR: heart rate; [a]p<0.01 compared to normal fitness group and control; [b]p<0.01 compared to the low fitness and control group; p>0.05 intergroup comparison; ANOVA *one-way* with Tukey *post hoc*.

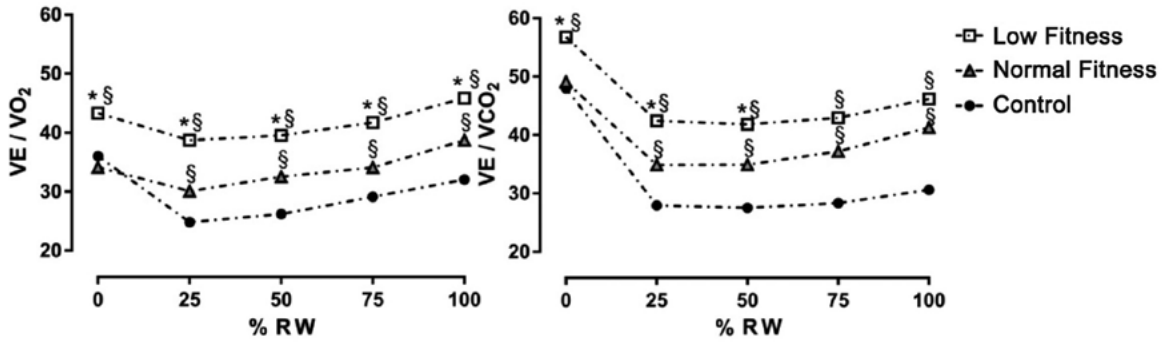
As shown in Figure 1, the groups showed varying behaviors regarding the ventilatory efficiency variables. The elderly with low cardiorespiratory fitness did not have different VE/VCO_2 slope values from the elderly with normal cardiorespiratory fitness (p>0.05). Both presented values above those observed in the control group (p<0.0001). The elderly with low cardiorespiratory fitness had higher COP values than the elderly with normal cardiorespiratory fitness and the control group (p<0.0001). There were differences between the COP of the group with normal cardiorespiratory fitness and the control group (p<0.01). In relation to OUES, the elderly with low cardiorespiratory fitness presented significantly lower values than the elderly with normal cardiorespiratory fitness and the control group (p<0.0001). There were no differences between those with normal cardiorespiratory fitness and the control group (p>0.05).

Regarding ventilatory oxygen equivalents, the elderly with low cardiorespiratory fitness presented higher values than those seen in the elderly with normal cardiorespiratory fitness and in the control group at all workloads (p<0.0001). The elderly with normal fitness presented higher values than the control group at 25%, 50%, 75% and 100% of the workload (Figure 2). Regarding the ventilatory equivalents of carbon dioxide, the elderly with low cardiorespiratory fitness presented higher values than those seen in the elderly with normal cardiorespiratory fitness and in the control group at 0%, 25% and 50% of workload (p<0.0001). At 75% and 100% of the workload there were no differences compared to the group with normal cardiorespiratory fitness (p>0.05). The elderly with normal cardiorespiratory fitness presented values above the control group at 25%, 50%, 75% and 100% of the workload (Figure 2).



VE/VCO_2 slope: ventilatory efficiency index; COP: cardiorespiratory optimal point; OUES: oxygen uptake efficiency slope; *p<0.01 compared to the normal cardiorespiratory fitness group; § p<0.01 compared to control group.

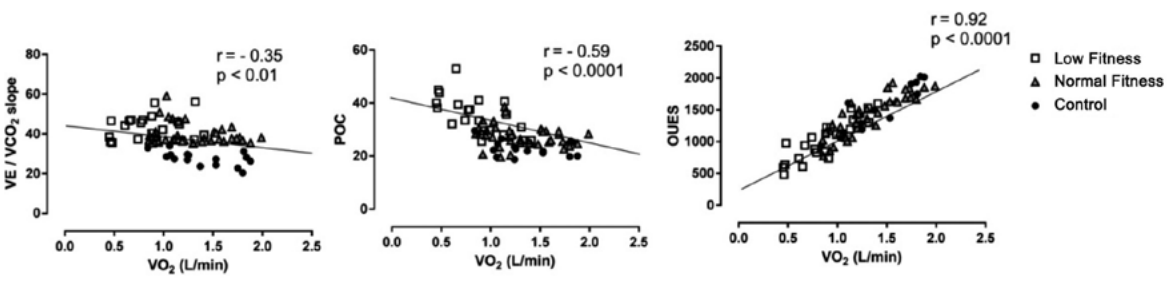
Figure 1. Behavior of ventilatory efficiency variables.



VE/VO_2: ventilatory equivalent of oxygen; VE / VCO2: ventilatory equivalent of carbon dioxide; RW: respiratory workload; *p<0.01 compared to normal cardiorespiratory fitness group; §p<0.01 compared to control group.

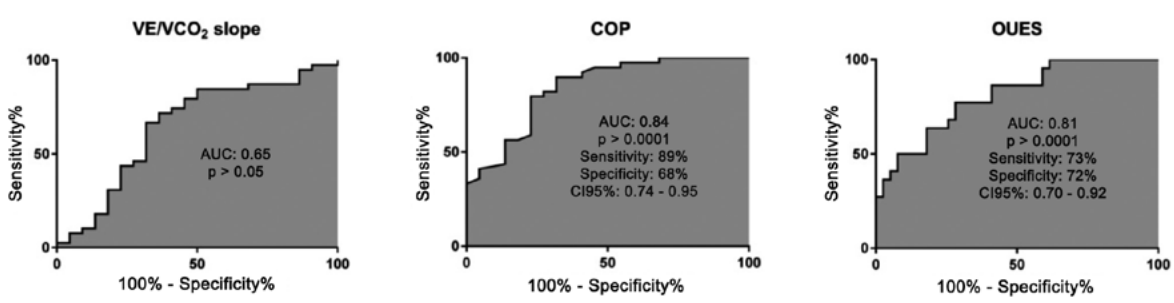
Figure 2. Oxygen and carbon dioxide ventilatory equivalents.

Oxygen consumption had a low correlation with VE/VCO_2 slope, a moderate correlation with COP and a strong correlation with OUES (Figure 3). Regarding the ROC curve to predict low cardiorespiratory fitness, the VE/VCO_2 slope presented an area under the curve with no statistical significance. (p>0.05). The COP presented an area under the curve of 0.84 (p <0.0001), with a value of 31 as the best point for sensitivity and specificity. The OUES presented an area under the curve of 0.81 (p<0.0001) with a value of 1224 as the best point of sensitivity and specificity (Figure 4).



VE/VCO_2 slope: ventilatory efficiency index; COP: cardiorespiratory optimal point; OUES: oxygen uptake efficiency slope.

Figure 3. Correlation between ventilatory efficiency variables and VO_2.



VE/VCO2 slope: ventilatory efficiency index; COP: cardiorespiratory optimal point; OUES: oxygen uptake efficiency slope.; AUC: area under the curve. CI: confidence interval

Figure 4. Accuracy of ventilatory efficiency variables in predicting low cardiorespiratory fitness.

DISCUSSION

The present study demonstrated that VE/VCO_2 slope is not necessarily associated with poor cardiorespiratory fitness in the elderly, but that increased COP and reduced OUES are associated with poor cardiorespiratory fitness in this population. These ventilatory efficiency variables, COP and OUES, demonstrated higher sensitivity and specificity for the prediction of low cardiorespiratory fitness in the elderly.

Ventilatory inefficiency is generally associated with unfavorable clinical outcomes (increased morbidity and mortality). Traditionally, the VE/VCO_2 slope variable is the most commonly used for this analysis. In pathological models, elevated VE/VCO_2 slope is related to pulmonary hypertension[18], low cardiorespiratory fitness[13,19] and increased mortality[20,21].

Despite this, the presence of elevated VE/VCO_2 slope with normal cardiorespiratory fitness has been reported. Guazzi et al.[17] analyzed 100 heart failure patients and found no correlation between elevated VE/VCO_2 slope and VO_2. Thirty-five percent of the patients analyzed had normal cardiorespiratory fitness, which corroborates the findings of this research. In the elderly evaluated in this study, the VE/VCO_2 slope was also unable to predict low cardiorespiratory fitness.

Typical ventilatory equivalent behavior describes a parabola-shaped graph[22]. The smaller this parabola, the worse the ventilatory efficiency. In this study, the elderly with the lowest parabola were those with low cardiorespiratory fitness.

In theory, the moment in which COP occurs (lower VE/VO_2 value) corresponds to the best ventilation/perfusion ratio, i.e., it represents the maximum integration between the respiratory and cardiovascular systems[10]. COP is practically detected and occurs at relatively low exertion intensities (30-50% VO_2 peak). High COP values indicate ventilatory inefficiency, as there is increased ventilation for the consumption of one liter of oxygen. In the elderly persons evaluated in the present study, a correlation was observed between ventilatory inefficiency, due to increased COP, and low cardiorespiratory fitness. In addition, COP exhibited good sensitivity and specificity for the prediction of low cardiorespiratory fitness. In a retrospective study with 3331 CPETs, including healthy and chronically ill individuals, Ramos and Araújo[23] also showed that subjects with high COP values had lower cardiorespiratory fitness and higher mortality.

Like COP, OUES does not require maximum effort to be determined. It reflects the relationship between oxygen uptake and total ventilation during incremental exercise and is well described by a single exponential function. Logarithmic regression is linear in almost all individuals, so it does not require maximum effort to be estimated[7]. OUES has excellent test/retest reliability and can serve as a complementary or alternative measure of cardiorespiratory fitness[24]. This is particularly important for individuals who have difficulty performing maximal effort, such as the elderly. Recently, Dougherty et al.[25] determined the effective accuracy of OUES for the prediction of cardiorespiratory fitness in this specific population, which is in line with the data presented in this research.

The present study had some limitations. A limiting factor was the absence of data on pulmonary artery pressure in the elderly, which is a variable directly related to markers of ventilatory efficiency. Other limiting factors were inherent to the retrospective analysis itself, such as the sample quantity (limited to exams already performed and which cannot be increased).

CONCLUSION

Ventilatory inefficiency is only related to poor cardiorespiratory fitness in the elderly when measured by the cardiorespiratory optimal point (COP) and oxygen uptake efficiency slope (OUES). These variables were more accurate for predicting such low cardiorespiratory fitness. Because they are submaximal measurements, they are excellent markers of cardiorespiratory fitness for the elderly, a population that often has limitations in performing the maximal exercise test.

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