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Technologies adopted to prevent falls among the elderly in communities: An integrative review

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ABSTRACT

Objective: Explore the scientific evidence on the use of technologies to prevent the risk of falls in the elderly in the community. Methodology: Integrative literature review in PubMed, Latin American and Caribbean Literature in Health Sciences and Scientific Electronic Library Online. To integrate the review, the studies needed to respond to 70% of the statements in the review checklist, to validate the quality of the manuscript. Results: 18 studies were identified, which showed the use of health technologies to mitigate the risk of falls, external and internal risk factors for the occurrence of falls and knowledge about falls as a preventive measure. Conclusions: The use of technologies allows the identification of risk factors for falls and can support the multidisciplinary planning of care based on the individualities of the elderly.

Keywords: Health of the Elderly; Accident Prevention; Accidental Falls; Biomedical Technology.

1 INTRODUCTION

Population aging has become a worldwide phenomenon. In Brazil, according to the United Nations, it is estimated that in 2030 about 12.0% of the Brazilian population will be in the age group between 60 and 80 years, and in 2100 this percentage will rise to 31.3%[1]. In this scope, the senescence that is characteristic of senile aging, causes several morphofunctional changes, such as the reduction of muscle strength and fat-free mass, the decrease in bone mass, the increase in fat deposits and the

impairment of the metabolic picture, which can cause important damages to the dependence in the performance of activities of daily living, Less autonomy and health impairment [2].

With aging, the decrease in functional capacity may corroborate with the increased risk of falls in the elderly, due to the loss of postural balance and correlates with the sudden incapacity of the neural and orthoarticular mechanisms involved in the postural conservation of the body, which tend to decrease over the years [(3)]. The presentation of decline in motor capacity may restrict the autonomy and independence of the individual; however, it cannot be attributed to the inherent characteristics of senescence, but rather to the presence of functional disability[2].

The concept of functional capacity is defined as the individual's ability to perform daily practices and self-care activities independently, without external help [(4).] In vogue to the functional capacity of the elderly, the stimulus to perform body practices and periodic physical activities leads to greater disposition, well-being, and autonomy to the individual, in addition to reducing the incidence of pathologies such as osteoporosis, diabetes, depression and certain types of cardiac risks5.

In the projection of population aging, scientific and technological advances that guarantee greater survival to the population stand out; However, providing the active aging of the population is still one of the great challenges in the health area for researchers and professionals1,2.

Faced with the challenges of primary health care in promoting actions of prevention, promotion, protection and recovery of the health of the elderly population, Ordinance No. 2,528 was established on October 19, 2006, which approved the National Health Policy for the Elderly, with the aim of providing the development of actions aimed at promoting active and healthy aging. Among the purposes of this proposal, actions to mitigate falls in people in this age group 6 stand out.

It is noteworthy that in the planning of fall prevention actions, the act of falling is characterized as a multifactorial event, outlining a high complexity of monitoring. Therefore, the assessment of the risk of falls is evidenced as one of the resources with greater efficiency in its prevention7. Thus, the use of health technologies contributes to greater adherence to prevention measures in the health care network, assisting professionals in the procedures of screening comorbidities and detecting the risk of falls in the elderly8.

From the perspective of population aging and the relationship between the occurrence of falls in the elderly, it is essential to highlight the methods adopted to prevent the risk of falls in the community scenario. Thus, this study aimed to explore the scientific evidence on the use of technologies to prevent the risk of falls of the elderly in the community.

2 METHOD

The methodological strategy adopted was the Integrative Literature Review (RIL), In the construction of the RIL, the following steps were performed: (1) Selection of the

hypothesis/elaboration of the research question; (2) Literature search of primary studies or sampling (definition of databases, establishment of inclusion and exclusion criteria, descriptors); (3) Data extraction from primary studies; (4) evaluation of the articles included; (5) categorization of studies and interpretation of results and synthesis of knowledge and (6) presentation of the review[9].

The RIL stages were held from April 2020 to May 2020. To elaborate the guiding question, the Population, Concept and Context (PCC) strategy was used. In this scope, the mnemonic was constituted in "Population", presented by the elderly; in the "Context", represented by the prevention of falls in communities and; the "Concept", referred to by the presentation of the technologies adopted for the prevention of falls, evidencing the question "What are the technologies adopted to prevent the risk of falls of the elderly in communities?".

The databases used to search for the articles were: PubMed, Latin American and Caribbean Literature in Health Sciences (LILACS) and *Scientific Electronic Library Online* (SciELO). The following descriptors were used: Health of the Elderly; Accidents due to falls; Accident Prevention. In *PubMed, the* following descriptors were used: *Health of the Elderly; Accidental Falls; Accident Prevention*. The descriptors were combined with the use of the Boolean operator "and".

As inclusion criteria, publications with free availability and in full were listed; articles written in languages Portuguese, English or Spanish; published between the years 2013 to 2020. Review articles, studies with publication of partial results and duplicate databases were excluded. This time frame is justified due to the publication of Ordinance No. 529 by the Ministry of Health in 2013, which established the National Patient Safety Program (PNSP) and safety strategies in Brazilian health facilities, including the prevention of falls10.

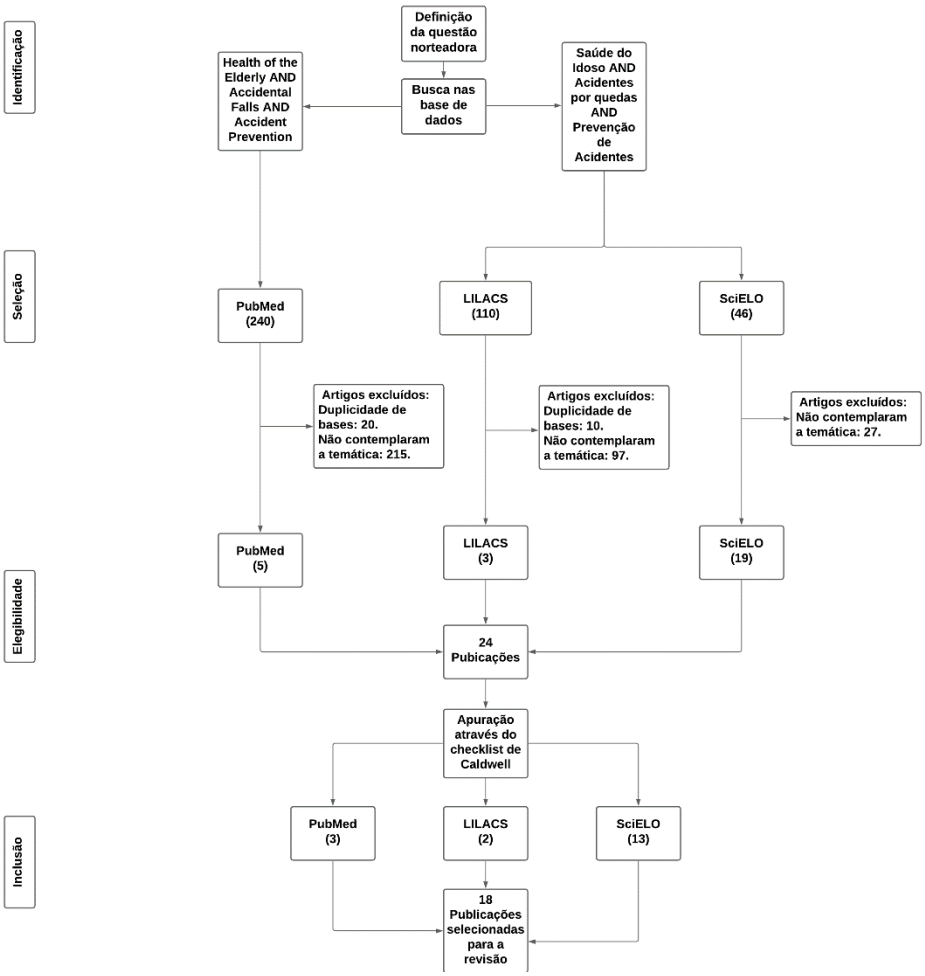
In the organization and extraction of the data, the adapted collection instrument proposed by Ursi and Galvão11 was used, containing: identification (title of the article, title of the journal, authors, country, language, year of publication), type of publication, methodological characteristics of the study, objective of the study, interventions performed, results, conclusions, limitations or biases. To integrate the review, the selected studies responded to 70% of the assertions of the *checklist12* adopted to analyze the quality of the productions, which includes questions such as: the title study reflects the content; the authors of the manuscript are reliable; the justification for conducting the research is clearly outlined; the literature review is comprehensive and up-to-date; the objective of the research is clearly indicated; all ethical issues are identified and Addressed; The methodology is identified and justified. In the organization and extraction of the data, a descriptive analysis of the selected studies was used, through the strategy Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA), being a search flowchart based on the recommendations in the check-list13.

This study does not require submission to the Ethics Committee on Research involving Human Beings, because it involves the use of secondary databases in the public domain.

3 FINDINGS

The search process in the databases showed 240 articles in PubMed, 110 in LILACS and 46 in SciELO, resulting in 396 publications that, from the application of the inclusion and exclusion criteria, and the use of the *proposed check-list*, resulted in a set of 18 publications, as shown in Figure 1.

Figure 1 – Flowchart of the selection of studies according to databases, Paranavaí-PR, Brazil, 2020.



Source: Adaptation of the PRISMA flowchart.

Chart 1 shows the main information extracted from the articles. Regarding language, all articles (n=18) were published in Brazil. Regarding the type of research, it was found that thirteen were of quantitative approach, with only one of the publications using qualitative method.

Table 1. Identification of studies included in RIL (n=18), Paranavaí, Paraná, Brazil, 2020

Article title	**Journal title/ Authors/ Year of publication/ Country.**	**Objective of the study**	**Method (Type of study)**
Construction and content validity of an instrument for the evaluation of falls in the elderly.	Einstein (São Paulo) /SILVEIRA et al./ 201814 / Brazil.	Develop and validate the content of the *online Questionnaire* for Assessment of the Risk of Falls in the Elderly.	A methodological study of the construction of the instrument was based on the International Classification of Functioning, Disability and Health (ICF). It was applied to 854 elderly people

			in Alfenas, Minas Gerais. (quantitative)
Caregiver of the elderly: knowledge, attitudes and practices about falls and their prevention.	Rev. Bras. Sick. /MAMANI et al./ 201915/ Brazil.	To investigate the knowledge, attitudes and practices of informal caregivers of the elderly about falls and their prevention.	This is a descriptive cross-sectional study conducted with 97 informal caregivers of elderly residents in the areas covered by five Family Health Strategy (FHS) Units in the city of Cuiabá. (quantitative)
Effectiveness of a multiple intervention for the prevention of falls in elderly participants of a University Open to the Third Age.	Rev. Bras. Geriatr. Gerontol. / SILVA et al./201916/ Brazil.	To evaluate the effectiveness of a multiple intervention for the prevention of falls in elderly participants of a University Open to the Third Age (UnATI).	This is a quasi-experimental, uncontrolled, longitudinal study conducted with 69 elderly people enrolled in UnATI. (quantitative)
Factors associated with falls in the elderly with cataracts.	Ciênc. Collective Health / PAZ et al./ 201817/ Brazil.	To evaluate the factors associated with falls in community-dwelling elderly with a diagnosis of cataracts.	This is a cross-sectional and analytical study conducted with 142 community-dwelling elderly, recruited through active search in active and healthy aging programs in the city of Ceilândia and in ophthalmology services of two public hospitals in the Federal District. (quantitative)
Gerontotechnology for fall prevention of the elderly with Parkinson's	Rev. Bras. Sick. /FERREIRA et al./ 201918/ Brazil.	To develop gerontological nursing care for the elderly with Parkinson's disease, aiming at health promotion through the creation of gerontotechnologies for fall prevention.	Convergent Care Research, which included the participation of nine elderly people with Parkinson's disease. (qualitative)
Incidence and predictive factors of falls in the elderly in the community: a longitudinal study	Ciênc. Collective Health / SOUZA et al./ 201919/ Brazil.	This study aimed to estimate the incidence of falls among the elderly and determine the predictive factors of recurrent falls.	Longitudinal study (2014-2016) conducted with 345 elderly people from the urban area in Uberaba-MG. (quantitative)
Perception of falls and exposure of the elderly to household risk factors	Ciênc. Collective Health /CHEHUEN NETO et al./201820/ Brazil.	The objective of this article is to describe the perception of falls among the elderly living in the community; measure the exposure of these individuals to related household risk factors.	This is a cross-sectional, quantitative study conducted in Juiz de Fora, Minas Gerais. (quantitative)

Falls in non-institutionalized elderly in the north of Minas Gerais: prevalence and associated factors.	Rev. Bras. Geriatr. Gerontol. CARNEIRO et al./ 2016[21]/ Brazil.	To estimate the prevalence of falls and associated factors in non-institutionalized elderly.	Cross-sectional study with a population-based sample of 683 non-institutionalized elderly in a city in the north of Minas Gerais (quantitative)
Relationship of falls in the elderly and the components of frailty.	Rev.Bras. epidemiol. /DUARTE et al./ 201822/ Brazil.	To assess whether the occurrence of falls in the year prior to the interview is associated with the components of frailty after a period of four years.	This is an exploratory, retrospective study conducted in 2006 and 2010 with a sample of 1,207 elderly people from the city of São Paulo. (quantitative)
Balance and functional mobility tests in the prediction and prevention of fall risks in the elderly.	Rev. Bras. Geriatr. Gerontol. /CASTRO et al./ 201523/ Brazil.	To evaluate the occurrence of falls and their associated factors and to identify the cutoff points of balance and functional mobility tests most appropriate to identify active elderly in the community at risk of falls.	Cross-sectional study composed of 127 active elderly in the community of Itabira-MG. (quantitative)
Validation of the Fall Risk Screening Tool (FRRISque) in elderly people living in the community	Ciênc. Collective Health / CHINI et al./ 201924/ Brazil.	Validate the Fall Risk Screening Tool (FRRISque) in elderly people living in the community.	A cross-sectional evaluative screening study was conducted. The sample consisted of 854 elderly people. (quantitative)
Frequency and factors associated with falls in adults aged 55 years and over.	Rev. of Public Health. / PRATO et al./ 201725/ Brazil.	To analyze the frequency and factors associated with the occurrence of falls in adults aged 55 years or older	This study was carried out in another population-based study, with a representative sample of 404 individuals aged 40 years or more in the urban area of Cambé, Paraná, in 2011. (quantitative)
Evaluation of risk factors that contribute to falls in the elderly.	Rev. Bras. Geriatr. Gerontol./ ALVES et al./201726/ Brazil.	To describe the incidence of falls in the elderly in the city of Barbacena, MG, with its causal factors, circumstances and consequences.	This is a cross-sectional study conducted by applying questionnaires to 206 patients over 60 years of age in the city of Barbacena, MG. (quantitative)
Falls in the elderly: evaluation of risk factors	Nursing (São Paulo). /SARDINE; CANTANHÊDE/ 20187/ Brazil.	To evaluate risk factors associated with falls in the elderly.	This is a descriptive, cross-sectional study conducted at the health center of liberdade in Maranhão, with 228 elderly people (quantitative)
Prevalence of fall risk and associated factors in community-dwelling elderly	Rev. Bras. Geriatr. Gerontol. /FIORITTO; CROSS; LEITE [27]/2020/ Brazil.	Estimate the prevalence of fall risk and associated factors	Cross-sectional study with 339 community-dwelling elderly living in Juiz de Fora, MG. (quantitative)

Ballroom dancing in the prevention of falls in the elderly: a case-control study	Cuidarte/ PAIVA Magazine; LOURES; MARINHO [28]/ 2019/ Brazil.	To evaluate the practice of ballroom dancing in the prevention of falls in the elderly.	This is a case-control study with 90 elderly people from a Primary Health Care Unit enrolled in the Family Health Strategy. (quantitative)
Association between symptoms of insomnia, daytime nap and falls in community elders	Cad. Public Health/ PEREIRA; CEOLIM; NERI [29]/2013/ Brazil.	To analyze associations between insomnia symptoms, daytime naps and the occurrence of falls in elderly residents in the community.	This is a cross-sectional population-based study with a probabilistic sample involving 689 elderly people from the community of Campinas, São Paulo. (quantitative)
Falls among the elderly: predictors and spatial distribution.	Rev. Salud Pública/ SOUSA et al [30]/ 2019/ Brazil.	To calculate the prevalence of falls in the last 12 months among the elderly in the Community.	Cross-sectional study conducted with 612 elderly people living in the urban area of Uberaba. (quantitative)

Source: Own elaboration.

Chart 2 shows the information regarding the use of technology in the health area, grouping related information, the strategies for preventing falls in the elderly, the classification of technologies and the main results of the inclusion of the technological resource.

Table 2 – Summary of the fall prevention strategy, technology used and main results evidenced in the studies included in the RIL (n=18).

Fall Prevention Strategies for the Elderly	**Classification of the technology employed**	**Main Findings**
Online Questionnaire for Risk Assessment of Falls in the Elderly.	Light-hard technology.	The values of the Content Validity Coefficient were satisfactory, both for the clarity (CVCt=0.76) and for the pertinence (CVCt=0.82) of the questions. The questionnaire was considered easy to understand by most of the elderly (95%), with an average of 4.75 (±0.11) points for each question14.
Mini Mental State Examination (MMSE); *Risk score of Downton*.	Light-hard technology.	More than half of the participants are aware of falls and identify them as a problem, as well as point out some risk factors and prevention measures. Regarding attitudes, more than half of the caregivers are not in favor of the prevention of falls. Most of them reported adopting practices to prevent falls in the elderly, such as changes in the home (52.6%) and supervision of the elderly (47.4%)[15].
Sociodemographic questionnaire; Geriatric Depression Scale; MEEM, *Falls Efficacy Scale-International*; e *Falls Risk Awareness Questionnaire* (FRAQ); *Timed Up and Go* (TUG), Levantar e Sentar da Cadeira e Força de Preensão Palmar.	Light-hard technology and Hard Technology.	Fifty-one of the participants were elderly [67 (±6.2) years; 76.3% women], 15 from the Control (CG), 20 from the Physical Exercise (GEF) and 16 from the Multiple Intervention (GIM) concluded the study. Both intervention groups reduced the TUG time, but only the GIM improved the FRAQ score. Both interventions had a small effect on the time of the (TUG), while the multiple intervention had a large effect on the (FRAQ)[16].
Sociodemographic questionnaire; the Katz Index, Lawton scale; MMSE; TUG; *Short Battery Performance Test*; Plataforma de Equilíbrio *Biodex Balance System*.	Light-hard technology and Hard Technology.	Among the participants, (85 of them with cataracts), with a mean age of 69.39 years (± 5.67). There was an association between falls and female gender (OR:4.45) and submaximal scores in *the Short Physical Performance Test* (SPPB) (OR:3.53) among patients with cataracts, while the

		presence of multimorbidities (OR:5.10) was the risk factor for the elderly without cataracts17.
Sociodemographic questionnaire; MMSE; Activities of Daily Living (ADL); Instrumental Activities of Daily Living (IADL); Educational booklet;Game of memory does not fall istepô; game of memory fell of mature.	Light-hard technology.	The application of gerontotechnology resulted in self-care, empowerment and knowledge through the game, revealing interest in behavior change, independence and learning on the part of the elderly, in addition to serving as an instrument that facilitates care [18].
Structured instrument referring to socioeconomic data and the occurrence of falls; AVD; IADL; Short *Physical Performance Battery (*SPPB) and *Falls Efficacy Scale-International* (FES-I).	Light-hard technology.	The incidence of falls in the follow-up period represented 37.1%, being 20% recurrent and 17.1% in a single event. The final model indicated that the increase in one SPPB unit decreased by approximately 15% and 17%, respectively, the chance of falls and recurrent falls 19.
Questionário *Falls Risk Awareness Questionnaire* (FRAQ-Brasil).	Light-hard technology.	The interviewees were mainly female (58.4%), and income of 2 minimum wages (46.3%); the average of correct answers in the FRAQ-Brazil questionnaire was 19.5 in up to 32 points and the elderly interviewed were exposed, on average, to 7.8 household risk factors such as: lighting, safety bars, slippery floors, height of furniture, obstacles on the way, long clothes and safe shoes; Of the elderly, 180 (26.2%) said they had already received information about falls 20.
Questionário sociodemográficos; *Edmonton Frail Scale*; Yesavage Geriatric Depression Scale; TUG.	Light-hard technology.	The factors that were associated with the occurrence of falls were: female gender (OR=1.67; CI95%:1.13-2.47); negative self-perception of health (OR=1.49; CI95%:1.02-2.20); impairment of functional mobility (TUG test > 20 seconds) (OR=1.66; CI95%:1.02-2.74); the record of hospitalization in the previous 12 months (OR=1.82; CI95%:1.17-2.84); and frailty measured by the *Edmonton Frail Scale* (OR=1.73; CI95%:1.14-2.64)[21].
Frailty phenotype: influence of each item in the determination of frailty in community-dwelling elderly. Palmar Grip Force (FPP).	Light-hard technology. and Hard Technology.	The frailty components for risk factors for falls were: (1) reduction in strength and grip (no falls = 21.8%; falls = 31.5%; hazard ratio – RR = 1.44; and p = 0.003); and (2) exhaustion (no falls = 7.6%; falls = 14.7%; RR = 1.93; and p = 0.003)[22].
Questionnaire regarding clinical and sociodemographic characteristics and functional balance and mobility; seated tests for standing, semi-tandem, step test and gait speed of six meters.	Light-hard technology.	The occurrence of falls was associated only with the variable "gender", and the chance of falling was higher among women. The cutoff points for the sitting-to-standing, step test and gait speed tests were 8.5 seconds, 7.5 seconds and 0.98 m/s, respectively23.
Fall Risk Tracking Tool (FRRISque).	Light-hard technology.	Most of the elderly were female (57.6%), with a mean age of 71.87 years. In the logistic regression analyses, it was evidenced that only 10 items of the FRRIS that contribute to the increased risk of falls in the elderly and refer to the risk factors previous fall, use of gait aid device, polypharmacy, use of psychotropic drugs, difficulty to go up or down a slope, difficulty to walk 100 meters, visual and auditory deficit, low physical activity and poorly lit environment. This risk stratification model assumes sensitivity values of 91.3% and specificity of 73.4%[24].
Information about lifestyle habits was obtained; health conditions; use of medications; basic activities of daily living (BADL); instrumental	Light-hard technology.	The frequency of falls was 24.3%. After adjustments, there were higher chances of falling among women (OR = 3.10; CI95% 1.79–5.38), among people aged 65 years or older (OR = 2.39; CI95% 1.45–3.95), with poor sleep quality

activities of daily living (IADL); and sleep quality by the Pittsburgh Index (PSQI).		(OR = 1.78; CI95% 1.08–2.93) and with low handgrip strength (OR = 2.31; CI95% 1.34–3.97)[25].
Questionário sociodemográfico; *Clinical falls risk assessmet from*	Light-hard technology.	Incidence of 36.41% of falls in the elderly, of the elderly who fell and suffered fracture (18.67%), 50% had already suffered an episode of stroke and 50% had chronic kidney disease, and 61.54% stopped performing their daily activities after the fall26.
Questionário sociodemográfico; *Risk score de Downton*.	Light-hard technology.	The study included elderly people aged 60 to 93 years. Of these, 136 (59.7%) females and 92 (42.3%) males predominated in the study elderly hypertensive (55.7%) and diabetic (33.8%) with a history of falls (36.41%) in the last twelve months, with the use of medication, with sensory deficits and without gait alteration7.
Mini-Mental State Examination (MMSE), Timed Up and Go Test (TUG) and Edmonton Frailty Scale (EFE), instrumental activities of daily living (IADL) was assessed by the Lawton and Brody Scale	Light-hard technology	The prevalence of low, moderate and high risk of falls was 36%, 43.7% and 20.3%, respectively. The variables associated with moderate risk of falls were female gender, age between 71-80 years and >80 years. Age >80 years, negative self-perception of general health, need for help to walk through an assistive device, human assistance and fear of falling remained associated with high risk [27].
Berg scale.	Light-hard technology	It was found that in the group of dance practitioners (case) only one of them had a score lower than 45, and in the group (control) ten users had a value lower than 45. The calculated relative risk was 0.2, demonstrating that the practice of ballroom dancing was a protective factor against falls [28].
Advanced Activities of Daily Living (ADLs), Instrumental Activities of Daily Living (IADLs), Physical Activity based on items from the Minnesota Leisure Activity Questionnaire.	Light-hard technology	The prevalence of insomnia and daytime nap symptoms was 49.9% (n = 339) and 62.8% (n = 432), respectively. Fourteen to four percent reported a single fall and 11.9 percent reported recurrent falls. The occurrence of falls was associated with female gender (OR = 7.73; CI95%: 3.03-19.72), age > 80 years (OR = 3.48; CI95%: 1.54-7.85), daytime nap (OR = 2.24; CI95%: 1.24-4.05) and depressive symptoms (OR = 1.98; CI95%: 1.11-3.53) [29].
Short Physical Performance Batteryii (SPPB), basic activities of daily living (BADL), using the Katz Index, instrumental activities of daily living (IADL) and evaluation of advanced activities of daily living (AADL)	Light-hard technology	It was found that 24.7% of the elderly had falls in the last 12 months. The largest proportion of the elderly who suffered falls was female (p=0.004); aged 80 years or more (p=0.001); no schooling (p=0.026); lived alone (p=0.049); without a partner (p=0.002); with negative self-perception of health (p<0.001); dependent for BADL (p=0.049) and IADL (p=0.027); with lower participation in AADL (p=0.003); pre-frail/frail (p<0.001) and with low/poor physical performance (p<0.001). The largest clusters of occurrences of falls were in the central-western region of the municipality, followed by the southeast region [30].

Source: Own elaboration.

4 DISCUSSIONS

In the analysis and grouping of recurrent results, three guiding axes were defined, which included: use of health technologies to mitigate the risk of falling; internal and external risk factors for the occurrence of falls; and knowledge about falls as a preventive measure.

4.1 USE OF HEALTH TECHNOLOGIES TO MITIGATE THE RISK OF FALLS

The technologies in the health area can be subdivided into three categories: light technology, which is based on relational technologies, such as welcoming with qualified listening for the

implementation of care; light-hard technology, which is based on the use of structured knowledge, not requiring high technology for operationalization; and hard technology that qualifies through the use of technological equipment to perform care31.

The strategies identified to measure the propensity of falls in the elderly in communities identified in the selected articles used mild hard technologies in fourteen of the studies; however, hard technology was concomitantly associated in three studies16,17,22.

The technologies classified as mild-hard were represented by the use of questionnaires regarding the risks of falling, sociodemographic data associated with the risk of falling and physical activities without the use of technological devices7,14-24,26,31.

In the planning of health care at the various levels of health care, the use of light-hard technology is essential for the prevention of falls, since this technological level is concretized by the use of structured knowledge, through the analysis of the individual's health and the contribution of current scientific evidence [32].

In the scope of hard technologies, it was evidenced the use of technological equipment such as the hydraulic dynamometer that analyzes the Palmar Grip Force (FPP) and the Biodex Balance System Balance Platform for the analysis of the postural control of the individual16,17. The Biodex Balance System is an equipment that was used in one of the literatures in order to measure the postural control of the elderly17. The equipment data are obtained by projecting the center of mass within the support base of the device, which determines the postural oscillations and the balance deficit, through the displacement of the individual's center of pressure on the platform, where the elderly remain erect during the evaluation33,17, which can be shown as an ally to analyze the potential risk of falls in the elderly and direct the elaboration of strengthening exercise plan in a multidisciplinary way to avoid its occurrence.

Regarding the Palmar Grip Strength (PPF), a technique used in two studies and is measured by means of a hydraulic dynamometer, capable of measuring the force produced by a maximum isometric contraction, recorded in kilograms16. The test is evaluated in the orthostatic posture, with the elbow flexed at 90º and other joints in neutral positions16. One of the literatures showed an association between the reduction of PPF and sarcopenia, with consequent loss of muscle mass and strength of the individual22. Thus, in the aging process of the human being, the appearance of this morphophysiological alteration is contacted, causing reduced balance, loss of agility and increased risk of falling22.

The use of technological resources in the management of care helps in the identification and monitoring of possible changes or risk factors to the health of the population, qualifying the methods of screening for comorbidities and reducing the incidence of diagnostic errors8.In the meantime, the use of hard technology in the identification of factors associated with the risk of falls evidences

possible morphofunctional changes arising from the senescence process, which can corroborate the incidence of falls, enabling early implementation of prevention strategies and improvements in the quality of life of the elderly2,7.

Although the isolated use of light technology has not been verified, it is reiterated that welcoming and qualified listening help communication between the health team and the patient, enabling better effectiveness in the promotion of care34, and can also help in obtaining greater adherence to the care plan. In this sense, it is considered that although light technology has not been used directly in the researches listed, it can be presented as an ally to the collective planning of an individualized care, appropriate to the needs of the individual.

4.2 EXTERNAL AND INTERNAL RISK FACTORS FOR THE OCCURRENCE OF FALLS

The risk factors related to the fall of the elderly identified in the studies can be subdivided into two groups, which includes those internal or intrinsic to the individual, represented by variables such as gender, advanced age, chronic and acute comorbidities, depression and reduction of muscle mass; and the external/extrinsic ones, referred to environmental factors such as irregular surfaces, slippery floor, inadequate lighting, and staircase without handrail21,17,19.

The estimation of the risk of falls in the elderly can be complex because it derives from external and internal factors with multifactorial categorization, as already discussed in the literature. Due to this difficulty in measuring the risk of falling, one of the studies showed that the best tactic to reduce the incidence of falls is to identify and neutralize their risk factors7. In this purpose, the identification of risk factors can be understood as a strategy for preventing/monitoring the risk of falls in the elderly. Thus, several studies employ scales/instruments for its identification, as observed in this RIL.

It is worth mentioning that the findings of two of the studies stated that extrinsic factors are associated with a single occurrence of falls, while intrinsic factors may have repercussions on the recurrence of falls in the elderly21,19. In this perspective, it is confronted with a challenge for the multiprofessional practice in health in the prevention of falls, since the intrinsic factors are mostly non-modifiable.

In the scope of sociodemographic variables, two studies17,19 have a higher incidence of falls in the gender variable, indicating that elderly females are four times more likely to fall than males, with a greater predisposition to fall and recurrence of the event17,19. The finding of the association of the gender variable was evidenced in the use of the Lawton and Brody *scale* for Activities of Daily Living (ADL), which was used in four of the studies [16-18,24]. In this scale are included questions such as: "are you able to use the phone?" and "are you able to control your finances?" The three answer options refer to the degree of autonomy/dependence to perform ADLs, resulting in a maximum final score of 27 points (good autonomy) and a minimum of nine points (dependence ratio)[35].

In relation to cataracts as an intrinsic factor for the risk of falling, a study with the objective of evaluating the factors associated with falls in community-dwelling elderly with a diagnosis of cataracts, the use of ADL denoted a higher score than in the group of patients without the pathology, indicating that although visual impairment may cause difficulties to detect obstacles, The risk of falls should be associated with other sensory impairments involving balance16. Corroborating this finding, one of the articles discusses the loss of balance, denoting that the decrease in the ability to balance should be considered as a frailty in the elderly, since it has repercussions in an increase in the risk of falling21.

The loss of balance, functional capacity and autonomy in daily activities were the intrinsic risk factors most investigated by the articles listed. The Katz Index, which assesses Instrumental Activities of Daily Living (IADL), was applied together with ADL and this association occurred in four literatures17-19,25. The IADL is composed of 8 topics with the objective of evaluating the autonomy of the individual in daily activities, which: preparing meals, washing clothes, handling money, using the telephone device, taking medications, shopping and using the means of transportation32,25.

Regarding the *Timed Up and Go* (TUG) test, its execution was evidenced in three of the literatures15,19,14. The test is intended to assess balance and functional capacity for gait and risk of falls, supported by physical tests, which include: getting up from a chair with arms, walking three meters ahead, turning, walking back and sitting in the chair, with results equal to or greater than 20 seconds suggestive of more difficult mobility for the elderly and consequently indicate a higher risk of falls [17,16].

The investigations carried out in two of the studies related to the TUG denote that elderly people who practice physical activity improve their scores in postural balance tests and mitigate the time of performance of the test, presenting a better score and a reduction in the risk of falling15,14. Corroborating this assertion, studies indicate that the practice of physical exercises promotes greater body coordination that provides satisfactory balance, and therefore contributes to the reduction of the incidence of falls, chronic pathologies and cardiac risks [36,5].

The Stand Up and Sit Chair (LSC) test was performed in two of the studies, which found no relationship between the LSC and the occurrence of falls15,24. It is worth mentioning that this test is able to assess the level of muscle strength in the lower limbs of the elderly, who should stand up and sit five times from a chair, as soon as possible, without the help of the upper limbs, which remained crossed in front of the body during the movement23.

The application of the Minnesota Leisure Time Activities Questionnaire in the elderly was used in one of the studies, composing 16 questions about weekly frequency and daily duration of physical activities performed by the elderly. The research considered active those who performed at least 150

minutes of weekly physical activity of moderate intensity exercises, or 120 minutes of vigorous intensity physical activity, individuals who did not meet these criteria were considered sedentary29.

In the scenario of evaluation of motor physical aptitudes, the *Short Physical Performance Battery* (SPPB) test was applied in two of the studies, evaluating the physical capacity of the lower limbs, and showed that elderly with a low score were 3.5 times more likely to fall than those who obtained high scores15. The SPPB uses 3 topics in its evaluation, namely: balance, gait speed and sitting and getting up from the chair. Its evaluation results in a score from 0 to 12, establishing that from 0 to 3 points (disability); 4 to 6 points (low performance); 7 to 9 points represents moderate performance and 10 to 12 points (good performance)[16,18].

One of the studies applied the Berg scale, which is a functional balance assessment instrument composed of 14 delegations, with five items and scores from 0 to 4 for each task: 0 points (inability to perform the task) and 4 (performs the task independently). The total score ranges from 0-56 points, evidencing that individuals with a score lower than 45 have a greater propensity to fall[28].

Four studies address the use of the mini mental state examination (MMSE) as an instrument for the cognitive screening of the elderly15-17 that qualifies five areas of cognition: orientation; recording; attention and calculation; recall and language. The maximum score of the instrument is 30 points, influenced by the individual's education and for this it presents different cutoff points, illiterate (13 points), low/medium schooling (18 points) and high schooling (26 points)19,37. The MMSE is essential for the application of other instruments/questionnaires used in the studies, since a reduction in the cognitive capacity of the elderly may result in answers that do not match the reality of the individual, generating research biases16,15.

The Geriatric Depression Scale (GDS) was used in two articles, and is presented with 15 items that reflect one of the main ways of screening for depressive symptoms in the elderly. Both literatures found no relationship between the presence of depressive symptoms and the occurrence of falls16, 21.

The Pittsburgh Index (PSQI) seeks to track and evaluate the quality of sleep of individuals, consisting of 19 self-report questions categorized into seven components, graded in scores from 0 (no difficulty) to 3 (severe difficulty)[34]. The PSQI was used in one study, contacting those individuals with a low *score* had poor sleep quality, associated with higher chances of falling risk25. Evidence corroborates the previous assertion, since poor sleep quality may be associated with decreased daytime performance, contributing to the occurrence of falls38.

The *Downton risk scale* was used in two of the investigations and deals with the risk of falling in the elderly with a score from 0 to 11, and scores greater than or equal to 3 represent a higher risk of falling7,14. In this evaluation, five criteria are used, which: (1) previous falls: responsible for evidencing if the elderly have already suffered any fall; (2) medications: seeks to produce a survey in order to measure whether the elderly use medications; (3) sensory deficit: evaluates whether the elderly

have any type of deficit; (4) mental state: informs the mental state of the individual, informing if he is oriented and aware of information regarding time and space and (5) gait: denotes the individual's walking process delimiting a type of gait39.

And finally, the Fall Risk Tracking Tool (FRRISque), seeks to track and identify people with a higher risk of falling in a comprehensive way. The cataloguing of people in the community with lower and higher risk of falls can trigger a more complete and detailed evaluation, addressing risk factors, whether biological, behavioral, social and economic22. The FRRISwhich was used in one of the studies, showing that elderly people with decline in the auditory process and with postural alteration are more susceptible to falls22.

In view of the screening of risk factors for the occurrence of falls, the use of several measurement tools/instruments was verified, which were related to the identification and association of internal and external factors to the elderly.

4.3 KNOWLEDGE ABOUT FALLS AS A PREVENTIVE MEASURE

The *Falls Efficacy Scale-International* (FES-I) was applied in two studies [17], [14]) and is able to measure the level of concern of the patient in the execution of daily activities by grading the *Likert* scale, ranging from 1 (not slightly worried) to 4 (extremely worried) [35]. The application of FES-I in the studies found that scores higher than 24 were indicative of the risk of future falls18,40,41.

The Falls Risk Awareness Questionnaire (FRAQ), which assesses the perception of the elderly regarding the risk of falls, was used in two studies18,15. The FRAQ score presents a variable from 0 to 32 in its score, and the higher the score of the elderly, the better the awareness about the risk factors and prevention of falls16. In this sense, the low score in the two scales mentioned above does not reflect in a lower risk of falls, but in a lower body awareness when confronted with other contributing factors and can direct the professional to carry out a health education process focused on the prevention of falls.

The two literatures denoted the low knowledge regarding risk factors for falls in elderly people, associated with a higher number of falls at home in the patient's history20,14. In this scenario, active aging aims to optimize health through strategies to promote healthy aging, which should be based on health education, since knowledge has repercussions on a process of autonomy of the individual, minimizing the incidence of comorbidities5.

In the perspective of the acquisition of knowledge about the risk of falling, in a study the method of gerontotechnologies was used, through the dissemination of an educational booklet, memory game, game does not fall istepô and game entitled fell of mature, with simultaneous application of the strategies with the measurement scales of the MEEM, TUG, AVD and IADL, that evaluated the effectiveness of the gerontotechnology processes, evidencing the greater self-care of the

elderly, with interest in interventions to reduce the risk of falls and the incidence of this event in the population studied18.

Faced with a scenario in which falls are characterized as a multifactorial event, multiple interventions that associate different methodologies/technologies in order to mitigate the incidence of falls in the elderly18 supply its multifactorial character and were evidenced as essential tools for the prevention of falls in the elderly. The instruments used in this thematic axis show that the context of low knowledge regarding the risk factors of falls and may be associated with a greater number of falls in the elderly.

As a limitation of this study, it is pointed out the scarcity of materials corresponding to the technologies adopted for the prevention of falls in the elderly population in communities, with the use of the descriptors listed. It is recommended to expand the methods of reviews in search of the association of the effectiveness of the use of health technologies with the prevention of falls. However, the present study can contribute to the monitoring and/or formulation of strategies based on scientific evidence, in vogue the mitigation of falls of the elderly in communities.

5 FINAL CONSIDERATIONS

The RIL made it possible to highlight the technologies adopted to prevent the risk of falls in the elderly population in communities with the predominant use of light-hard and hard technology. In addition, external and internal risk factors for the occurrence of falls and knowledge about the risks of falls as preventive measures were verified.

In view of the risk factors for falls, the intrinsic factors related to the loss of balance, muscle mass and strength stand out, as well as the knowledge regarding the risk of falling. In this perspective, the association of physical practices in order to promote increased body coordination and the acquisition of knowledge about strategies to reduce the risk of falling, as observed in the adoption of multiple intervention, enabled greater autonomy of the elderly in their self-care.

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