

AN OVERVIEW OF FALL RISK FACTORS, ASSESSMENT MEASURES AND INTERVENTIONS IN OLDER ADULTS

Visão geral dos fatores de risco para quedas, medidas de avaliação e intervenção na população de idosos

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ABSTRACT

The objective of this study was to present the main factors responsible for falls in older adults, measures for assessing risk, and prevention strategies. This is a qualitative study, developed from the international and national gerontology literature. Two models were created, one including the main fall risk factors and another including common assessment and prevention measures. Five types of intervention procedures were identified: educational, physical, cognitive, exergames and exercise programs. It was concluded that early identification of fall risk is important. The most appropriate intervention methodologies for preventing falls in the elderly include periodic dual and multi-task physical training followed by educational measures. In addition, exercise programs and exergames are effective in preventing falls, especially in congregate housing.

KEYWORDS: aging; risk factors; health of the elderly; strategies.

RESUMO

O objetivo deste estudo foi apresentar os principais fatores responsáveis por quedas em idosos, medidas para avaliar seu risco, bem como o conjunto de estratégias utilizadas para prevenir o caso. Trata-se de um estudo qualitativo desenvolvido com base na literatura nacional e internacional de gerontologia. Foram criados dois modelos, que mostram os principais fatores de risco para quedas, também as medidas comumente aplicadas à avaliação e prevenção de quedas. Em termos de procedimentos de intervenção, cinco tipos foram identificados: educacional, físico, cognitivo, *exergames* e programas baseados em exercícios. Concluiu-se que a identificação precoce do risco de quedas é importante. As metodologias de intervenção mais adequadas para a prevenção de quedas em idosos consistem no treinamento físico periódico de dupla e multitarefa, seguido de medidas educativas. Além disso, programas baseados em exercícios e *exergames* são eficazes à prevenção de quedas, especialmente nas residências dos idosos.

PALAVRAS-CHAVE: envelhecimento; fatores de risco; saúde do idoso; estratégias.

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INTRODUCTION

Falls are the leading cause of injury-related death in people aged 65 and over.¹ The data are alarming: each year, one in three individuals over 65 is a victim of falling, and this figure worsens with advancing age. Studies have shown that older adults aged 75 or older are four times more likely to fall.^{2,3} This indicates that care measures and fall prevention studies must be developed with older adults. Falls are considered a multifactorial event, caused by extrinsic and intrinsic factors. According to the Brazilian Society of Geriatrics and Gerontology, falls have their own etiology, which makes them preventable.⁴

Systematic reviews^{5,6} and meta-analyses^{7,8} have shown that most falls can be attributed to the physiological changes inherent in human aging, indicating that 72% of falls could be anticipated. This means that falls can be predicted through clinical assessment, since cognitive and motor performance deficits significantly increase fall risk.⁹ According to the literature, 8% of fall events cannot be predicted and are classified as accidental, being the result of environmental hazards.⁵

In identifying fall risk, the type of event must be differentiated, since this will affect the type of strategy necessary to avoid future accidents. Falls also have a financial impact on public and private health systems.¹⁻³ Barros et al.¹⁰ surveyed data on hospitalizations of older Brazilians due to falls between 2005 and 2010, finding 399,681 cases, which cost a total of US\$ 464,874,275.91.

Thus, to deepen current understanding of falls and older adults, the present study aims to present, based on the literature, the main factors responsible for falls among older adults, as well as means of assessing fall risk and fall prevention strategies.

STRATEGIES TO PREVENT FALLS

Before choosing a fall prevention strategy, the gerontology literature recommends identifying and quantifying fall risk factors.¹⁻⁴ This allows an individual's fall risk to be classified and his or her deficits (cognitive or motor) to be identified.¹¹ For the second step, it is advisable to determine the preventive action, which can be applied on an individual or group level as a single activity or a combination of strategies. It is important to point out that the choice of procedure also depends on the professional and material resources available.^{12,13}

Based on the literature, Figure 1 shows the main fall risks in the elderly population, the most recommended assessment types (motor performance, cognitive and psychosocial aspects) and the most commonly applied intervention strategies.¹⁴⁻¹⁶

The main factor in reducing the rate of fall events is the efficacy of the procedures used to identify intrinsic and extrinsic risk factors.⁹ Furthermore, since falls are multifactorial events, the specialized literature suggests developing

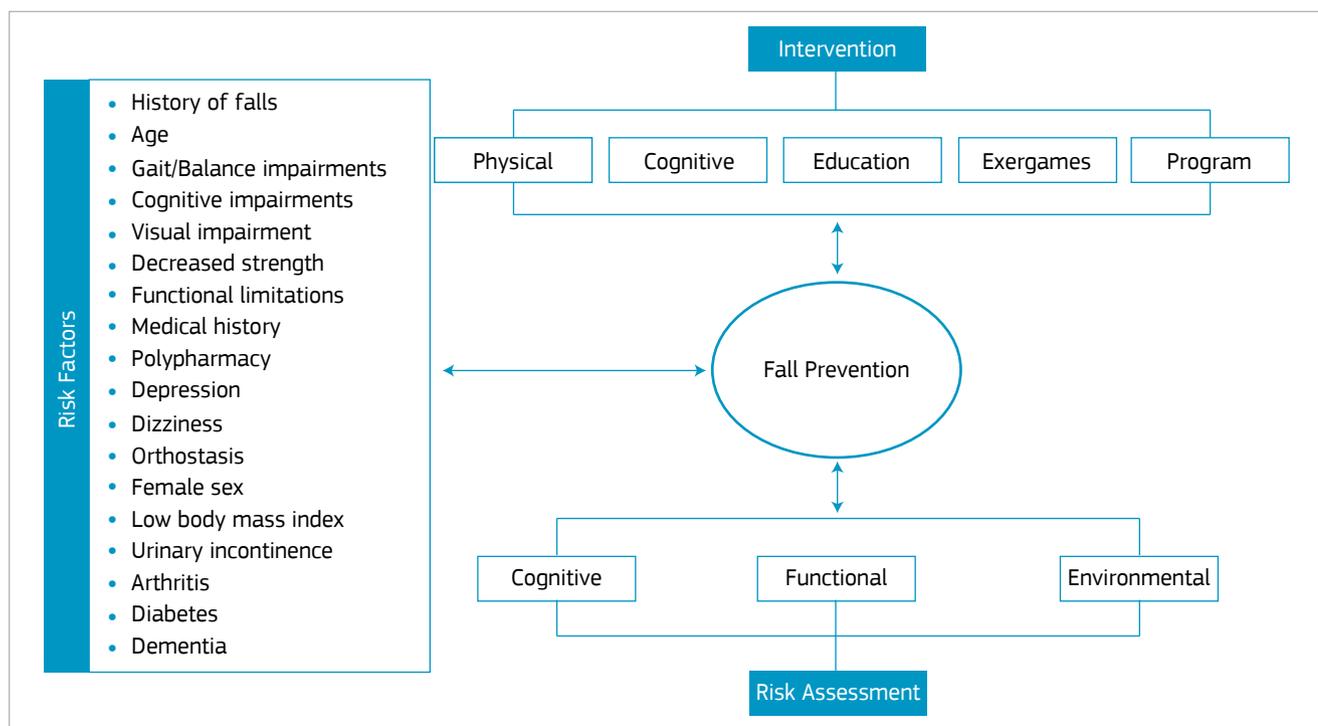


Figure 1 Model for the identification and prevention of falls.

procedures that associate professionals and instruments from different fields.¹⁵ Through exchanging information and methodological procedures, preventive and intervention actions can be improved.

Thus, multifactorial assessment is recommended (Figure 1).¹⁷ Studies suggest using gerontology tests and protocols to identify motor, functional, cognitive and psychosocial deficits, which can be classified as follows:

- assessment of the sensory condition of the visual, vestibular and proprioceptive systems, which are responsible for the regulation of static and dynamic balance control;¹⁸
- assessment of gait pattern: the speed, length and cadence of strides;¹⁹
- assessment of lower limb strength and stretching ability;¹⁷
- assessment of cognitive performance: executive function, attention, and memory;²⁰
- assessment of psychosocial factors: perceived quality of life, depression, dementia, insomnia, fear of falls and confidence about balance.²¹

FALL INTERVENTION STRATEGIES

Figure 2 presents five types of intervention used to prevent falls among older adults: educational, physical, cognitive,

exercise programs and exergames. These types can be implemented separately or in combination.

EDUCATION

Educational interventions about fall risk in the elderly population can include the distribution of leaflets, booklets, posters, workshops, home visits, environmental modifications, telephone calls and medication review, all geared toward individual counseling. Educational strategies combining public health policies and interventions are carried out in private residences, rest homes and fall prevention programs in Universities of the Third Age.¹³ These activities seek to inform the elderly about the relationship between physical, functional, and cognitive factors and falls. Educational actions also strengthen a person's understanding of his or her deficits and abilities, contributing to increased confidence.¹⁻³

In a systematic review study by Balzer et al.,²² six of the 184 analyzed articles reported that educational measures (i.e., a standardized examination of the home environment followed by recommended changes) had significant effects on fall risk. Educational strategies have been effective in treating groups of older adults with high functional vulnerability, such as people over 85 years old who spend long hours

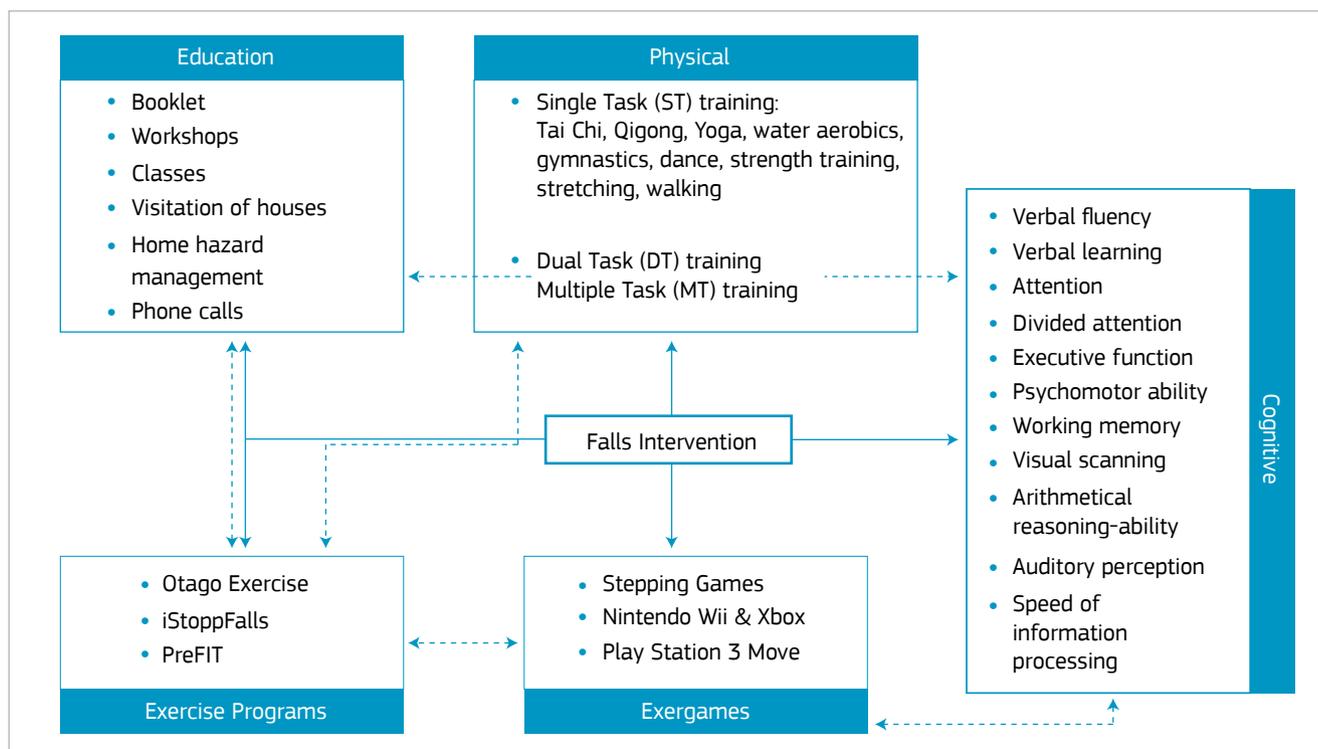


Figure 2 Set of activities developed in interventions to prevent falls.

at home. According to Chehuen Neto et al.,²³ in addition to the extrinsic and intrinsic factors of falls in older adults, the targeted individuals' perception level about the subject is fundamental for the effectiveness of prevention strategies. This means that older adults must consider the danger of falling as well as the consequences of a fall.

Balzer et al.²² also highlighted the effectiveness of educational strategies based on the principle of self-efficacy. This methodology seeks to improve older adults' ability to deal with the transformations involved in the aging process. However, it is known that educational programs alone are insufficient to combat all risk factors, especially those responsible for physical decline, which can only be achieved by regular exercise.²⁰ Thus, educational actions and physical interventions are often associated.^{21,22}

COGNITIVE

Aging results in gradual changes in an individual's cognitive ability. The prevalence of cognitive complaints among older adults is estimated at between 11 and 56%.²⁴ Early treatment of cognitive deficit is indicated upon the first self-reported cognitive complaints by an older adult. The evaluation and intervention procedures include different neurological processes, such as attention, memory, perception and executive function. Systematic reviews and meta-analyses have shown cognitive training has significant effects on executive function, memory, overall cognitive function, and subjectivity.^{8,19,25} Cognitive deficit can be identified by low scores on the Mini-Mental State Examination, the Trail Making Test, verbal fluency, the Stroop Color-Word Test, the Clock Test, Monte Carlo analysis, etc.

Figure 2 presents a set of deficits typical of human aging, which fall prevention programs can improve. Many of these actions can be associated with gait (dual task). In fall prevention, rigorously developed randomized controlled trials have suggested an association between exercise programs based on aerobic, balance and strength training with cognitive training tasks (Multiple Tasks).^{20,26} The advantage is the breadth of training, which is more effective in preventing falls than strategies focused on a single task/strategy.

EXERGAMES

Exergames use computer technology to train the physical and cognitive capacity of older adults.²⁷ These are usually video games that involve body movement, which is detected in real time by sensors, by means of which

individuals receive feedback on their motor and cognitive performance. The methodology utilizes effective 3D gaming features to stimulate motor and neurocognitive abilities. This method's advantage is that participants are not required to go to rehabilitation or sports centers, since training can be done at home in front of the computer or television.

Exergames have attracted interest in different health areas, such as physical therapy, medicine and physical education, and are increasingly incorporated into strategies for the prevention and rehabilitation of cognitive and motor deficits. Exergames are a great pedagogical tool because they are a playful and attractive combination of exercise and games. Studies have reported that exergames help develop muscle strength, improve postural control in the orthostatic position, facilitate body weight displacement and improve reaction time in different directions.^{6,28}

Another advantage of digital methodologies is the possibility of including vulnerable groups with special needs.²⁸ In general, older adults with mobility problems or neurological diseases remain inactive for long periods of time. Through interactive games and video games it is possible to motivate these individuals to think and move.

EXERCISE PROGRAMS

Exercise programs for older adults have been used for decades in Australia, the US, the UK and countries in the European Community. Including sets of exercises that can be performed at home or in groups, these programs combine systematic planning with educational sessions, increasing awareness of fall risks and safety measures. One example is the Otago Exercise Program,¹⁵ which is an individual home exercise program.

The activities associate ankle weight exercises for strengthening the lower limbs, balancing exercises of moderate intensity and a walking plan. They also include periodic home visits by an instructor to supervise the execution and progress of the procedures. A meta-analysis involving 1503 participants (81.6 ± 3.9 years) verified the efficacy of Otago Exercise Program after 12 months of participation. The results included a significant reduction in fall events (incidence rate = 0.68, 95%CI 0.56–0.79), as well as a reduction in the risk of death for participants over 80 years of age and a low dropout (rate of risk rate = 0.45, 95%CI 0.25–0.80).¹⁵

Another program is the Prevention of Fall Injury Trial, which was developed in the UK by the National Health Service.²⁹ This trial is described as a multifactorial fall

prevention assessment with an intervention strategy that involves a number of exercises. Thus, the method can be used to treat a wide range of fall risk factors. The activities are taught by properly trained physical therapists or exercise instructors. The training consists of individually prescribed progressive exercises that can be administered at home or in a group setting: 5 warm-up exercises, 5 strength exercises, with or without ankle weights, and 12 balancing exercises. The exercises are to be performed for 6 months, with a minimum of three home visits or telephone contacts.

Another elderly fall prevention program involving in-home exercise is iStoppFalls. This program combines the following technical components: a set-top box with a controller, the Microsoft Kinect motion detection system, a mini-PC (exergame), a Senior Mobility Monitor for mobility tracking, voice and gesture control, a tablet PC as an alternative input and output device for the iTV system, and a TV with the iTV system. A multicenter randomized controlled trial conducted in Germany, Spain and Australia ($n = 153$; 74.7 ± 6.3 years) showed significant fall prevention results for the iStoppFalls group.³⁰ The experimental group underwent a 16-week program involving two weekly exergames sessions (120 min), combined with balance and strength exercises, while the control group was involved in no exercise intervention. Participants from both groups received a booklet containing guidelines on fall prevention and healthy lifestyles.

PHYSICAL EXERCISE

Physical exercise is a fall prevention alternative that improves the health and quality of life of older adults, is low cost and has been proven effective. When performed in a regular and planned way, exercise can significantly reduce fall rates.^{12,25,31} A systematic review of 174 studies whose meta-analysis included 23 studies with a total of 114 elderly participants (30% men) found a considerable association between regular exercise and health status.⁸ Thus, exercise improves and maintains the physiological system, as well as functional and mobility capacity, facilitating activities of daily living.

Exercise also stimulates social interaction among older adults, reflecting positively in their perceived quality of life and generating well-being.^{17,21} A meta-analysis reported that a fall prevention program involving challenging balance exercises for more than 3 hours per week led to a 25% reduction in falls.³¹ One of the reported benefits was improved balance performance, which increased by 19%. Other benefits from regular exercise include increased agility, as well as increased

muscle strength, stretching, flexibility and lung resistance.^{26,28,32} In 12-week quasi-experimental controlled blinded study with 41 male participants (≥ 60 years), Pereira et al.³³ found that tai chi chuan had significant effects on functional capacity and quality of life. This type of exercise is widely applied in fall prevention programs due to its postural control benefits.

A systematic review by Levin et al.⁶ on interventions to improve motor and cognitive function in older adults included 1,095 articles published in the last decade, of which 41 were selected and 19 fulfilled the selection criteria. The analysis indicated considerable improvement in motor and cognitive function for interventions that associated physical and cognitive training.⁶ Physical training associated with cognitive tasks is called dual-task training. It develops motor components during activities in which the cognitive functions are divided, a factor that has been found determinant in fall prevention during the daily activities of older adults.²⁰

The literature emphasizes that physical-cognitive training and multitask training present better results than motor training with a single type of exercise or multicomponent physical training.³¹ Multi-component training improves gait and cognitive information processing speed.³² On the other hand, combined physical and cognitive training is more effective for developing psychomotor speed, attention, and dual-task processing speed.

CONCLUSION

Based on the literature, the present review presented models synthesizing the main factors of fall risk in older adults, procedures for assessing cognitive, physical and functional deficit and the main fall prevention strategies. Since fall risk is multifactorial and proportional to advancing age, periodical broad scale emotional, physical and cognitive assessment of the older adult population should be carried out. Regarding interventions, previous studies have recommended methodologies that prioritize an association of physical-cognitive and multi-task training followed by educational measures. Exercise programs have also been highly effective in preventing falls, especially in congregate housing contexts, because they prioritize body movement through a systematic, individualized training progression and can be associated with exergames. Periodic residential visits by health professionals also facilitate educational measures.

CONFLICT OF INTERESTS

The authors declare no conflict of interests.

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