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Actions to control the fear of falling in older people: An umbrella review

Ana Rita Capela Oliveira [a,*], Carla Maria Pintado Magueja [b], Armando Manuel Gonçalves de Almeida [a]

[a] Universidade Católica Portuguesa, Faculdade de Ciências da Saúde e Enfermagem - Porto, Centro de Investigação Interdisciplinar em Saúde (CIIS), Portugal
[b] Universidade Católica Portuguesa, Faculdade de Ciências da Saúde e Enfermagem – Lisboa, Centro de Investigação Interdisciplinar em Saúde (CIIS), PortugalUniversidade Católica Portuguesa, Faculdade de Ciências da Saúde e Enfermagem – Lisboa, Centro de Investigação Interdisciplinar em Saúde (CIIS)Universidade Católica Portuguesa, Faculdade de Ciências da Saúde e Enfermagem - Porto, Centro de Investigação Interdisciplinar em Saúde (CIIS)

HIGHLIGHTS

- 25 studies identifies effective interventions for fear of falling in older adults;.
- Holistic exercises (Tai Chi, Yoga, Pilates) are the most effective;.
- Cognitive behavioral therapy has benefits, especially when combined with exercise;.
- Multifactorial community programs show promising results;.
- Exergames have inconclusive evidence, requiring further research;.

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ABSTRACT

Background: Fear of falling in older adults is a multifactorial psychological condition associated with the degree of confidence in performing activities of daily living without falling, leading to reduced physical activity, quality of life, and life satisfaction, and resulting in social isolation.
Purpose: This study aimed to summarize and evaluate effective actions to control fear of falling in older adults.
Method: An umbrella review of interventions that control fear of falling in people aged ≥60 years was conducted, in accordance with JBI and PRISMA guidelines. The search was conducted in six electronic databases: CINAHL, Web of Science, MEDLINE, Scopus, Cochrane Reviews, and JBI Databases, during the period from February to April 2024.
Results: Of a total of 706 references identified, 25 met the eligibility criteria. Of those included, eleven studies are systematic review, three studies are meta-analysis, and eleven studies are systematic review with meta-analysis. Five types of action to control fear of falling with therapeutic potential were identified: Physical and functional therapy; Cognitive Behavioral Therapy; Combined strategies; Multifactorial preventive programs; Technological interventions.
Conclusions: The results of this umbrella review indicate that holistic exercises (Tai Chi, Yoga, Pilates) are the most effective in mitigating fear of falling in older adults. Interventions that incorporate multimodal approaches also appear to be beneficial. The combination of physical and cognitive actions is widely recognized as effective and long-lasting. Longitudinal studies are needed to assess the effectiveness of actions over time.

1. Introduction

The aging population represents one of the greatest challenges for global healthcare systems. The number of people over the age of 60 will double by 2050, exceeding two billion individuals. This demographic transformation requires a reconfiguration of care models, traditionally focused on disease, to integrated and personalized approaches that promote functionality, well-being, and autonomy for the elderly (World Health Organization, 2015).

With the increase in average life expectancy, it is becoming

* Corresponding author at: Universidade Católica Portuguesa, Faculdade de Ciências da Saúde e Enfermagem | Porto, Centro de Investigação Interdisciplinar em Saúde (CIIS). Address: Rua de Diogo Botelho, 1327. 4169-005 Porto, Portugal.
E-mail address: s-anricaoliveira@ucp.pt (A.R.C. Oliveira).

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increasingly clear that health problems tend to be chronic, complex, and multidimensional. Among these problems, accidental falls emerge as one of the leading causes of morbidity and mortality among older adults. The World Health Organization identifies this multifactorial phenomenon as the second leading cause of accidental or unintentional death worldwide, with adults over 65 representing the age group with the highest number of fatal falls (World Health Organization, 2021).

After a fall, another phenomenon often emerges called fear of falling (FoF), which has a negative impact on quality of life, functionality, autonomy, and social participation, and is also predictive of further falls.

The FoF, initially described by Murphy and Isaacs (1982) as part of a "post-fall syndrome" and later defined by Tinetti and Powell (1993) as a "lasting concern about falling, which leads the individual to avoid activities that they are still capable of performing.", is now studied as a complex emotional and cognitive response. Although it may be a protective and adaptive reaction, it has been widely associated with negative consequences for the health of older adults, including: reduction or avoidance of physical activity, decreased quality of life, social isolation, fear, anxiety, postural instability and increased dependence.

Scientific literature indicates that FoF has a multifactorial etiology, involving physical, psychological, functional, and social components (Scheffer et al., 2008). It is often related to balance deficits, decreased muscle strength, history of falls, depressive symptoms, low self-efficacy, and unsafe environmental context. However, it is equally important to recognize that FoF can be present even in the absence of a previous fall, which highlights its complexity and the need for assessment beyond the physical experience of falling.

Studies show wide variability in the prevalence of FoF, which can range from 3 % to 85 %, depending on the population, context, assessment methods, and instruments used (Hu et al., 2024). In Portugal, it is estimated that this prevalence reaches around 54.1 % (Vitorino et al., 2019), higher than in countries such as the United States (29 %) or Spain (41.5 %), but lower than in Korea (76.6 %) and Japan (57.9 %) (Santos et al., 2023). This disparity reinforces the need for studies that systematize the factors associated with the phenomenon in different contexts.

The FoF represents a challenge not only for older adults and their families, but also for healthcare professionals, especially nurses, who play a central role in fall prevention, health education, and the development of interventions that promote confidence and autonomy.

Early identification of factors associated with FoF, as well as useful strategies for mitigating it, are essential for designing effective intervention programs that contribute to healthy aging and the optimization of health resources (Zhang, 2023).

In a preliminary search, several systematic reviews were identified that addressed actions to control FoF in older adults, each exploring different interventions and contexts of application. Given the diversity of available results, it became clear that there was a need to organize and critically synthesize this body of evidence to provide accessible and useful information to support more effective decision-making processes. This finding motivated the conduct of an umbrella review.

The umbrella review is a robust and comprehensive methodological approach, as it allows for the assessment of whether different reviewers, when investigating similar issues, identify consistent results and reach convergent conclusions (Aromataris et al., 2024). Thus, it is a rigorous and appropriate method for integrating evidence from systematic reviews and meta-analyses, especially in the field of FoF in older adults, with a particular focus on interventions identified for its control.

The objective of this review is to critically synthesize the interventions identified for the control of FoF, to guide future research and contribute to the implementation of health practices based on the best evidence. The aim is to support the development of strategies that promote the safety, autonomy, and quality of life of the elderly population.

2. Methods

2.1. Design

This umbrella review follows the methodological guidelines by the Joanna Briggs Institute (JBI) (Aromataris et al., 2024) and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement (Moher et al., 2009). The umbrella review protocol was registered in PROSPERO, registration number CRD42024534268.

2.2. Research question

The PICo methodology was used to define the research question:

P – Participants – all studies that include elderly people as participants will be considered, without restrictions on gender, ethnicity, or other personal characteristics. An elderly person is defined as someone who is 65 years of age or older in developed countries and 60 years of age or older in developing countries (World Health Organization, 2002).
I – Phenomenon of interest – studies that refer to actions taken to control the FoF will be considered. FoF is understood as an individual's constant concern, when standing or walking, about falling, compromising the performance of daily activities (Tinetti & Powell, 1993). An action is understood to be a measure or set of measures taken to achieve a certain objective.
Co – Context – all intervention contexts will be included, without limitation: social institutions and facilities; health institutions and facilities; home environment.

Based on this methodology, the research question for the study was formulated: What are effective actions to control FoF in older adults?

2.3. Search strategy

The JBI recommends a three-phase research process that should be used in developing a comprehensive research strategy (Aromataris et al., 2024).

The search strategy aimed to locate systematic reviews of the literature (with or without meta-analyses) in Portuguese, English, and Spanish. No temporal, geographical, or cultural limits were considered in the research.

The search strategies were adapted and customized for each database of published studies, as each one uses its own controlled vocabulary. The full search strategy is presented in Supplementary Table A. The research was conducted between February and April 2024, using CINAHL complete (via EBSCO), Web of Science Core Collection, MEDLINE complete (via EBSCO), Scopus, Cochrane Reviews, and JBI Databases.

2.4. Review selection

All identified bibliographic references were grouped and managed in Rayyan Intelligent Systematic Review software, with duplicates removed.

The selection of relevant results was carried out by two independent researchers. Disagreements were resolved through discussion and consensus or, when necessary, with the intervention of a third researcher.

The selection process began with an analysis of titles and abstracts, based on the defined inclusion criteria. Subsequently, the full text of the selected studies was evaluated in detail. Studies that did not meet the inclusion criteria were excluded.

The entire research process was described in full in narrative form and presented schematically using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart.

2.5. Data extraction and synthesis

Data extraction was conducted using a standardized form, previously prepared by the researchers. Information was extracted on authors, year of publication, purpose of the review, number of studies included, characteristics of the population, main results, type of interventions.

The data were summarized narratively and grouped into categories for better analysis. Whenever possible, the results with the greatest consistency and methodological quality were highlighted.

2.6. Quality appraisal

After reading the articles in full, they were evaluated by two independent researchers to validate their methodological quality before being included in the review. In this process, the JBI Critical Appraisal Checklist for Systematic Reviews and Research Syntheses was used as an evaluation tool (Aromataris et al., 2015).

Any disagreements between researchers were resolved through discussion and analysis, and when consensus could not be reached, the support of a third researcher was sought.

The following scale was used to assess methodological quality:

- total score of 0 to 3, considered very low quality;
- 4 to 6, low quality;
- 7 to 9, moderate quality;
- 10 to 11, high quality.

Only studies that obtained a minimum score of 7 were included in this review.

3. Results

3.1. Results of the search

A total of 706 references were identified, of which 375 were excluded because they were duplicates. Of the selected articles (n = 331), 62 studies were identified for full-text retrieval through analysis of the title and abstract. After evaluation by the reviewers, 37 were excluded for not meeting the eligibility criteria, resulting in the inclusion of 25 articles. The selection process is described in PRISMA flowchart diagram in Fig. 1.

3.2. Assessment of methodological quality of included reviews

The quality of the included reviews was appraised using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Systematic Reviews

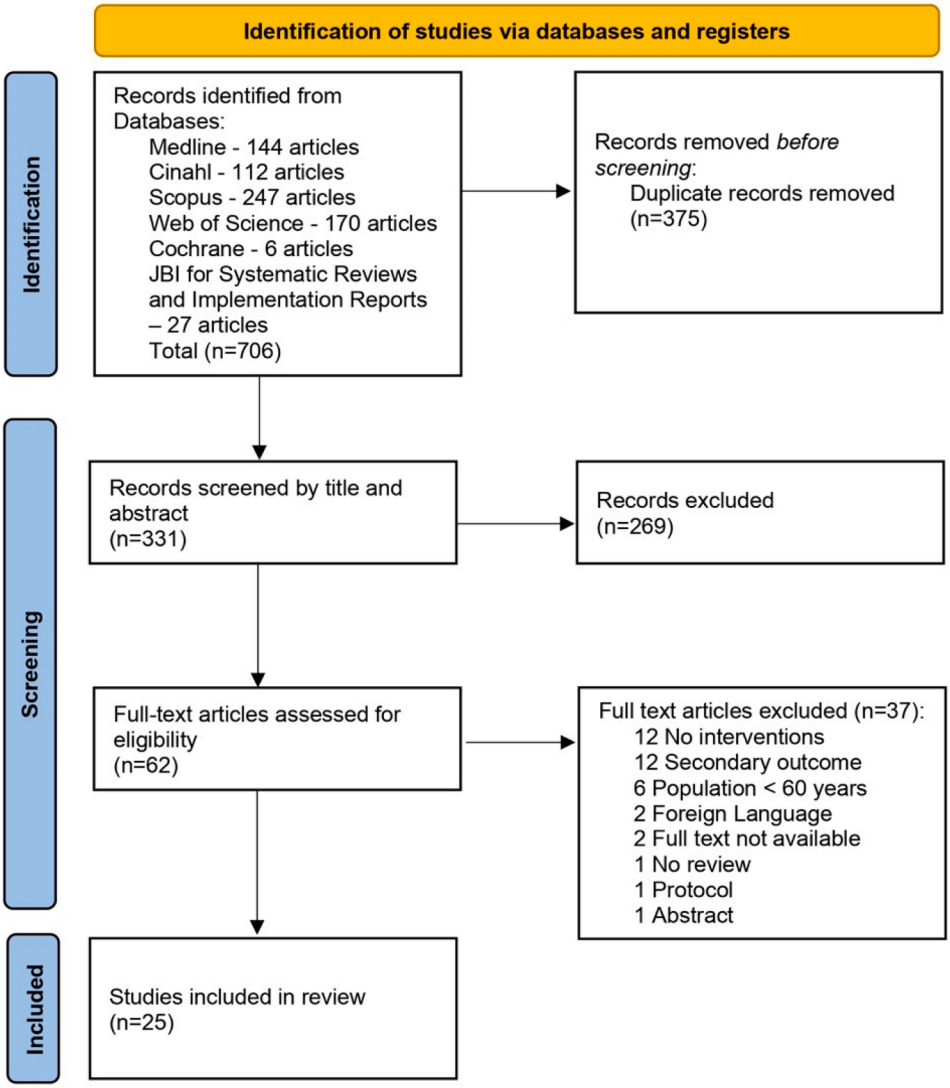

Fig. 1. Detailed search strategy of PRISMA 2020 flow diagram.

and Research Syntheses recommended by the JBI (Aromataris et al., 2015), and this information is shown in Table 1.

The two researchers agreed on the selection of studies, so it was not necessary to include the third researcher. In accordance with JBI criteria for systematic reviews, research, and synthesis, 17 high-quality articles and 8 moderate-quality articles were included.

The number of criteria met ranged from 7 (minimum) to 11 (maximum), so no articles were excluded due to poor methodological quality.

Table 1
JBI Critical appraisal checklist.

Citation	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Total
1. Kruisbrink et al. (2022)	+	+	+	+	−	−	+	+	+	+	+	9/11
2. Ge et al. (2022)	+	+	+	+	+	−	+	+	−	+	+	9/11
3. Hu et al. (2024)	+	+	+	+	+	+	+	+	+	+	+	11/11
4. Zhang et al. (2023)	+	+	−	+	+	+	+	+	+	+	+	10/11
5. Vo et al. (2023)	+	+	+	+	+	+	+	+	−	+	+	10/11
6. Liu et al. (2018)	+	+	+	+	+	+	+	+	+	+	+	11/11
7. Feng et al. (2022)	+	+	+	+	+	+	+	+	+	+	+	11/11
8. Kruisbrink et al. (2021)	+	+	+	+	+	−	+	+	+	+	+	10/11
9. Chua et al. (2019)	+	+	+	+	+	+	+	+	+	+	+	11/11
10. Kumar et al. (2016)	+	+	+	+	+	+	+	+	+	+	−	10/11
11. Papadimitriou & Perry (2020)	+	+	+	+	+	+	+	+	+	+	+	11/11
12. Sjösten et al. (2008)	+	+	+	+	+	−	?	+	−	+	−	7/11
13. Yoshikawa et al. (2020)	+	+	+	+	+	+	+	+	+	+	+	11/11
14. Harling & Simpson (2008)	+	+	−	+	+	+	−	+	−	+	+	8/11
15. Zijlstra et al. (2007)	+	+	+	+	+	?	+	−	−	+	+	8/11
16. Jung et al. (2009)	+	+	+	+	+	+	+	+	−	+	+	10/11
17. Savvakis et al. (2024)	+	+	+	+	+	+	+	−	+	+	+	10/11
18. Lenouvel et al. (2023)	+	+	+	+	+	?	+	+	+	+	+	10/11
19. Santos et al. (2024)	+	+	+	+	+	−	+	+	+	−	+	9/11
20. Papalia et al. (2020)	+	+	+	+	+	−	+	+	+	+	+	10/11
21. S. E. R. Lim et al. (2021)	+	+	−	+	+	+	+	−	−	−	+	7/11
22. Howes et al. (2017)	+	+	+	+	+	+	+	+	+	−	+	10/11
23. Campos et al. (2021)	+	+	+	+	+	−	+	+	−	+	+	9/11
24. Chiu et al. (2021)	+	+	+	+	+	+	+	+	+	+	+	11/11
25. da Silva et al. (2021)	+	+	+	+	+	+	+	+	+	+	+	11/11

+ - Yes; − - No; ? - Unclear

3.3. Characteristics of the included articles

Of the 25 articles selected, 11 correspond to systematic reviews and meta-analyses, 11 to systematic reviews only, and 3 to meta-analyses.

As for the characteristics of the included studies, all were published between 2007 and 2024, of which 84 % ($n = 21$) were published in the last 10 years.

The total number of primary studies on actions that control FoF was 559. We employed the Corrected Covered Area (CCA) method to deal with the potential overlap among the primary studies included in different systematic reviews. A CCA value of 0–5 % represents slight overlap, 6 %−10 % represents moderate overlap, 11 %−15 % represents high overlap, and values over 15 % represent very high overlap. In our study, the CCA was 7.4 %, indicating a moderate overlap between the systematic reviews included in the analysis. This result indicates that each review adds its own value and context, and that there is no excessive redundancy in the literature on FoF.

The number of participants ranged from $n = 702$ to $n = 12.656$, and they were over 60 years of age.

Table 2 summarizes the characteristics of the 25 studies, which were described according to year of publication, study design, population, FoF assessment instruments, type of intervention, and intervention outcomes.

Twenty-five articles were included in the final analysis, fulfilling the central objective of this review—to synthesize and evaluate actions that control FoF in older adults.

3.4. Actions to control fear of falling in older adults

In the analysis of the selected studies, several interventions/actions were found to control the FoF in older adults, which were grouped into the following categories: Physical and functional therapy; Cognitive Behavioral Therapy; Combined strategies; Multifactorial preventive programs; Technological interventions.

The choice of categorical framework in this umbrella review is based on theoretical and empirical grounds. Theoretically, the physical, psychological, combined, preventive, and technological domains reflect predominant strategies in the literature on FoF, allowing for comparison across studies. Empirically, the categorization provides a clear and pedagogical organizational structure. This categorization is not intended to exclude the multifactorial nature of many interventions but to highlight their core components. The approach facilitates the identification of central intervention components, includes overlaps such as combined interventions, and preserves multifactorial complexity without compromising analytical clarity.

3.4.1. Physical and functional therapy

- Holistic exercises (Kruisbrink et al., 2021, 2022):
  - Tai Chi (Harling & Simpson, 2008; Savvakis et al., 2024; Sjösten et al., 2008; Zhang et al., 2023; Zijlstra et al., 2007)
  - 3D exercises - Tai Chi and Yoga (Kumar et al., 2016)
  - Pilates (da Silva et al., 2021; Santos et al., 2024)
  - 3D exercises – Tai Chi and Pilates (Feng et al., 2022)
- Meditation (Kruisbrink et al., 2022)
- Body awareness (Kruisbrink et al., 2022)
- Otago Exercise Program (OEP) (Chiu et al., 2021; Vo et al., 2023)
- Exercise interventions with multiple components (balance, strength, endurance, coordination) (Feng et al., 2022; Papalia et al., 2020; Zijlstra et al., 2007)
- Balance training (Feng et al., 2022; Kumar et al., 2016; Savvakis et al., 2024)
- Strength training (Feng et al., 2022)
- Physical exercise (Jung et al., 2009; Kruisbrink et al., 2021):
  - Aquatic physical exercise (Campos et al., 2021)
  - Physical exercise led by trained volunteers (S. E. R. Lim et al., 2021)
  - Aerobic exercises (Feng et al., 2022)
  - Exercises with resistance elastic bands (Savvakis et al., 2024)
  - Whole-body vibration platform (Feng et al., 2022; Savvakis et al., 2024)
- Feldenkrais exercises (Feng et al., 2022)
- Fall training (Feng et al., 2022)

3.4.2. Cognitive behavioral therapy

- Cognitive Behavioral Therapy (CBT) (Chua et al., 2019; Lenouvel et al., 2023; Liu et al., 2018; Papadimitriou & Perry, 2020)

3.4.3. Combined strategies

- Combined physical and cognitive interventions (Hu et al., 2024; Jung et al., 2009)

3.4.4. Multifactorial preventive programs

- Hip protection (Jung et al., 2009; Zijlstra et al., 2007)
- "Matter of Balance/ Volunteer Lay Leader (AMOB/VLL)" program (Yoshikawa et al., 2020)
- Intervention on fall risk factors (Zijlstra et al., 2007)
- Multifactorial fall prevention interventions (Sjösten et al., 2008; Zijlstra et al., 2007)
- Health education (Kruisbrink et al., 2021)
- Assessment-based home modification (Kruisbrink et al., 2021)

3.4.5. Technological interventions

- Exergames (Feng et al., 2022; Ge et al., 2022; Howes et al., 2017; I. K. dos Santos et al., 2024; Savvakis et al., 2024; Vo et al., 2023)
- Computer-based visual feedback training (Savvakis et al., 2024)

3.5. Assessment of evidence quality of included reviews

The quality of the evidence was assessed in Table 3, using the GRADE (Grading of Recommendations, Assessment, Development and Evaluation) approach, as described by Guyatt et al. (2008). This methodology considers five key domains — risk of bias, inconsistency, indirectness, imprecision, and publication bias — to rate the quality of evidence into one of the following levels: high, moderate, low, or very low.

The review by Feng et al. (2022) included six studies that used novel exercise interventions, such as water-based exercise, Feldenkrais, video games, whole-body vibration, and fall training. These interventions were grouped together under the category of "novel exercises" and were not evaluated separately regarding their specific effects on FoF. The review's subgroup analysis found no statistically significant difference between exercise types, with balance exercises showing the largest effect, while the novel interventions did not demonstrate a distinct or superior effect on FoF. Although these interventions were mentioned in the results section of the present umbrella review, they were not individually analyzed in the original review, and therefore a separate GRADE assessment was not performed for them.

4. Discussion

This umbrella review aimed to synthesize and evaluate interventions that control FoF in older adults. A total of 25 systematic review and meta-analysis studies were included, encompassing research with quantitative evidence. The discussion of the results will be carried out according to each of the five categories identified.

Table 2
The Characteristics of studies in the Umbrella Review ($n = 25$).

Author (Year)	Study design	Study Population	Outcome measures	Types of interventions	Results
Kruisbrink et al. (2022)	SR, MA	Non-institutionalized populations with a mean age of 65 years	-Not specified	-A total of 68 different components of interventions were identified, such as discussion, education, balance exercises, strength exercises, graded tasks, relaxation, feedback, goal setting, diet, energy conservation, visualization, and home adaptation.	Body awareness, holistic exercises and meditation were significantly associated with a decrease in the SMD, meaning they were more effective in reducing FoF than interventions without these components. The intervention components balance, self-monitoring, and tailoring were significantly associated with an increase in the SMD. This indicates that interventions with these components were significantly less effective in reducing FoF than studies without these components.
Ge et al. (2022)	SR	Community-residing older-adult sample with or without fall history.	-FES, ABC and their modified versions; -SAFFE -FFM	-Wii exergame platform including Nintendo Wii Fit, Nintendo Wii Fit Plus game, Wii Balance Board (WBB). -Non-Wii exergame systems.	15 out of the 23 (65 %) studies showed an exergame intervention to be associated with a statistically significant reduction in FoF. Among these 15 studies, nine reported either significant between-group differences or both significant within and between-group differences. The remaining six studies reported only significant within-group differences. Of the five studies that monitored long term effects, only two documented significant between-group differences at 24 and 36 weeks.
Hu et al. (2024)	SR, MA	Older adults aged 60 years or older, with no restrictions on location (e.g. community, hospitalization, or institution).	-FES-I, -Chinese version, the Brazilian version, and the Thai version of the FES-I, -ABC -FES, -MFES -Short-FES-I -Icon-FES	-Combined interventions of physical exercise and cognitive training. -Combined physical exercise and cognitive behavior intervention (CBI). -Physical exercise, cognitive training plus CBI.	The results showed the combined intervention had a small to moderate effect on FoF, in comparison with blank/placebo/ usual control. Moreover, a small effect size on FoF was observed in the combined intervention vs. cognitive intervention, while there was no positive effect when comparing the combined intervention with a single physical intervention. In a short-term retention effect, only the combined intervention had a positive effect compared to blank/ placebo/ usual control. Furthermore, no effect was found in a long-term retention effect of combined interventions on reducing FoF.
Zhang et al. (2023)	MA	Elderly people aged > 60 years living in communities or retirement homes.	-FES -MFES, -FES-I	-Tai chi.	The results showed that Tai Chi had a significant short-term effect on the FoF in older adults, and the medium and long-term effects were not statistically significant. In the medium and long term, the FoF in older adults was alleviated, and there was no statistical difference between the two groups.
Vo et al. (2023)	SR	Community-dwelling or older adults who were hospitalized for a short term and were aged 60 years according to the government's regulations and retirement age.	-FES-I and its expanded versions -A single item: 'Are you afraid/fear of falling?' -Thai Geriatric FOF Questionnaire	-Self-enhancement in combination with exercise, the modified Otago exercise. -Nintendo Wii exercise to compare it with a standard gym exercise.	Three experimental studies showed the effect on FOF by improved FoF scores in measurements. The multiprograms that combined movement, balance and self-efficacy enhancement did not show a significant increase in the FES score. However, the experimental group showed a significant improvement in the FES score over time after receiving the program. The exercise programs modified home-based Otago exercises to prevent falls among older adults with balance dysfunction. FoF was significantly lower in the exercise group than in

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Table 2 (*continued*)

Author (Year)	Study design	Study Population	Outcome measures	Types of interventions	Results
					the control group. The effect of Nintendo Wii exercise showed a significant reduction in FoF compared with a standard gym exercise.
Liu et al. (2018)	SR, MA	Community-dwelling older people aged >60	-FES -FES-I -Chinese version of the FES-I. -MFES	-Cognitive behavioral therapy (CBT)	CBT with components of cognitive restructuring, promotion of physical activities, and goal setting, is effective in reducing FoF immediately with retention effect up to 12 months. It also demonstrated effects on enhancing balance at <6 months follow-up when compared with control conditions. Subgroup analysis suggested that the effect of group-based CBT may be weaker than individual CBT on reducing FoF.
Feng et al. (2022)	SR, MA	Community-dwelling older adults who were at least 65 years old.	-ABC -FES-I -FES -A single-item question, a measure of balance confidence, -Visual analog scale -SAFFE	-Multicomponent exercise interventions (balance, resistance, endurance, and coordination), -Balance exercises. −3-dimensional exercises (Tai Chi and Pilates). -Strengthening exercises. -Aerobic exercises. -Novel exercises (water-based exercise, Feldenkrais, video games, whole-body vibration, and fall training).	Our results also showed an overall small to moderate effect size of exercise interventions in reducing. Most exercise principles and intensity of exercises were not adequately reported in included trials. However, we should take the risk of bias into account when interpreting this finding. However, findings in our study showed that the balance exercise yielded the largest effect size among all other types of exercise interventions.
Kruisbrink et al. (2021)	SR, MA	Older people living at home (non-institutionalized). The mean age of the total population was 65 years or over.	-Not specified	-Exercise interventions -Strength training and balance training in combination with endurance training. -Assessment-based care, in which care is delivered based on a formal assessment. -Assessment-based home modification. -Cognitive behavioral programs. -A referral protocol for emergency ambulance visits. -Nutritional supplementation, mental imagery, in which a stable position is visualized. -Education.	Most intervention types (e.g., cognitive behavioral, assessment-based, education, etc.) and overarching characteristics (e.g., supervisor, delivery method, group format, etc.) were not significantly associated with the SMD in FoF at the first follow-up after the intervention. However, interventions with holistic exercise, supervision by a tai chi instructor and delivery of the intervention in a community setting were more effective than interventions without these characteristics. Interventions delivered at home or with written materials and tailoring were significantly less effective in reducing FoF at the first follow-up after the intervention.
Chua et al. (2019)	SR, MA	Community-dwelling participants aged 60 years old and above.	-FES-I -FES -ABC modified -MFES -FES and ABC components -GFFM -FES and GFFM	-Cognitive behavior therapy-based multicomponent interventions	The results from the current review suggest that interventions that use cognitive restructuring, motivational interviewing, or goal setting as components of a complex biopsychosocial intervention program have favorable short- and long-term effects in reducing FoF among community-dwelling older adults who are at risk of fall.
Kumar et al. (2016)	SR, MA	Participants aged ≥65 and community-living (i.e. living at home or places of residence without nursing care or rehabilitation)	-FES (all versions), -ABC, -Other numerical scales.	- 3D (Tai Chi, Yoga) -Gait, balance, coordination and functional tasks. -Strength- and resistance-based interventions	Exercise interventions were associated with a small to moderate, and statistically significant reduction in FoF with significant heterogeneity between effect sizes. The effect of exercise interventions did not vary by type, frequency or duration of exercise, falls risk or between trials aimed at reducing FoF and those with other primary aims. Subgroup analyses suggested that the effect of exercise interventions may be smaller where control groups received an alternative intervention

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Table 2 (*continued*)

Author (Year)	Study design	Study Population	Outcome measures	Types of interventions	Results
					rather than no intervention and may be greater where group rather than individual exercises were used. No significant reduction in FoF was found beyond the end of the exercise interventions.
Papadimitriou and Perry (2020)	SR; MA	Participants of mean age 65 years or older, with fall-related psychological concerns, such as FoF or reduced falls efficacy.	-FES-I -GFFM	-Cognitive and behavioral interventions	For the FoF outcomes, the meta-analysis showed an SMD of 0.30 in favor of cognitive and behavioral interventions immediately after the intervention period. At the later follow-up, the strength of the effect in favor of cognitive and behavioral interventions was similar, at 0.29. This implies that the benefits persist over time, up to a period of around 1 year.
Sjösten et al. (2008)	SR	Community dwellers and from 16 to 81 in studies among the institutionalized aged.	-FES -ABC -MFES -Subjective rating of fear questionnaire; a percentage of those having FoF -SAFFE	-Tai chi. -Education program and a low resistance. -Training program, along with home training. -Balance and strength exercise formats with or without some educational content an adjustment of medication, home- or group-based exercises, an assessment of the living environment and some education on fall prevention.	According to the results, FoF may be reduced by different fall prevention interventions, since nearly 70 % of the studies assessing FoF or fall efficacy produced positive results in at least one outcome measure. Among community-dwellers, the most effective strategy seems to be a multifactorial approach, while 86 % of the multifactorial trials produced significant improvement in FoF compared to 45 % of the SE trials. Both individual and group-based programs were effective in reducing FoF.
Yoshikawa et al. (2020)	SR; MA	Community-dwelling older adults.	-Scale of fear of falling interfering with social activity (FOFSA) -FES-I -General fear of falling or concern about falling scale	-Multifactorial fall prevention program, AMOB/VLL.	This meta-analysis of the 13 studies found a small to moderate effect on reducing FoF and improving fall-related efficacy with the relatively large heterogeneity.
Harling and Simpson (2008)	SR	Adults aged 60 years and older, of either sex, living in the community or in institutionalized care.	-FES -ABC	-Tai Chi. -Combination of interventions including a Tai Chi component.	There is, however, strong evidence to support the effectiveness of Tai Chi in reducing fear of falls in older adults, with five high-quality trials demonstrating statistically significant reductions in FoF. Four of the six trials finding significant reductions in FoF used Yang style.
Zijlstra et al. (2007)	SR	General population of community-living older people with a mean age of 65 and older.	-FES -MFES -An adapted version of the FES; -One item fear-of-falling measure	-Fall-related multifactorial interventions. -Tai chi. -Exercise intervention. -Balance intervention. -Hip protector. -Intervention on fall risk factors.	A statistically significant reduction in FoF in favor of the intervention group was determined in 12 trials. This review showed fairly consistent findings in reducing FoF in community-living people in trials of higher methodological quality: two home-based exercise interventions, three community-based tai chi group interventions, and five fall-related multifactorial programs, of which three were home based and two were community based in group format.
Jung et al. (2009)	MA	Elderly individuals aged 60 years or older.	-FES -Simple question -ABC; -MFES	-Combined exercise and education intervention group. -Exercise intervention only group. -Hip protector group.	Our analysis suggests that community- and home-based interventions rather than facility-based interventions have a significant effect on decreasing the FoF. In the analysis of the subgroups classified according to the type of intervention, the results obtained in the exercise-only group were not statistically significant; however, significant results were obtained in the group in which exercise was combined with educational

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Table 2 (*continued*)

Author (Year)	Study design	Study Population	Outcome measures	Types of interventions	Results
					intervention and in the hip protector group.
Savvakis et al. (2024)	SR	Frail and pre-frail older adults aged 60 years and older.	-FES-I -ABC -Simple questions about the concern and FoF on a three- or four-point Likert scale -Single-item question method, which asked the subjects whether they were worried about falling.	-Tai Chi Exercises. - Functional training in a dynamic and static position or on a Whole-body vibration platform. -Functional tasks using only body weight Balance exercises on a force platform. -Interactive video and computer feedback training. -Resistance strength exercises. -Exercises with resistance elastic bands.	The evidence from the published articles included in this review focuses on the effects of balance, strength, and mobility improvement on FoF reduction and self-esteem build-up in both frail and pre-frail older adults. In most studies, it is reported that physical-activity interventions focusing on muscle strengthening, balance improvement, and mobility training can significantly contribute to fall reduction and minimize associated fear in frail and pre-frail older adults. It is supported that different training means and combinations with balance and/or mobility exercises, can reduce FoF. In five of these studies, FoF was significantly reduced. This may indicate that interventions that helped to improve physical activity led to greater reductions in FoF.
Lenouvel et al. (2023)	SR	Community-dwelling older adults, with a mean population age of at least 60 years minus one standard deviation.	-FES-I; -Swedish version of the FES-I; -FES -MFES; -ABC. -Single-item instruments	-Cognitive behavioral therapy (CBT) with and without exercise.	These results suggest that CBT with and without exercise interventions probably reduces FoF following the end of treatment and over six months, compared to control. The benefits up to six months may be sustained following cessation of the intervention. Sensitivity analyses show that the conclusions from the primary analysis remain stable.
Santos et al. (2024)	SR	Community-dwelling participants aged >60 years.	-FES-I	-Pilates - iStoppFalls exercise program	Moderately certain evidence suggested that home-based exercises improved FoF.
Papalia et al. (2020)	SR, MA	Patients aged 65 or older.	-FES-I -MFES -Thai version and Swedish version of the FES-I	- Multicomponent exercise programs combining balance and strength training, and in some cases, flexibility, coordination, or functional exercises.	Physical exercise was shown to be very beneficial for older people in terms of dynamic and static balance, FoF, balance confidence, quality of life, and physical performance, with a significant improvement reported for all the considered scores in patients who participated in a physical treatment compared to controls.
S. E. R. Lim et al. (2021)	SR	Community-dwelling older people aged ≥ 65 years.	-FES-I -MFES	-Volunteer-led physical activity interventions.	Two studies measured fear of falls as an outcome measure and both reported reduction in FoF. The homebased physical and nutritional intervention RCT demonstrated an improvement in FoF scores, with a statistically significant reduction in FES-I score in the intervention group, with no change in the control group. A non-randomized single group repeated measure design study examined the effectiveness of volunteer-led exercise on FoF. The exercise included home-based strength and balance exercise plus cognitive-behavioral techniques to reduce FoF. The study found that those who received the intervention had an improvement in FoF as measured by the MFES scale, at 6 months and at 12 months.
Howes et al. (2017)	SR, MA	Older adults aged >65 years.	Not specified	-Active computer gaming.	Sixteen studies evaluated the effect of ACG on FoF and provided very low-quality evidence of no significant effect. Sensitivity and subgroup analyses according to control and delivery dose did not

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Table 2 (*continued*)

Author (Year)	Study design	Study Population	Outcome measures	Types of interventions	Results
					produce a significant effect. The available literature did not provide evidence of its effectiveness in improving mobility or FoF.
Campos et al. (2021)	SR	Samples with mean age of 65 years old and over;	-MFES	-Water-based exercise	The study that evaluated older women with osteopenia or osteoporosis showed an improvement in the mental component of quality of life in the Intervention Group, with differences between groups. No effects were found in FoF. Other study found differences between groups in FoF, role-emotional and mental health, with water-based exercises being more effective.
Chiu et al. (2021)	MA	Older adults aged >65 years without any neurological diseases.	-FES -MFES -FES-I	-Otago exercise program (OEP)	The results of our meta-analysis indicated that the OEP, with its resistance and balance training, can reduce the FoF and enhance balance confidence. Interventions to overcome the FoF and build balance confidence are crucial because fall-related psychological factors can lead to various adverse health outcomes.
da Silva et al. (2021)	SR, MA	Healthy older adults 60 years of age and older.	-FES	-Pilates	The results show a decreased FoF score and statistically significant between groups in favor of the Pilates group. The main findings of the review show that functional mobility, mobility, gait, postural balance and FoF have improved in older participants after practicing Pilates.

Note: ABC, Activities-specific Balance Scale; FES, Falls Efficacy Scale; FES-I, Falls Efficacy Scale-International; FFM, Fear of Falling Measure; FoF – Fear of falling; GFFM - Geriatric Fear of Falling Measure; MA, Meta-analysis; MFES, Modified Falls Efficacy Scale; SR, Systematic review; SAFFE, Survey of Activities and Fear of falling in the Elderly; Short-FES-I, Short Falls Efficacy Scale International.

4.1. Physical and functional therapy

The most frequently mentioned interventions were holistic exercises; balance, strength, and endurance training in various formats; and physical exercise with varying modalities.

Holistic exercises have been shown to be significantly more effective in controlling FoF when compared to other types of actions.

In the systematic review by Kruisbrink et al. (2021), 62 randomized controlled trials were included, of which 50 intervention groups were analyzed in the meta-analysis. The authors found that holistic exercise interventions, including Tai Chi, Yoga, and Pilates, were significantly more effective in reducing FoF than all other intervention types. This finding, based on eight studies, supports the role of mind–body approaches as particularly powerful components in interventions targeting FoF among community-dwelling older adults (GRADE: Moderate).

The same authors conducted a new systematic review in 2022 (Kruisbrink et al., 2022), which included 66 studies describing 85 interventions and 68 different components aimed at reducing FoF. They reported that holistic exercise interventions, such as Tai Chi, Yoga, or Pilates, were more effective in reducing FoF than all other types of interventions combined. This effect was based on nine studies and suggests that mind–body approaches are among the most effective components for addressing FoF in older adults (GRADE: Low).

Tai Chi emerges as the most frequently cited intervention in the reviews included in this umbrella review. Harling and Simpson (2008) conducted a systematic review including seven randomized controlled trials to evaluate the effectiveness of Tai Chi in reducing falls and FoF among older adults. Five of the seven trials reported a significant reduction in FoF following Tai Chi practice. The authors concluded that there is strong evidence supporting the effectiveness of Tai Chi in reducing FoF, while evidence for its effect on fall incidence was weaker (GRADE: Moderate). The most consistent benefits were observed in studies using the Yang style and in participants with a higher baseline FoF, suggesting that Tai Chi may be particularly effective for psychologically or functionally frail older adults. As evidenced by Savvakis et al. (2024), Tai Chi is an appropriate and effective intervention, even for frail older adults, with a positive impact on FoF (GRADE: Moderate). Zhang et al. (2023) analyzed 13 reviews on its effectiveness and concluded that it had a significant short-term effect on FoF in older adults, but the medium and long-term effects were not statistically significant (GRADE: Moderate). Both Zijlstra et al. (2007) and Sjösten et al. (2008) based their conclusions on the same three randomized controlled trials examining the effects of Tai Chi on FoF. These studies demonstrated that group-based Tai Chi interventions conducted in community settings were effective in reducing FoF (GRADE: Moderate). In addition, Sjösten et al. (2008) noted that Tai Chi enhances concentration, relaxation, and proprioception, and helps relieve stress, all of which may contribute to its beneficial effects on FoF.

Kumar et al. (2016) grouped Tai Chi and Yoga under the category of 3D exercises, recognizing their integrated focus on balance, strength, and body awareness. Nine of the thirty included trials involved such 3D exercises; however, the authors did not evaluate their effectiveness separately from other types of exercise. While the meta-analysis showed a small to moderate overall effect of exercise interventions on reducing FoF among community-dwelling older adults, no significant differences were found between exercise types, and no specific conclusion could be drawn regarding the distinct impact of Tai Chi and Yoga (GRADE: Low). In the Feng et al. (2022) review, Tai Chi and Pilates were classified as 3D

Table 3
GRADE assessment.

Action	Reference	Impact on FOF	N° of Participants (Studies)	Quality of the Evidence GRADE
PHYSICAL AND FUNCTIONAL THERAPY				
Holistic exercises (Tai Chi, Yoga, Pilates)	Kruisbrink et al. (2021)	$B=-0.823$; $p < 0.001$	Not reported (8)	Moderate
	Kruisbrink et al. (2022)	$B=-0.67$; $p < 0.05$	Not reported (9)	Low
Tai Chi	Zhang et al. (2023)	SMD (<3 m)=−1.02; $p = 0.002$ SMD (3–6 m)=0.84; $p = 0.56$ SMD (>6 m)=0.09; $p = 0.23$	1217 (13)	Moderate
	Harling and Simpson (2008)	5 studies showed a significant reduction in FOF	1146 (7)	Moderate
	Savvakis et al. (2024)	Significant reduction in FOF	376 (2)	Moderate
	Sjösten et al. (2008)	Significant reduction in FOF	767 (3)	Moderate
	Zijlstra et al. (2007)	Significant reduction in FOF	767 (3)	Moderate
Tai Chi and Yoga (3D Exercises)	Kumar et al. (2016)	Not evaluated separately	897 (9)	Low
Pilates	da Silva et al. (2021)	SMD=−8.61; $p < 0.00001$	151 (2)	Low
	I. K. dos Santos et al. (2024)	Significant reduction in FOF	110 (1)	Moderate
Pilates and Tai Chi (3D Exercises)	Feng et al. (2022)	Small to moderate effect in reducing FOF	Not reported (11)	Low
Meditation	Kruisbrink et al. (2022)	$B=-0.79$; $p = 0.006$	1281 (5)	Low
Body awareness	Kruisbrink et al. (2022)	$B=-0.53$; $p = 0.009$	2015 (11)	Low
Otago Exercise Program (OEP)	Chiu et al. (2021)	Hedges's $g=-0.184$; $p = 0.008$	2807 (12)	Moderate
	Vo et al. (2023)	Significant reduction in FOF	439 (1)	Low
Exercise - multicomponents	Feng et al. (2022)	Small to moderate reduction in FOF	Not reported (33)	Moderate
	Papalia et al. (2020)	1 study showed a 1 study showed a significant reduction in FOF	737 (5)	Low
	Zijlstra et al. (2007)	2 studies reported a significant reduction in FOF	635 (4)	Low
Balance training	Feng et al. (2022)	SMD=−0.62; $p < 0.001$	2560 (14)	Moderate
	Kumar et al. (2016)	Not evaluated separately	Not reported (19)	Low
	Savvakis et al. (2024)	4 studies demonstrated a significant reduction in FOF	Not reported (9)	Moderate
Strength training	Feng et al. (2022)	Small reduction in FOF	695 (7)	Low
Physical exercise	Jung et al. (2009)	MWES=0.024; $p > 0.05$	319 (1)	Low
	Kruisbrink et al. (2021)	$B=-0.294$; $p < 0.119$	Not reported (37)	Low
Aquatic physical exercise	Campos et al. (2021)	1 study showed a significant reduction in FOF	130 (2)	Low
Physical exercise led by trained volunteers	M. L. Lim et al. (2018)	SMD=0.3; $p < 0.05$	415 (2)	Moderate
Aerobic exercises	Feng et al. (2022)	Small and non-significant effect on FOF	538 (4)	Low
Exercises with resistance elastic bands	Savvakis et al. (2024)	Significant reduction in FOF	140 (2)	Moderate
Whole-body vibration platform	Savvakis et al. (2024)	Not produce a significant overall effect	77 (1)	Very low
COGNITIVE BEHAVIORAL THERAPY				
Cognitive behavioral therapy (CBT)	Chua et al. (2019)	SMD (post-intervention)−0.28; $p < 0.001$ SMD (<6 m)−0.32; $p = 0.0003$ SMD (>6 m)−0.30; $p = 0.0002$	3165 (15)	High
	Lenouvel et al. (2023)	SMD (post-intervention) −0.23 ($p < 0.001$) SMD (≤6 m) −0.24 ($p < 0.01$) SMD (>6 m) −0.28 ($p < 0.01$)	2357 (11)	Moderate
	Liu et al. (2018)	Hedges's (immediate) $g = 0.33$; $p < 0001$ Hedges's (12 m) $g = 0.37$; $p < 0001$	1626 (6)	High
	Papadimitriou and Perry (2020)	SMD = −0.30; $p < 0.01$	449 (5)	Moderate
COMBINED STRATEGIES				
Combined (physical+cognitive) vs. control	Hu et al. (2024)	SMD=0.37; $p = 0.001$	1201 (9)	Moderate
Combined vs. cognitive only		SMD=0.20; $p = 0.04$	426 (4)	Low
Combined vs. physical only		SMD=−0.09; $p = 0.29$	1456 (17)	Low
Exercise + Education	Jung et al. (2009)	MWES = 0.249 $p < 0.05$	232 (2)	Low
MULTIFACTORIAL PREVENTIVE PROGRAMS				
Hip protection	Jung et al. (2009)	MWES = 0.418; $p < 0.05$	131 (1)	Low
	Zijlstra et al. (2007)	SMD = 0.09; $p = 0.52$	234 (1)	Low
AMOB/VLL	Yoshikawa et al. (2020)	SMD = −0.29; $p < 0.001$	3201 (13)	Low
Intervention on fall risk factors	Zijlstra et al. (2007)	Significant reduction in FOF	68 (1)	Very low
Multifactorial fall prevention interventions	Sjösten et al. (2008)	Six studies reported a statistically significant reduction in FOF	1511 (7)	Moderate
	Zijlstra et al. (2007)	Significant reduction in FOF	3436 (8)	Low
Health education	Kruisbrink et al. (2021)	SMD=0.64; $p = 0.139$	600 (2)	Very low
Assessment-based home modification	Kruisbrink et al. (2021)	SMD=0.23; $p = 0.51$	1305 (4)	Very low
TECHNOLOGICAL INTERVENTIONS				
Exergames	Ge et al. (2022)	Statistically significant changes in FOF	1778 (15)	Low
	Howes et al. (2017)	SMD=0.18; $p > 0.05$	816 (16)	Low
	Savvakis et al. (2024)	No effect after the intervention	96 (2)	Low
	Vo et al. (2023)	Significant reduction in FOF	80 (1)	Moderate

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Table 3 (*continued*)

Action	Reference	Impact on FOF	N° of Participants (Studies)	Quality of the Evidence GRADE
PHYSICAL AND FUNCTIONAL THERAPY				
	I. K. dos Santos et al. (2024)	Significant reduction in FOF	153 (1)	Moderate
Computer-based visual feedback training	Savvakis et al. (2024)	No effect after the intervention	27 (1)	Very low

exercises. Eleven trials included these modalities, which demonstrated a small to moderate effect in reducing FoF among community-dwelling older adults. However, most trials did not adequately report exercise intensity or progression, limiting the ability to determine optimal dosage or exercise parameters (GRADE: Low).

Regarding Pilates, in the review by da Silva et al. (2021), two studies demonstrated a statistically significant decrease in FoF in favor of the intervention group (GRADE: Low). Similarly, in the review by I. K. dos Santos et al. (2024) a study of Pilates practice at home is mentioned, in which the intervention group showed a reduction in FoF compared to the control group (GRADE: Moderate).

In Kruisbrink et al. (2022), meditation and body awareness were identified as key components that, when included in fall-fear interventions, were associated with significantly greater reductions in FoF compared to interventions lacking them. However, the robustness of these associations is somewhat tempered by sensitivity analyses, suggesting that some of the apparent advantages may depend on specific outlier studies (GRADE: Low).

Regarding the Otago Exercise Program (OEP), in their meta-analysis, Chiu et al. (2021) synthesized 12 RCTs and found that the OEP significantly improved perceived balance and reduced FoF in older adults. The effects were stronger when the OEP was delivered in group sessions lasting more than 30 min (GRADE: Moderate). In their systematic review, Vo et al. (2023), identified the OEP as a structured home-based strength and balance training program reported to reduce FoF and enhance balance confidence among community-dwelling older adults. However, this conclusion was derived from a single study that specifically examined the OEP, indicating that the evidence remains limited (GRADE: Low).

Multicomponent exercise programs were the most frequently investigated interventions in the systematic review and meta-analysis by Feng et al. (2022), encompassing 33 of the 75 included RCTs. These programs combined balance, strength, endurance, and coordination training, typically delivered three times per week for 12–16 weeks at moderate intensity. Multicomponent interventions produced a small to moderate reduction in FoF, although the effect was smaller than that observed for balance training alone. Most studies did not report exercise intensity or adherence in detail, and few applied the core exercise principles of progression, overload, and reversibility. The authors concluded that multicomponent and group-based programs are effective and practical strategies for reducing FoF in older adults (GRADE: Moderate).

In the systematic review and meta-analysis by Papalia et al. (2020) , five of the sixteen included studies assessed FoF. All trials implemented multicomponent exercise programs combining balance and strength training, and in some cases, flexibility, coordination, or functional exercises. Only one study reported a statistically significant reduction in FoF, while the others demonstrated modest or non-significant improvements. Overall, the findings suggest that multicomponent exercise can contribute to improving balance confidence and reducing FoF (GRADE: Low).

In the systematic review by Zijlstra et al. (2007) four studies evaluated physical exercise interventions involving strength, balance, mobility, and coordination training. Among these, two studies reported a significant reduction in FoF, while the other two found no significant effect. Overall, the same authors concluded that physical exercise interventions showed mixed results, with some programs proving effective but others not, suggesting that exercise alone may not consistently reduce FoF and could benefit from being combined with educational or psychological components (GRADE: Low).

Balance training was identified as the most effective exercise modality for reducing FoF among community-dwelling older adults in the systematic review and meta-analysis by Feng et al. (2022). Fourteen randomized controlled trials focused primarily on balance exercises, indicating a moderate to large reduction in FOF. However, most studies did not report on the intensity or progression of balance exercises, and few applied the core exercise principles of overload, progression, or reversibility. The authors highlighted the need for validated tools to measure balance intensity and for more consistent reporting of exercise parameters to optimize prescription and replication in clinical practice (GRADE: Moderate).

In the Cochrane systematic review and meta-analysis by Kumar et al. (2016), 19 of the 36 included interventions were classified as gait, balance, coordination and functional task training. These programs involved exercises aimed at improving postural control, gait, and performance of daily activities. However, this category was not evaluated separately, as all exercise modalities were analyzed together. The pooled results showed a small to moderate reduction in FoF immediately after the intervention, with no significant difference in effect between exercise types (GRADE: Low).

The systematic review by Savvakis et al. (2024) found that balance training plays a central role in reducing FoF among frail and pre-frail older adults. Nine studies included balance-focused interventions, of which four demonstrated a significant decrease in FoF. Effective programs commonly integrated static and dynamic balance exercises—such as one-leg stance, tandem standing, weight shifting, and multi-directional walking—often combined with strength or mobility components. Overall, the review highlights that regular, multicomponent, and long-term balance training can substantially reduce FoF and improve balance confidence in frail and pre-frail older adults, though its benefits tend to diminish when the exercise is discontinued (GRADE: Moderate).

The review by Feng et al. (2022) also examined seven trials that focused on strength training. These studies focused primarily on strengthening exercises, produced a small but significant reduction in FOF, along with improvements in physical performance and self-efficacy among older adults. The review emphasized that key exercise principles, particularly overload and progression, were often underreported, which limits the ability to determine the optimal dosage. Nevertheless, the evidence indicates that progressive resistance training alone can contribute to reducing FoF, especially in individuals with lower baseline balance confidence or higher initial FoF (GRADE: Low).

In the meta-analysis by Jung et al. (2009) physical exercise interventions showed no significant effect on reducing FoF. The authors noted that in most studies, physical exercise alone did not meaningfully decrease FoF, particularly when control groups also received light physical activity or social interaction. They concluded that physical exercise by itself may not be sufficient, as FoF is influenced not only by physical capacity but also by psychological and cognitive factors; therefore, incorporating educational or cognitive components is likely necessary to achieve significant improvements (GRADE: Low).

In the systematic review and meta-analysis by Kruisbrink et al. (2021) physical exercise interventions were examined across 37

randomized controlled trials involving community-dwelling older adults. The meta-regression analysis showed that these interventions were not significantly associated with a greater reduction in FoF compared to other types of interventions. Although physical exercise generally produced small overall benefits in reducing FoF across studies, the specific category of exercise interventions did not outperform alternative approaches such as educational, multifactorial, or holistic programs (GRADE: Low).

Regarding aquatic physical exercise, Campos et al. (2021) refer to two studies that evaluated its effect on FoF in older adults, but only one showed a significant reduction in FoF. Thus, the review suggests that aquatic exercise may help reduce FoF in older adults, although results vary according to sample characteristics and the type of intervention applied (GRADE: Low).

The systematic review by S. E. R. Lim et al. (2021), which explored the effectiveness of physical activity interventions led by community-dwelling volunteers, included eight overall studies. However, only two specifically evaluated FoF. Both studies reported a significant reduction in FoF following volunteer-led interventions involving strength and balance exercises (GRADE: Moderate).

Of the 75 randomized controlled trials included in the systematic review by Feng et al. (2022), only four studies used aerobic exercise interventions to address FoF among community-dwelling older adults. These programs typically involved walking-based endurance activities or cardiorespiratory training, such as supervised walking sessions, home-based walking programs, and ergometer cycling. Overall, these interventions were found to improve physical fitness and mobility and contributed to some reduction in FoF, although their impact appeared modest compared with other exercise approaches. Aerobic exercise, therefore, may play a supportive role in maintaining confidence and functional capacity in older adults, but evidence suggests it is less effective when used alone to significantly reduce FoF (GRADE: Low).

In the review by Savvakis et al. (2024), two studies examined the effects of resistance exercises using elastic bands on FoF in frail and pre-frail older adults. Both studies reported a significant reduction in FoF within the intervention groups, although no significant differences were observed between groups after follow-up. These findings suggest that resistance training with elastic bands can positively influence confidence and FoF, even if the between-group effects remain modest (GRADE: Moderate).

In the same review by Savvakis et al. (2024), only one study investigated the effects of whole-body vibration platform training on FoF in frail older adults. The study reported a significant within-group improvement in FoF immediately after the intervention; however, no significant differences were found between the intervention and control groups. Therefore, the review concluded that whole-body vibration did not produce a significant overall effect on reducing FoF (GRADE: Very Low).

4.2. Cognitive behavioral therapy

Regarding cognitive behavioral therapy (CBT), Chua et al. (2019), when analyzing 15 randomized clinical trials, it concluded that CBT-based interventions significantly reduced FoF immediately after the intervention, as well as in the short term (up to 6 months) and in the long term (more than 6 months after the intervention). Multicomponent interventions based on CBT included elements such as cognitive restructuring, setting personal goals, promoting physical activity, and strategies for coping with FoF (GRADE: High). Lenouvel et al. (2023) concluded that CBT, with or without exercise, it probably reduces the FoF immediately after the intervention, with a short-lived but statistically significant effect. No significant differences were found between CBT alone and CBT combined with physical exercise, suggesting that both are equally effective in reducing FoF, with effects that can be sustained over the long term (GRADE: Moderate). Additionally, CBT can contribute to maintaining daily activities and reducing depressive symptoms.

In their study, Liu et al. (2018) investigated the effectiveness of CBT interventions in reducing FoF, conducted in groups or individually. CBT interventions included cognitive restructuring, setting personal goals, and promoting physical activity. As a result, group interventions showed a small effect, while individual interventions had a small to moderate effect. They concluded that CBT demonstrated immediate and sustained effects in reducing FoF, with benefits observed up to 12 months after the intervention (GRADE: High). Finally, Papadimitriou and Perry (2020) demonstrated that cognitive and behavioral interventions were effective in reducing FoF, both immediately after treatment and in long-term follow-ups (GRADE: Moderate).

4.3. Combined strategies

In relation to combined strategies, the review by Hu et al. (2024) examined the effects of combined physical and cognitive interventions on FoF in older adults. The findings showed that these combined interventions had a small to moderate immediate effect in reducing FOF compared with control, placebo, or usual care (GRADE: Moderate), and were more effective than cognitive interventions alone (GRADE: Low), though not superior to physical exercise alone (GRADE: Low). In the short term, some benefits were maintained, but no long-term effects were observed. Overall, the review concluded that while combined interventions can temporarily reduce FoF, physical exercise remains the key component, offering similar results with greater simplicity and feasibility for clinical practice.

In the meta-analysis by Jung et al. (2009) ,the combined interventions integrated physical exercise (such as balance, strength, mobility, and Tai Chi training) with educational components addressing fall risk factors, nutrition, physical activity, and coping with FoF. These programs, typically delivered in community or home settings over periods of three to six months, produced a significant reduction in FoF, outperforming exercise-only interventions. The authors concluded that combining exercise with education is more effective because FoF is influenced by both physical limitations and psychological or cognitive factors, and this integrated approach enhances older adults' confidence, knowledge, and functional ability over time (GRADE: Low).

4.4. Multifactorial preventive programs

Two of the reviews consulted (Zijlstra et al. (2007) and Jung et al. (2009)) mention a study that tested an intervention using hip protection devices to increase confidence by reducing the risk of fractures in the event of a fall. As a result, they highlight a statistically significant reduction in FoF in favor of the intervention group (GRADE: Low).

Yoshikawa et al. (2020) analyzed 13 studies to evaluate the effectiveness of the community intervention program - A Matter of Balance/Volunteer Lay Leader (AMOB/VLL), concluding that there was a significant reduction in FoF and a significant increase in participants' confidence to perform activities without falling (GRADE: Low).

In the review by Sjösten et al. (2008), seven randomized controlled trials investigating multifactorial fall prevention interventions assessed FoF among community-dwelling older adults. These programs typically combined exercise, education, environmental modification, medication review, and behavioral strategies. Of the seven studies, six (86 %) reported a statistically significant reduction in FoF compared with control groups. Improvements were attributed to the multifactorial nature of these interventions, which simultaneously addressed the physical, environmental, and psychological determinants of fear (GRADE: Moderate).

In their systematic review, Zijlstra et al. (2007) examined one study was classified as an intervention on fall risk factors (GRADE: Very Low) and eight as multifactorial fall prevention programs (GRADE: Low). The single fall risk factor intervention involved individualized home visits to assess and modify personal fall risks, resulting in a significant reduction

in FoF. The multifactorial fall prevention interventions, which combined components such as exercise, education, medication review, and environmental modification, consistently demonstrated beneficial effects. Across these eight trials, most reported significant decreases in FoF and improved confidence and physical function, particularly when interventions were home-based and individually tailored.

Kruisbrink et al. (2021) conducted a systematic review which examined intervention characteristics associated with a reduction in FoF among community-dwelling older adults, neither assessment-based home modification (GRADE: Very Low) nor health education (GRADE: Very Low) demonstrated significant effects. The authors noted that home modification interventions may reduce actual fall risk but are unlikely to influence the emotional and cognitive dimensions of fear, while educational programs alone appear insufficient to modify self-efficacy or confidence in balance.

4.5. Technological interventions

Exergames are the most frequently mentioned intervention in literature in the area of technological measures that can reduce the FoF. In the systematic review by Ge et al. (2022), 15 of the 23 studies included reported a positive effect on reducing FoF after intervention with exergames, with Nintendo Wii console games being the most widely used (GRADE: Low). Vo et al. (2023) also mentioned an experimental study that used the Nintendo Wii console as an intervention and achieved a significant reduction in FoF, compared to conventional gym exercises (GRADE: Moderate). On the other hand, in the review by Howes et al. (2017), 16 studies evaluated the effect of active computer games, which combine digital games with physical effort, concluding that there was no significant effect on FoF (GRADE: Low). In their systematic review on home-based indoor physical activity programs for community-dwelling older adults, I. K. dos Santos et al. (2024) identified the iStoppFalls trial as one of only two studies that directly assessed FoF. The review reports that participation in the iStoppFalls exergame program, a 12-week interactive home-based training system designed to improve balance and strength, was associated with a significant reduction in FoF compared with the control group (GRADE: Moderate).

Finally, in the systematic review by Savvakis et al. (2024), three studies are mentioned, two of which used exergames (GRADE: Low) and one of which used computer-based visual feedback training (GRADE: Very Low), concluding that none had a significant effect on reducing FoF.

4.6. Study limitations

This umbrella review has some limitations that should be considered when interpreting the results. First, the included studies used different instruments to assess FoF — namely the Falls Efficacy Scale (FES), Falls Efficacy Scale-International (FES-I), Modified Falls Efficacy Scale (MFES), Activities-specific Balance Confidence Scale (ABC), and other adapted versions. This methodological heterogeneity may have influenced the comparability of the results and contributed to the variability observed among the included reviews.

Most of the included reviews had short follow-up periods, which limit the assessment of the sustainability of intervention effects over time. Therefore, it is recommended that future research adopt standardized measures and conduct longitudinal studies to allow for better comparability and robustness of evidence.

5. Conclusion

The findings of this umbrella review indicate that interventions designed to reduce FoF in older adults are most effective when they incorporate multimodal and person-centered approaches. Evidence of moderate to high quality supports the effectiveness of CBT, which demonstrates consistent and sustained reductions in FoF, particularly when combined with physical exercise.

Among physical interventions, Tai Chi and balance training show the most reliable benefits, supported by moderate-quality evidence. These holistic practices enhance body awareness, postural control, and confidence in movement, addressing both the physical and emotional dimensions of FoF. Pilates and the OEP also present positive outcomes, though supported by moderate-to-low-quality evidence, suggesting value in community-based applications under professional supervision.

Multifactorial preventive programs, integrating physical, behavioral, and environmental components, are also promising, with moderate-quality evidence indicating their usefulness in real-world and community contexts. In contrast, educational and technology-based interventions, such as exergames, currently rely on low-quality or inconsistent evidence, and therefore should be considered complementary rather than standalone strategies.

Overall, the evidence highlights the importance of integrated, evidence-based programs that combine structured physical exercise, especially balance-oriented and holistic modalities, with psychological approaches such as CBT. Future research should focus on evaluating the long-term effects and implementation feasibility of these interventions across different cultural, institutional, and geographical contexts.

6. Implications for nursing practice

In addition to the evidence synthesized in this umbrella review, qualitative research provides valuable insights into how older adults experience and manage FoF. A recent meta-synthesis by Baltes et al. (2023) identified three core dimensions of this phenomenon: triggers and underlying causes; the perceived consequences for daily life; and the coping strategies developed by older adults. These findings emphasize that effective interventions must not only target physical and psychological mechanisms but also incorporate older adults' lived experiences and perspectives, ensuring that care is truly person-centered and acceptable in real-world contexts.

Building on this understanding, the findings of the present review highlight that FoF requires an integrated and multidisciplinary approach, in which nurses play a pivotal role in prevention, rehabilitation, and health education. Implementing multimodal interventions that combine structured physical exercise (such as Tai Chi, Pilates, or the Otago Exercise Program) with cognitive-behavioral strategies has proven effective in reducing fear and enhancing older adults' self-confidence.

Nurses are uniquely positioned to assess fall risk, promote safe environmental modifications, and educate older adults about self-care, encouraging regular and adapted physical activity. The incorporation of digital technologies, including exergames, can complement these interventions by increasing engagement and motivation.

To ensure high-quality, evidence-based care, continuous professional development in therapeutic exercise, cognitive-behavioral approaches, and digital health tools is essential for strengthening nursing competencies. Such training enables nurses to deliver interventions that not only reduce fear but also promote autonomy, safety, and healthy aging.

Finally, interventions should be designed and implemented with attention to the individual experiences, perceptions, and coping strategies of older adults, as highlighted by Baltes et al. (2023). Integrating these experiential dimensions into nursing practice can foster more person-centered, acceptable, and sustainable approaches to managing FoF in older populations.

CRediT authorship contribution statement

Ana Rita Capela Oliveira: Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Carla Maria Pintado Magueja:** Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Armando Manuel Gonçalves de Almeida:** Visualization, Validation,

Supervision, Conceptualization.

Declaration of competing interest

The authors declare no conflicts of interest in the article "Actions to control the fear of falling in older people: an umbrella review."

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There is nothing to disclose.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.archger.2025.106087.

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