



## Original Investigation | Geriatrics

# Evaluation of Clinical Practice Guidelines on Fall Prevention and Management for Older Adults

## A Systematic Review

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### Abstract

**IMPORTANCE** With the global population aging, falls and fall-related injuries are ubiquitous, and several clinical practice guidelines for falls prevention and management for individuals 60 years or older have been developed. A systematic evaluation of the recommendations and agreement level is lacking.

**OBJECTIVES** To perform a systematic review of clinical practice guidelines for falls prevention and management for adults 60 years or older in all settings (eg, community, acute care, and nursing homes), evaluate agreement in recommendations, and identify potential gaps.

**EVIDENCE REVIEW** A systematic review following Preferred Reporting Items for Systematic Reviews and Meta-analyses statement methods for clinical practice guidelines on fall prevention and management for older adults was conducted (updated July 1, 2021) using MEDLINE, PubMed, PsycINFO, Embase, CINAHL, the Cochrane Library, PEDro, and Epistemonikos databases. Medical Subject Headings search terms were related to falls, clinical practice guidelines, management and prevention, and older adults, with no restrictions on date, language, or setting for inclusion. Three independent reviewers selected records for full-text examination if they followed evidence- and consensus-based processes and assessed the quality of the guidelines using Appraisal of Guidelines for Research & Evaluation II (AGREE-II) criteria. The strength of the recommendations was evaluated using Grades of Recommendation, Assessment, Development, and Evaluation scores, and agreement across topic areas was assessed using the Fleiss  $\kappa$  statistic.

**FINDINGS** Of 11 414 records identified, 159 were fully reviewed and assessed for eligibility, and 15 were included. All 15 selected guidelines had high-quality AGREE-II total scores (mean [SD], 80.1% [5.6%]), although individual quality domain scores for clinical applicability (mean [SD], 63.4% [11.4%]) and stakeholder (clinicians, patients, or caregivers) involvement (mean [SD], 76.3% [9.0%]) were lower. A total of 198 recommendations covering 16 topic areas in 15 guidelines were identified after screening 4767 abstracts that proceeded to 159 full texts. Most ( $\geq 11$ ) guidelines strongly recommended performing risk stratification, assessment tests for gait and balance, fracture and osteoporosis management, multifactorial interventions, medication review, exercise promotion, environment modification, vision and footwear correction, referral to physiotherapy, and cardiovascular interventions. The strengths of the recommendations were inconsistent for vitamin D supplementation, addressing cognitive factors, and falls prevention education. Recommendations on use of hip protectors and digital technology or wearables were often missing. None of the examined guidelines included a patient or caregiver panel in their deliberations.

(continued)

### Key Points

**Question** What are the most common consistent recommendations in fall prevention clinical practice guidelines, across settings, for adults 60 years or older?

**Findings** In this systematic review of 198 recommendations across 15 selected guidelines, most guidelines recommended fall risk stratification, assessment tools, fractures or osteoporosis management, multifactorial interventions, medication review, exercise, physiotherapy referral, environment modification, and vision, footwear, and cardiovascular interventions. Recommendations on vitamin D supplementation, addressing cognitive factors, and education were inconsistent, whereas hip protectors, digital technology, clinical applicability, and stakeholder involvement were less commonly addressed.

**Meaning** This systematic review found that agreement was high on several recommendations for fall prevention clinical practice guidelines for older adults, but certain areas, including stakeholder perspectives and clinical applicability, were often not addressed.

### + Supplemental content

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Abstract (continued)

**CONCLUSIONS AND RELEVANCE** This systematic review found that current clinical practice guidelines on fall prevention and management for older adults showed a high degree of agreement in several areas in which strong recommendations were made, whereas other topic areas did not achieve this level of consensus or coverage. Future guidelines should address clinical applicability of their recommendations and include perspectives of patients and other stakeholders.

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## Introduction

Falls and fall-related injuries are common for older adults,<sup>1</sup> with approximately 30% of adults 60 years of age or older falling each year.<sup>2-4</sup> Falls are more likely for older adults with greater frailty severity and among those living in nursing homes.<sup>5,6</sup> Consequences of falls include injuries,<sup>7</sup> fractures,<sup>8</sup> problems with mobility, depression, loss of independence,<sup>9,10</sup> and a substantial economic burden on health care systems.<sup>11</sup>

Falls and their concomitant injuries represent a worldwide phenomenon.<sup>12</sup> Accordingly, several medical societies and organizations in different countries have created clinical practice guidelines for fall prevention and management.<sup>13-27</sup> These guidelines are typically based on systematic reviews of the available evidence and consensus by experts in the fields of geriatric medicine, rehabilitation medicine, and physiotherapy, among others.<sup>28,29</sup> Although several of these clinical practice guidelines for fall prevention have been published, little is known about the level of agreement between the recommendations made by them. Clinicians face the challenge of selecting high-quality guidelines based on robust methods with internally and externally validated recommendations applicable to their setting in informing their practice.<sup>30,31</sup>

We aimed to (1) systematically review existing clinical practice guidelines on fall prevention and management for older adults; (2) identify common areas evaluated and level of agreement in the recommendations made; (3) address fall risk stratification in each guideline, describing which assessments are recommended to guide this and inform management across settings (eg, community, acute care, and nursing homes); and (4) identify potential gaps and areas that should be addressed in future clinical practice guidelines.

## Methods

We followed the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) reporting guideline and preregistered in PROSPERO (CRD42020173597). This systematic review was performed under the umbrella of the World Falls Guidelines for Prevention and Management of Falls in Older Adults.<sup>32</sup>

### Identification of Guidelines

Our initial search on April 2, 2020, was updated July 1, 2021, and included the following databases: MEDLINE, PubMed, PsycINFO, Embase, CINAHL (Cumulative Index to Nursing and Allied Health Literature), the Cochrane Library, PEDro (Physiotherapy Evidence Database), and Epistemonikos. Three of us (M.M.M.-O., S.W.H., and T.M.) also provided consultation to include guidelines potentially not indexed in databases.

### Search Terms

Our search used Medical Subject Headings terms pertaining to (1) falls, (2) clinical practice guidelines, (3) management and prevention, and (4) older adults (eTable 1 in Supplement 1 describes our search syntax).

## Inclusion Criteria

The inclusion criteria were (1) outcome of guidelines: fall reduction, prevention, and management; (2) study type: clinical practice guidelines for preventing or managing falls categorized as consensus- or evidence-based guidelines<sup>13</sup>; and (3) target population of guidelines: older adults. There were no restrictions on date, language, or setting for inclusion.

## Screening, Review Process, and Quality Assessment

Three of us as independent reviewers (M.M.M.-O., N.K., and Y.S.-A.) selected records for full-text examination if they followed evidence- and consensus-based processes; disagreements were resolved by consensus. Three of us as reviewers (N.K., F.P.-F., and A.O.) assessed guideline quality using the 23-item Appraisal of Guidelines for Research & Evaluation II (AGREE-II) tool<sup>31</sup> (eTable 2 in Supplement 1). The scores for AGREE-II range from 0 to 100, with higher scores indicating higher quality. Extracted recommendations were grouped in common areas and independently appraised by 3 of us (N.K., F.P.-F., and A.O.; blinded among us 3) using Grades of Recommendation, Assessment, Development, and Evaluation (GRADE),<sup>29,33</sup> which reflects the strength of the recommendation (1 = strong; 2 = weak) paired with the quality of the supporting evidence (A = high; B = moderate; and C = low). Agreement across guidelines for specific recommendations was assessed using the Fleiss  $\kappa$  statistic.

## Results

Our search yielded 11 414 records. There were 6647 duplicates, and 4608 records were excluded after title and abstract review, resulting in 159 records that were fully reviewed and assessed for eligibility (Figure 1).<sup>34</sup> Of the 159 records, 144 were excluded, yielding 15 records retained for final analyses and included in the data synthesis.<sup>13-27</sup> Table 1 shows the quality assessment characteristics using the AGREE-II tool for the 15 guidelines selected.

## Quality Assessment

The AGREE-II total scores were high across all guidelines (mean [SD], 80.1% [5.6%]; range, 69.7%-92.8%). Descriptive statistics for AGREE-II scores by domain are given in Table 1, and mean AGREE-II scores by domain are illustrated in Figure 2. Domain 6 (editorial independence, competing interests, and conflicts of interest disclosed) scored highest across guidelines. Domain 1 (guideline objectives, clinical research question being addressed, and target population) and domain 4 (clarity of presentation) also showed high mean scores. Domain 2 (representation and involvement from professional backgrounds, and by patients and stakeholders) showed moderate mean scores (mean [SD], 76.3% [9.0%]) mainly owing to involvement of only clinicians in some of the guidelines; however, none of guidelines included an exclusive panel of patients or caregivers involved in the entirety of the guideline development process. Domain 3 (systematic methods used to obtain evidence, strengths and limitations clearly outlined, and the extent to which the health benefits and adverse effects of each recommendation are considered) scores were moderately high with more variability. Domain 5 (applicability of the recommendations, descriptors of facilitators and barriers to the application of each recommendation, and advice on tools and resources for applying each recommendation) scored consistently lower (mean [SD], 63.4% [11.4%]) than the other domains mainly because only 5 guidelines provided a toolkit or a step-by-step process in how to apply the recommendations.<sup>15,18,21,24,25</sup>

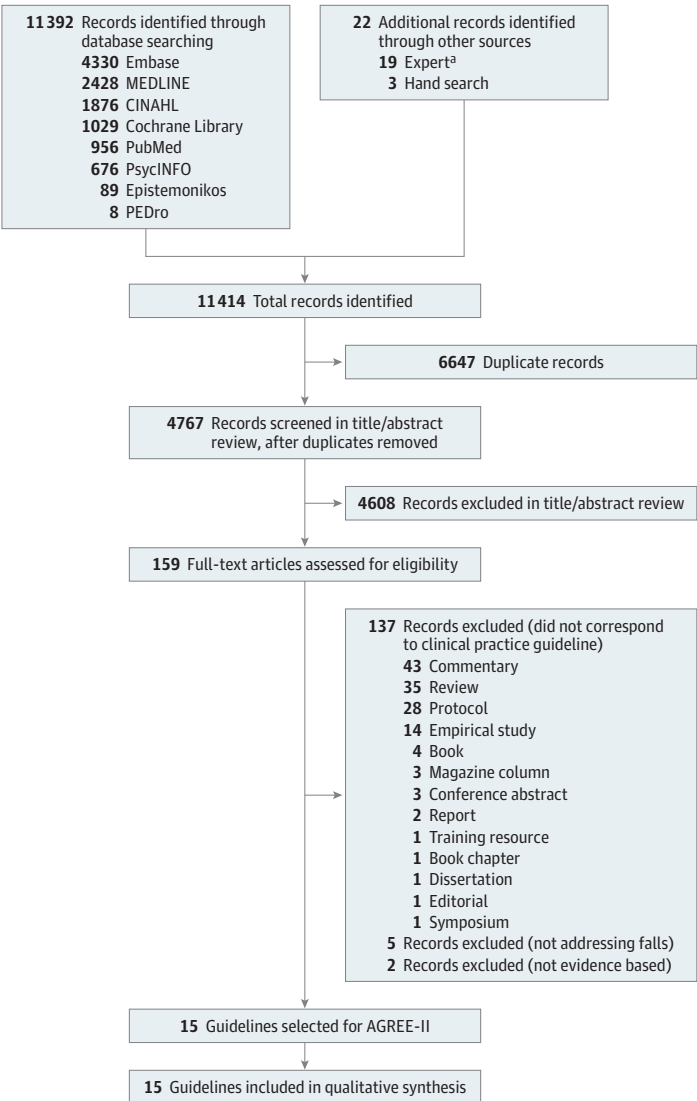
## Recommendations and Agreement Across Guidelines

After screening 4767 abstracts that proceeded to 159 full texts, we extracted 198 recommendations from the 15 guidelines that we grouped into 16 commonly addressed topic areas (Table 2). Topic areas that were presented in more than 40% of the guidelines were included in Table 2. Each topic area in Table 2 includes an accompanying GRADE score, which reflects the strength of the

recommendation and the quality of the evidence. Across all areas and in all guidelines, the direction of the recommendation was in favor of the guideline (rather than recommending against its use). For definitions of the 16 commonly addressed topic areas, refer to eTable 3 in Supplement 1. The following topic areas were presented in less than 40% of the guidelines: addressing the use of canes or walking aids in the recommendations, alcohol use, depression, urinary incontinence, hearing impairment, atypical blood glucose, social isolation, and functional dependence as risk factors for falls, followed by staff education in nursing homes as part of interventions to prevent and manage falls.

Of 15 guidelines, 4 addressed all 16 topic areas identified,<sup>14,17,25,27</sup> whereas 5 addressed at least 13 of them.<sup>13,15,18,22,24</sup> Two topic areas (use of assessment tools for individuals who screened positive in falls risk, and exercise interventions) were covered in all of the guidelines, indicating consistent support for their importance. Medication review for fall risk-increasing drugs, use of multifactorial interventions to manage falls, and environment modification to prevent falls were recommended in 14 of the guidelines. Thirteen of the guidelines recommended performing risk stratification to detect high-risk individuals if they screened positive in the case-finding step using gait and balance tests.

Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses Flowchart of Search Yield



AGREE-II indicates Appraisal of Guidelines for Research & Evaluation II.

<sup>a</sup> Records suggested by 3 of us who are experts in the field of geriatric medicine (M.M.M.-O., S.R.L., and T.M.).

Thirteen guidelines also recommended conducting vision interventions, cardiovascular interventions for falls, and referral to a physiotherapist for exercises and balance retraining. Twelve guidelines recommended footwear evaluation and intervention and falls prevention education. Concerning the strength of the recommendations and quality of the evidence supporting the recommendation, GRADE A scores were most commonly found for 9 topic areas (Table 2). Agreement across guidelines was high ( $\kappa > 0.80$ ) for 5 areas: risk stratification, assessment tools, fractures and osteoporosis management, exercise interventions, and use of multifactorial interventions. Agreement was moderate ( $\kappa = 0.50$ -0.80) for 7 topic areas and low ( $\kappa < 0.5$ ) for the remaining 4 areas (Table 2).

Table 1. Quality Assessment Total and Domain-Specific Scores of the Guidelines Using AGREE-II<sup>a</sup>

Source or guideline	AGREE-II total score, %	AGREE-II domain scores, %					
		1: Scope and purpose	2: Stakeholder involvement	3: Rigor of development	4: Clarity of presentation	5: Applicability	6: Editorial independence
Baraff et al, <sup>16</sup> 1997 (US)	78.5	96.3	81.5	72.2	88.9	62.5	88.9
AGILE, <sup>21</sup> 1998 (UK)	74.6	94.4	68.5	66.7	94.4	56.9	91.7
Feder et al, <sup>19</sup> 2000 (UK)	77.8	92.6	66.7	81.9	81.5	54.2	97.2
AGS/BGS/AAOS, <sup>13</sup> 2001 (US/UK)	84.5	94.4	81.5	82.6	96.3	66.7	100
Moreland et al, <sup>24</sup> 2003 (Canada)	80.0	96.3	68.5	80.6	83.3	66.7	91.7
ACSQHC, <sup>15</sup> 2009 (Australia)	81.9	94.4	83.3	68.8	94.4	79.2	100
FSGG, <sup>17</sup> 2011 (France)	78.0	92.6	74.1	75.0	85.2	59.7	100
NICE, <sup>18</sup> 2013 (UK)	92.8	98.1	94.4	91.7	92.6	86.1	100
STEADI, <sup>27</sup> 2013 (US)	74.2	90.7	81.5	66.7	81.5	58.3	88.9
Jung et al, <sup>22</sup> 2014 (Korea)	77.5	90.7	64.8	77.8	90.7	56.9	97.2
RACGP, <sup>26</sup> 2016 (Australia)	69.7	83.3	72.2	58.3	83.3	54.2	100
KAIM/KGS, <sup>23</sup> 2017 (Korea)	80.4	79.6	81.5	86.8	90.7	51.4	97.2
RNAO, <sup>25</sup> 2017 (Canada)	88.0	94.4	86.1	84.4	88.9	85.4	100
SENATOR ONTOP, <sup>20</sup> 2017 (Ireland)	79.2	94.4	61.1	86.1	85.2	52.8	100
USPSTF, <sup>14</sup> 2018 (US)	82.9	92.6	79.6	82.6	96.3	59.7	100
Mean (SD) [range]	80.1 (5.6) [69.7-92.8]	92.3 (4.8) [79.6-98.1]	76.3 (9.0) [61.1-94.4]	77.6 (9.3) [58.3-91.7]	88.7 (5.4) [81.5-96.3]	63.4 (11.4) [51.4-86.1]	96.9 (4.2) [88.9-100]

Abbreviations: ACSQHC, Australian Commission on Safety and Quality in Health Care; AGILE, a recognized professional network of the Chartered Society of Physiotherapy; AGREE-II, Appraisal of Guidelines for Research & Evaluation-II; AGS/BGS/AAOS, American Geriatrics Society/British Geriatrics Society/American Academy of Orthopaedic Surgeons; FSGG, French Society of Geriatrics and Gerontology; KAIM/KGS, Korean Association of Internal Medicine/Korean Geriatrics Society; NICE, National Institute for Health and Care Excellence; RACGP, The Royal Australian College of General

Practitioners; RNAO, Registered Nurses' Association of Ontario; SENATOR ONTOP, software engine for the assessment & optimization of drug and non-drug therapy—older persons optimal evidence-based non-drug therapies in older people; STEADI, Stopping Elderly Accidents, Deaths and Injuries; USPSTF, US Preventive Services Task Force.

<sup>a</sup> Scores range from 0 to 100, with higher scores indicating higher quality.

Figure 2. Mean Appraisal of Guidelines for Research & Evaluation II (AGREE-II) Total and Domain-Specific Scores Across Guidelines<sup>31</sup>

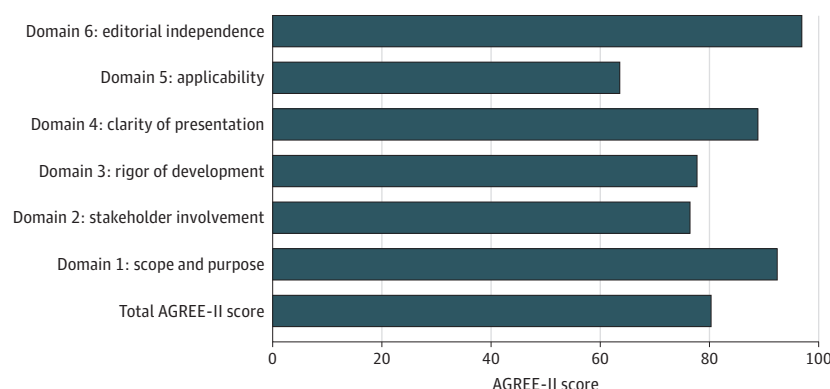


Table 2. Guidelines Appraised With Evidence and Strength for Each Recommendation Stratified by Topic Areas Identified

16 Areas identified	No. (%) of guidelines addressing this area	Mode of GRADE score <sup>a</sup>	GRADE agreement Fleiss κ	15 Guidelines included <sup>a</sup>															SENATOR			
				Baraff et al., <sup>16</sup> 1997	AGILE, <sup>21</sup> 1998	Feder et al., <sup>19</sup> 2000	AGS/BGS/AAOS, <sup>13</sup> 2001	Moreland et al., <sup>24</sup> 2003	ACSOHC, <sup>15</sup> 2009	FSGG, <sup>17</sup> 2011	NICE, <sup>18</sup> 2013	STEADI, <sup>27</sup> 2013	Jung et al., <sup>22</sup> 2014	RACGP, <sup>26</sup> 2016	KAIM/KGS, <sup>23</sup> 2017	RNAO, <sup>25</sup> 2017	ONTOP, <sup>20</sup> 2017	USPSTF, <sup>14</sup> 2018				
Risk stratification	13 (87)	1A	.92	NA	1A	1A	1A	1A	1A	1A	1C	1B	1A	1A	1A	1C	1A	NA	1A	1A		
Assessment tools	15 (100)	1A	.88	1A	1A	1B	1A	1A	1A	1A	1C	1A	1A	1A	1A	1C	1B	1B	1A	1A		
Fractures and osteoporosis management	11 (73)	1A	.83	1A	1A	NA	NA	NA	1A	1A	1C	1A	1A	1A	2B	1A	1C	NA	1A	1A		
Multifactorial interventions	14 (93)	1A	.82	NA	1A	1A	2B	1B	1A	1A	1C	1A	1A	1A	1A	1A	1A	1C	1C	1C		
Medication review	14 (93)	1A	.68	1A	1B	NA	1C	1A	1B	1C	1C	1A	1A	1A	1A	1A	1A	1B	1B	2C		
Exercise interventions	15 (100)	1A	.88	1A	1A	1B	1B	1B	1A	1A	1C	1A	1B	1A	1A	1A	1A	1B	1B	1B		
Vitamin D supplementation	11 (73)	Mixed	.30	1A	NA	NA	2C	NA	1A	1A	1C	2C	1A	1A	1A	2C	1B	NA	NA	2C		
Hip protectors	9 (60)	Underrep	.69	NA	NA	1B	1C	NA	1A	1A	2C	2B	1A	1A	NA	NA	1B	NA	NA	1A		
Vision modification	13 (87)	1B	.66	1A	NA	NA	1C	1B	2B	1C	1C	1B	1A	1A	1A	1C	2C	1B	1B	1B		
Environment modification	14 (93)	1A	.70	1B	1A	1B	1B	1A	1A	1A	1C	1A	1A	1A	1A	1C	1A	NA	NA	2C		
Cognitive factors management	11 (73)	Mixed	.39	1B	NA	NA	1B	1B	1C	1C	1C	2C	1B	1A	1A	NA	2C	NA	NA	2C		
Physiotherapy referral	13 (87)	1A	.50	1A	2B	NA	1B	1B	1A	1A	1C	1B	1A	1A	NA	1A	2C	1C	1C	2B		
Falls education	12 (80)	Mixed	.20	NA	2C	2A	2B	2C	1A	1A	1C	1B	1B	1A	NA	NA	1A	2B	2B	2B		
Cardiovascular intervention	13 (87)	1B	.61	1B	2C	1B	1C	1B	1B	1B	1C	1B	1B	1A	1A	1C	NA	NA	1C	1C		
Footwear evaluation and intervention	12 (80)	1A	.42	1B	2B	NA	2C	1B	2C	1C	1C	1A	1A	NA	1A	1C	1A	NA	NA	2C		
Technology	7 (47)	Underrep	.78	NA	NA	NA	1C	1B	NA	NA	NA	NA	1C	1A	NA	NA	2B	1B	1C	1C		
Areas addressed in each guideline (of 16), %				69	75	50	94	81	94	94	100	94	100	94	75	75	100	50	100	100		
Setting of intended recommendations <sup>b</sup>																						
Community dwelling				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Nursing homes				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		
Acute care and hospitals				✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

Abbreviations: ACSQHC, Australian Commission on Safety and Quality in Health Care; AGILE, a recognized professional network of the Chartered Society of Physiotherapy; AGS/BGS/AAOS, American Geriatrics Society/ British Geriatrics Society/American Academy of Orthopaedic Surgeons; FSGG, French Society of Geriatrics and Gerontology; GRADE, Grades of Recommendation, Assessment, Development, and Evaluation; KAIM/KGS, Korean Association of Internal Medicine/Korean Geriatrics Society; NA, not available; NICE, National Institute for Health and Care Excellence; RACGP, The Royal Australian College of General Practitioners; RNAO, Registered Nurses' Association of Ontario; SENATOR ONTOP, software engine for the assessment & optimization of drug and non-drug therapy—older persons optimal evidence-based non-drug therapies in older people; STEADI, Stopping Elderly Accidents, Deaths and Injuries; Underrep, Underrepresented; USPSTF, US Preventive Services Task Force.

<sup>a</sup> GRADE strength of recommendation (1 = strong; 2 = weak) and quality of evidence (A = high quality; B = moderate quality; C = low quality).

<sup>b</sup> The check mark indicates setting of intended recommendation.

## Inconsistent and Underrepresented Topic Areas in Recommendations

### Across Guidelines

Recommendations on vitamin D supplementation ( $\kappa = 0.30$ ) and education on falls prevention ( $\kappa = 0.20$ ) had low levels of agreement across the 15 guidelines. Seven guidelines strongly recommended the use of vitamin D supplementation, 4 guidelines provided weak recommendations, and the remaining 4 guidelines did not address the topic. For education on falls prevention, 6 guidelines provided strong recommendations to offer patients and caregivers education on fall prevention and management strategies, 6 gave weak recommendations, and 3 did not address this topic area. Recommendations for addressing cognitive impairment during fall risk assessment and management were present in 11 guidelines, with low agreement across them ( $\kappa = 0.39$ ). Physiotherapy referral was recommended in 13 guidelines but with low agreement ( $\kappa = 0.50$ ).

The use of hip protectors to prevent fall-related injuries and the use of digital technology (including wearables) to detect, prevent, or manage falls had a low level of agreement across the 15 guidelines. For recommendations on hip protectors, 7 guidelines provided strong recommendations for their use in nursing home settings, 2 guidelines provided weak recommendations, and 6 guidelines did not address their use. Recommendations on the use of digital technology had similar results. Six guidelines provided strong recommendations to use digital technology, 1 guideline provided a weak recommendation, and 8 guidelines did not address their use.

### Risk Stratification

Most guidelines strongly recommended risk stratification using "case finding" self-reported questions, including fall history, fear of falling, and gait and balance difficulties, and reserving gait and balance testing for those who screen positive on these questions. Five guidelines included a risk-stratification algorithm, but evidence validating the algorithm was not consistently presented, as described in **Table 3**.<sup>2-4,13-27,35,36</sup> The majority of these algorithms followed the format proposed by the American Geriatrics Society/British Geriatrics Society/American Academy of Orthopaedic Surgeons (AGS/BGS/AAOS) guidelines.<sup>13</sup> Individuals who had either no falls or 1 noninjurious fall in the last year and no impairment of balance and gait evident on examination were considered low risk, with a reassessment suggested sometime in the future. The interval proposed to reassess these low-risk individuals ranged from 1 year to 2 years across the guidelines examined.

For individuals who screened positive in fall history, several guidelines stratified their risk by demographic factors (ie, advanced age or female sex)<sup>14,17,20,24,26</sup> or clinical characteristics (gait and balance abnormalities).<sup>13-18,20,22-27</sup> The assessment of balance and gait, at this step, was recommended in 13 out of 15 guidelines<sup>13-18,20,22-27</sup> using the Timed Up and Go Test (TUG),<sup>37</sup> the Berg Balance Scale,<sup>38</sup> and the Tinetti Performance-Oriented Mobility Assessment Tool,<sup>39</sup> with the TUG being the most recommended test, appearing in 6 of the 15 guidelines (Table 3).<sup>13,14,16,17,23,27</sup>

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## Discussion

This systematic review identified 15 high-quality practice guidelines for fall prevention and management, which provided 198 recommendations for risk assessment, prevention, and management of falls for older adults. Most guidelines strongly recommended risk stratification screening using short questionnaires and reserving gait and balance testing for those who screened positive. Similarly, most guidelines strongly recommended medication review, exercise interventions, environment modifications, multifactorial approaches, and active management of fractures and osteoporosis as key elements in the prevention of falls. Vision or footwear intervention, physiotherapy referral, and cardiovascular interventions were less commonly addressed. Although all selected guidelines had high overall methodologic quality, clinical applicability and stakeholder involvement were domains missed or lacking in details.

Table 3. Description of Risk Stratification by Guidelines and Use of an Algorithm

Guidelines identified	Determination steps for risk assessment in the recommendations				Gait, balance, and mobility assessment			Gaps and areas to expand	
	Stratification method	Fall history	Age, y	Sex	TUG test	Other		Absence of a clear risk stratification methods algorithm	
Baraff, <sup>16</sup> 1997	Narrative	Any previous falls	NA	NA	NA	NA			
AGILE, <sup>21</sup> 1998	NA	NA	NA	NA	NA	NA			
Feder et al, <sup>19</sup> 2000	NA	NA	NA	NA	NA	NA			
AGS/BGS/AAOS, <sup>2-4,13,35</sup> 2001	Algorithm	1 Fall in 12 mo: gait and balance evaluation; recurrent falls in 12 mo or an acute fall or difficulty with walking and balance: fall evaluation <sup>1</sup>	NA	NA	TUG test	NA			Individuals with no fall history or low (1 fall) fall history may fall and require fall evaluation <sup>36</sup>
Moreland et al, <sup>24</sup> 2003	Narrative	NA	≥74	Female	Tinetti Performance-Oriented Assessments of Gait and Balance	NA			Fall history is not included in risk stratification
ACSQHC, <sup>15</sup> 2009	Narrative	Any previous fall	NA	NA	List of assessment tool options	NA			Demographic risk factors
FSGG, <sup>17</sup> 2011	Algorithm	1 Fall in 12 mo: gait and balance evaluation; recurrent falls in 12 mo or an acute fall or difficulty with walking and balance: fall evaluation <sup>1</sup> and multifactorial intervention	≥80	Female	TUG test	Multiple risk factors <sup>2</sup>			Individuals with no fall history or low (1 fall) fall history may fall and require fall evaluation <sup>36</sup>
NICE, <sup>18</sup> 2013	Narrative	≥1 Fall or emergency department visit for fall: multifactorial risk assessment	NA	NA	List of assessment tool options	Gait or balance problems			Broad list of assessment tools
STEADI, <sup>27</sup> 2013	Algorithm	≥1 Fall in 12 mo: multifactorial risk assessment; low risk (no fall history): patient education and referral to community exercise, balance, fitness, or fall prevention program	NA	NA	TUG test, 4-stage balance test	Fear of falling			Demographic risk factors
Jung et al, <sup>22</sup> 2014	Algorithm	≥1 Fall in 12 mo: comprehensive intervention; low risk (no fall history) regular checkups	NA	NA	Gait or balance problems	Polypharmacy, dementia, general diseases, cognition, fall-related symptoms, physical fitness, environmental factors, and aids			Details pertaining to assessment tools
RACGP, <sup>26</sup> 2016	Table	≥1 Fall with multiple risk factors in 12 mo: risk factor screening and preventive activities; low risk (no fall history): yearly fall screening	≥65	NA	Gait or balance and mobility difficulties	Clinical judgment			Broad list of assessment tools
KAIM/KGS, <sup>23</sup> 2017	Algorithm	≥2 Falls in 12 mo: multifactorial falls evaluation	NA	NA	TUG test and BBS	NA			Individuals with no fall history or low (1 fall) fall history may fall and require fall evaluation <sup>36</sup>
RNAO, <sup>25</sup> 2017	Narrative	Any previous falls: comprehensive assessment; ≥2 falls in 12 mo: clinician referral	NA	NA	Gait, balance, or mobility difficulty	Clinical judgment			Broad list of assessment tools
SENATOR ONTOP, <sup>20</sup> 2017	Narrative	Any previous falls: multifactorial intervention; low risk (no fall history): group-based exercise	≥65	NA	Gait problems	Walking aid, dizziness, muscle weakness, and polypharmacy			Unspecified assessments to determine risk
USPSTF, <sup>14</sup> 2018	Table	Any previous falls: multifactorial intervention	≥65	NA	TUG test	Physical function or mobility problems			Adults aged 60-65 y may experience falls

Abbreviations: ACSQHC, Australian Commission on Safety and Quality in Health Care; AGILE, a recognized professional network of the Chartered Society of Physiotherapy; AGS/BGS/AAOS, American Geriatrics Society/ British Geriatrics Society/American Academy of Orthopaedic Surgeons; BBS, Berg Balance Scale; FSGG, French Society of Geriatrics and Gerontology; KAIM/KGS, Korean Association of Internal Medicine/Korean Geriatrics Society; NA, not applicable; NICE, National Institute for Health and Care Excellence; RACGP, The Royal Australian

College of General Practitioners; RNAO, Registered Nurses' Association of Ontario; SENATOR ONTOP, software engine for the assessment & optimization of drug and non-drug therapy—older persons optimal evidence-based non-drug therapies in older people; STEADI, Stopping Elderly Accidents, Deaths and Injuries; TUG, Timed Up and Go; USPSTF, US Preventive Services Task Force.

Recommendations for vitamin D supplementation showed mixed results. The strength of recommendations varied from strong to weak, with several guidelines not making any suggestions. This may reflect the inconsistent evidence about vitamin D supplementation for fall prevention and how the evidence varied based on settings: community vs residential or nursing home care.<sup>40-42</sup> Similarly, recommendations about fall prevention education were mixed with a similar pattern seen. The use of hip protectors and digital technologies and wearables were often not included, with half of guidelines making no recommendation in these areas. The latest Cochrane meta-analyses found only weak evidence supporting the efficacy of hip protectors in preventing fractures after a fall in long-term care facilities<sup>43</sup> and noted challenges in implementing the daily use of these protectors. This weak evidence, coupled with not all guidelines addressing falls in long-term care, likely explains the omission of hip protector recommendations.<sup>44</sup> The underrepresentation of digital and wearable technologies is probably a reflection of their novelty.<sup>45</sup>

Risk stratification was an area addressed by most guidelines, with some proposing a specific risk stratification algorithm. Those algorithms often recommended performing gait and balance tests for individuals who screened positive.<sup>38,39</sup> The most frequently recommended gait and balance test was the TUG, potentially owing to its simplicity, acceptance, and ease of administration. Evidence does not support acceptable predictive validity for any of the tests recommended in isolation for falls prediction,<sup>46-50</sup> and specifically the TUG has low predictive validity.<sup>51</sup> Consistent with the overall lower score in the applicability domain of the AGREE-II scale, details on resources, facilitators, and barriers to use of any of the recommended tests warranted more complete descriptions.

In addition to gait and balance, 5 guidelines stratified risk by some demographic characteristics (ie, advanced age, female sex).<sup>14,17,20,24,26</sup> Explicit statements within the guidelines indicating the validation of their stratification algorithms were lacking. Few studies assessed the predictive accuracy of some of the proposed algorithms and found low sensitivity to detect individuals at higher risk of falls.<sup>2,3,52</sup> Future guidelines providing risk stratification algorithms should conduct validation studies of their effectiveness, address the adaptability of the proposed algorithm to different care or residential settings, and include validations in resource-constrained areas, such as low- and middle-income countries. Finally, only 2 guidelines recommended active interventions with follow-up care for individuals deemed low risk in their stratification strategy, including education and exercises involving balance and lower limb strengthening.<sup>20,22,26,27</sup> Recommendations for low-risk older adults that may help prevent falls and improve their overall health are also needed.

Recommendations to evaluate and manage medication-related risks for falls varied from judicious deprescribing of psychotropic and cardiovascular medications to performing a comprehensive medication review. Across all guidelines, medication review was recommended generally and in all settings. Although a search for medication review for fall risk-increasing drugs was identified in medication review recommendations, resources and tools for clinicians were lacking. This deficiency may have been attributable to the unavailability of resources. Tools such as STOPPFall (Screening Tool of Older Persons Prescriptions in older adults with high fall risk) have only recently been developed.<sup>53</sup>

Specific recommendations for older adults with cognitive impairment were scarce. Although cognitive evaluation was recommended as part of the initial assessment in most of the guidelines, specific guidance for evaluating specific aspects of cognition associated with increased fall risk (such as deficits in executive function) were lacking, despite the evidence in the literature of elevated fall risk factors in this group.<sup>54,55</sup> Consideration of specific cognitive domains is imperative because executive function deficits are a known and prominent risk factor for falls among older adults—even among individuals without a formal diagnosis of cognitive impairment or dementia.<sup>54,56-58</sup> Executive function may be a target for fall prevention interventions, as shown in recent studies.<sup>59,60</sup> Future guidelines should consider including specific recommendations for individuals with cognitive deficits, including executive functioning and memory.<sup>57,61</sup>

The perspectives of people with a history of falls and associated injuries were not thoroughly and consistently embedded in the appraised guidelines. Moreover, personalized approaches that

incorporate individual preferences in the fall prevention recommendations made to patients were also lacking.<sup>62,63</sup> In general, patient and caregiver perspectives have not been consistently incorporated in clinical practice guidelines and related health resources.<sup>64</sup>

Clinical applicability was underrepresented in all the guidelines. Facilitators or barriers to implement recommendations were thoroughly detailed in only 3 guidelines.<sup>15,25,27</sup> Similarly, advice or toolkits on how to implement the recommendations into practice were described in detail in only 5 guidelines,<sup>15,18,21,24,25</sup> potential resource implications of applying the recommendations were detailed in only 2 guidelines,<sup>15,18</sup> and monitoring or auditing criteria were discussed in only 2 guidelines.<sup>18,25</sup> Our findings suggest that the challenges encountered in implementing recommendations should be better addressed in future clinical practice guidelines. A complementary way to address implementing recommendations is by following the example of the Stopping Elderly Accidents, Deaths and Injuries initiative from the Centers for Disease Control and Prevention, which focuses more on practical implementation with toolkits for the AGS/BGS/AAOS guidelines, as opposed to standing alone as a clinical practice guideline.

Finally, all the selected guidelines in our systematic review were led by authors from developed countries. We used 60 years of age or older as the definition of older adults to be geographically inclusive in our search<sup>1</sup>; however, our search found only a limited number of clinical practice guidelines from low- and middle-income countries, which were not evidence-based or based on a formal expert consensus process. This finding may reflect the lack of guidelines for fall prevention in many regions of the developing world, which may represent inadequate attention to this phenomenon or limited resources to develop clinical practice guidelines for older adults.

## Limitations

This systematic review has some limitations. Although no language restrictions were placed on our search, bibliographic databases of peer-reviewed papers included only journals that were indexed, which are mainly published in English. In addition, there is a possibility that we missed relevant clinical practice guidelines that were not in the databases searched, known to the experts we consulted, or on the public or health policy sites we examined.

## Conclusions

This systematic review found high agreement across clinical practice guidelines with strong recommendations for risk stratification, the use of specific tests for gait and balance assessments, multifactorial interventions, medication review, physical exercise, vision and footwear intervention, physiotherapy referral, environment modification, management of osteoporosis and fracture risk, and cardiovascular interventions. Recommendations on vitamin D supplementation and educational programs for fall prevention and management were inconsistent, whereas recommendations on hip protectors and wearable technologies were often not included. Future clinical practice guidelines should better address the clinical applicability of their recommendations, with more explicit consideration of resources, costs, and implementation barriers. Patients' and caregivers' perspectives should also be better reflected in developing future fall prevention and management guidelines for older adults. Our findings may assist clinicians in choosing the best-suited guidelines and recommendations for their setting and resource availability. The gaps detected may inform future guideline development, including the recent international initiative: World Falls Guidelines.<sup>32,65</sup>

## ARTICLE INFORMATION

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## REFERENCES

1. World Health Organization. *WHO Global Report on Falls Prevention in Older Age*. World Health Organization; 2008.
2. Muir SW, Berg K, Chesworth B, Klar N, Speechley M. Application of a fall screening algorithm stratified fall risk but missed preventive opportunities in community-dwelling older adults: a prospective study. *J Geriatr Phys Ther*. 2010;33(4):165-172. doi:10.1519/JPT.0b013e3181ff23cc
3. Lamb SE, McCabe C, Becker C, Fried LP, Guralnik JM. The optimal sequence and selection of screening test items to predict fall risk in older disabled women: the Women's Health and Aging Study. *J Gerontol A Biol Sci Med Sci*. 2008;63(10):1082-1088. doi:10.1093/gerona/63.10.1082
4. Tinetti ME, Speechley M, Ginter SF. Risk factors for falls among elderly persons living in the community. *N Engl J Med*. 1988;319(26):1701-1707. doi:10.1056/NEJM198812293192604
5. Samper-Ternent R, Karmarkar A, Graham J, Reistetter T, Ottenbacher K. Frailty as a predictor of falls in older Mexican Americans. *J Aging Health*. 2012;24(4):641-653. doi:10.1177/0898264311428490
6. Cameron EJ, Bowles SK, Marshall EG, Andrew MK. Falls and long-term care: a report from the care by design observational cohort study. *BMC Fam Pract*. 2018;19(1):73. doi:10.1186/s12875-018-0741-6
7. Stevens JA, Adekoya N. Brain injury resulting from falls among elderly persons. *JAMA*. 2001;286(21):2665-2666. doi:10.1001/jama.286.21.2665
8. Abolhassani F, Moayyeri A, Naghavi M, Soltani A, Larijani B, Shalmani HT. Incidence and characteristics of falls leading to hip fracture in Iranian population. *Bone*. 2006;39(2):408-413. doi:10.1016/j.bone.2006.01.144
9. Iaboni A, Flint AJ. The complex interplay of depression and falls in older adults: a clinical review. *Am J Geriatr Psychiatry*. 2013;21(5):484-492. doi:10.1016/j.jagp.2013.01.008
10. Turcu A, Toubin S, Mourey F, D'Athis P, Manckoundia P, Pfitzenmeyer P. Falls and depression in older people. *Gerontology*. 2004;50(5):303-308. doi:10.1159/000079128
11. Haddad YK, Bergen G, Florence CS. Estimating the economic burden related to older adult falls by state. *J Public Health Manag Pract*. 2019;25(2):E17-E24. doi:10.1097/PHH.0000000000000816
12. Yoshida-Intern S. *A Global Report on Falls Prevention: Epidemiology of Falls*. World Health Organization; 2007.
13. Guideline for the prevention of falls in older persons. American Geriatrics Society, British Geriatrics Society, and American Academy of Orthopaedic Surgeons Panel on Falls Prevention. *J Am Geriatr Soc*. 2001;49(5):664-672. doi:10.1046/j.1532-5415.2001.49115.x
14. American Family Physician. U.S. Preventive Services Task Force: interventions to prevent falls in community-dwelling older adults: recommendation statement. Published August 15, 2018. Accessed November 1, 2021. <https://www.aafp.org/afp/2018/0815/od1.html>
15. Australian Commission on Safety and Quality in Healthcare: Commonwealth of Australia. Preventing falls and harm from falls in older people: best practice guidelines for Australian community care. 2009. Accessed November 1, 2021. <https://www.safetyandquality.gov.au/sites/default/files/migrated/Guidelines-COMM.pdf>
16. Baraff LJ, Della Penna R, Williams N, Sanders A; Kaiser Permanente Medical Group. Practice guideline for the ED management of falls in community-dwelling elderly persons. *Ann Emerg Med*. 1997;30(4):480-492. doi:10.1016/S0196-0644(97)70008-8
17. Beauchet O, Dubost V, Revel Delhom C, Berrut G, Belmin J; French Society of Geriatrics and Gerontology. How to manage recurrent falls in clinical practice: guidelines of the French Society of Geriatrics and Gerontology. *J Nutr Health Aging*. 2011;15(1):79-84. doi:10.1007/s12603-011-0016-6
18. NICE. *Falls in Older People: Assessing Risk and Prevention*. National Institute for Health and Care Excellence; 2013.

19. Feder G, Cryer C, Donovan S, Carter Y. Guidelines for the prevention of falls in people over 65: the guidelines' development group. *BMJ*. 2000;321(7267):1007-1011. doi:10.1136/bmj.321.7267.1007
20. Rimland JM, Abraha I, Dell'Aquila G, et al. Non-pharmacological interventions to prevent falls in older patients: clinical practice recommendations—the SENATOR ONTOP Series. *Eur Geriatric Med*. 2017;8(5-6):413-418. doi:10.1016/j.eurger.2017.07.013
21. Simpson JM, Marsh N, Harrington R. Guidelines for managing falls among elderly people. *Physiotherapy*. 1998;84(4):172-177.
22. Jung D, Shin S, Kim H. A fall prevention guideline for older adults living in long-term care facilities. *Int Nurs Rev*. 2014;61(4):525-533. doi:10.1111/inr.12131
23. Kim KI, Jung HK, Kim CO, et al; Korean Association of Internal Medicine, The Korean Geriatrics Society. Evidence-based guidelines for fall prevention in Korea. *Korean J Intern Med*. 2017;32(1):199-210. doi:10.3904/kjim.2016.218
24. Moreland J, Richardson J, Chan D, et al. Evidence-based guidelines for the secondary prevention of falls in older adults. *Gerontology*. 2003;49(2):93-116. doi:10.1159/000067948
25. RNAO. *Preventing Falls and Reducing Injury From Falls*. 3rd ed. Registered Nurses' Association of Ontario; 2017.
26. Royal Australian College of General Practitioners. Guidelines for Preventive Activities in General Practice, 9th ed. Published 2016. Accessed November 5, 2021. <https://www.racgp.org.au/download/Documents/Guidelines/Redbook9/17048-Red-Book-9th-Edition.pdf>
27. Stevens JA, Phelan EA. Development of STEADI: a fall prevention resource for health care providers. *Health Promot Pract*. 2013;14(5):706-714. doi:10.1177/1524839912463576
28. Institute for Quality and Efficiency in Health Care. *What Are Clinical Practice Guidelines?* Institute for Quality and Efficiency in Health Care; 2016.
29. Guyatt GH, Oxman AD, Schünemann HJ, Tugwell P, Knottnerus A. GRADE guidelines: a new series of articles in the *Journal of Clinical Epidemiology*. *J Clin Epidemiol*. 2011;64(4):380-382. doi:10.1016/j.jclinepi.2010.09.011
30. Siering U, Eikermann M, Hausner E, Hoffmann-Eßer W, Neugebauer EA. Appraisal tools for clinical practice guidelines: a systematic review. *PLoS One*. 2013;8(12):e82915. doi:10.1371/journal.pone.0082915
31. Brouwers MC, Kho ME, Browman GP, et al; AGREE Next Steps Consortium. AGREE II: advancing guideline development, reporting, and evaluation in health care. *Prev Med*. 2010;51(5):421-424. doi:10.1016/j.ypmed.2010.08.005
32. World Falls Guidelines for Prevention and Management of Falls in Older Adults. Welcome: global guidelines for falls in older adults. Accessed November 1, 2021. <https://worldfallsguidelines.com>
33. Andrews J, Guyatt G, Oxman AD, et al. GRADE guidelines: 14. Going from evidence to recommendations: the significance and presentation of recommendations. *J Clin Epidemiol*. 2013;66(7):719-725. doi:10.1016/j.jclinepi.2012.03.013
34. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta-Analyses: the PRISMA Statement. *PLoS Med*. 2009;6(7):e1000097. doi:10.1371/journal.pmed1000097
35. Muir SW, Berg K, Chesworth BM, Klar N, Speechley M. Modifiable risk factors identify people who transition from non-fallers to fallers in community-dwelling older adults: a prospective study. *Physiother Can*. 2010;62(4):358-367. doi:10.3138/physio.62.4.358
36. Journal of the American Geriatrics Society. Falls risk stratification: when is "low risk" not low risk? Abstract S172. Published 2020. Accessed November 2, 2021. <https://agsjournals.onlinelibrary.wiley.com/doi/epdf/10.1111/jgs.16431>
37. Shumway-Cook A, Brauer S, Woollacott M. Predicting the probability for falls in community-dwelling older adults using the Timed Up & Go Test. *Phys Ther*. 2000;80(9):896-903. doi:10.1093/ptj/80.9.896
38. Muir SW, Berg K, Chesworth B, Speechley M. Use of the Berg Balance Scale for predicting multiple falls in community-dwelling elderly people: a prospective study. *Phys Ther*. 2008;88(4):449-459. doi:10.2522/ptj.20070251
39. Abbruzzese LD. The Tinetti performance-oriented mobility assessment tool. *Am J Nurs*. 1998;98(12):16J-16L.
40. Murad MH, Elamin KB, Abu Elnour NO, et al. Clinical review: the effect of vitamin D on falls: a systematic review and meta-analysis. *J Clin Endocrinol Metab*. 2011;96(10):2997-3006. doi:10.1210/jc.2011-1193
41. Bischoff-Ferrari HA, Dawson-Hughes B, Willett WC, et al. Effect of vitamin D on falls: a meta-analysis. *JAMA*. 2004;291(16):1999-2006. doi:10.1001/jama.291.16.1999

42. Smith LM, Gallagher JC, Suiter C. Medium doses of daily vitamin D decrease falls and higher doses of daily vitamin D3 increase falls: a randomized clinical trial. *J Steroid Biochem Mol Biol*. 2017;173:317-322. doi:[10.1016/j.jsbmb.2017.03.015](https://doi.org/10.1016/j.jsbmb.2017.03.015)
43. Santesso N, Carrasco-Labra A, Brignardello-Petersen R. Hip protectors for preventing hip fractures in older people. *Cochrane Database Syst Rev*. 2014;(3):CD001255. doi:[10.1002/14651858.CD001255.pub5](https://doi.org/10.1002/14651858.CD001255.pub5)
44. Hall A, Boulton E, Stanmore E. Older adults' perceptions of wearable technology hip protectors: implications for further research and development strategies. *Disabil Rehabil Assist Technol*. 2019;14(7):663-668. doi:[10.1080/17483107.2018.1491647](https://doi.org/10.1080/17483107.2018.1491647)
45. Pang I, Okubo Y, Sturnieks D, Lord SR, Brodie MA. Detection of near falls using wearable devices: a systematic review. *J Geriatr Phys Ther*. 2019;42(1):48-56. doi:[10.1519/JPT.0000000000000181](https://doi.org/10.1519/JPT.0000000000000181)
46. Lima CA, Ricci NA, Nogueira EC, Perracini MR. The Berg Balance Scale as a clinical screening tool to predict fall risk in older adults: a systematic review. *Physiotherapy*. 2018;104(4):383-394. doi:[10.1016/j.physio.2018.02.002](https://doi.org/10.1016/j.physio.2018.02.002)
47. Barry E, Galvin R, Keogh C, Horgan F, Fahey T. Is the Timed Up and Go test a useful predictor of risk of falls in community dwelling older adults: a systematic review and meta-analysis. *BMC Geriatr*. 2014;14:14. doi:[10.1186/1471-2318-14-14](https://doi.org/10.1186/1471-2318-14-14)
48. Scott V, Votova K, Scanlan A, Close J. Multifactorial and functional mobility assessment tools for fall risk among older adults in community, home-support, long-term and acute care settings. *Age Ageing*. 2007;36(2):130-139. doi:[10.1093/ageing/af1165](https://doi.org/10.1093/ageing/af1165)
49. Rosa MV, Perracini MR, Ricci NA. Usefulness, assessment and normative data of the Functional Reach Test in older adults: a systematic review and meta-analysis. *Arch Gerontol Geriatr*. 2019;81:149-170. doi:[10.1016/j.archger.2018.11.015](https://doi.org/10.1016/j.archger.2018.11.015)
50. Schoene D, Wu SM, Mikolaizak AS, et al. Discriminative ability and predictive validity of the Timed Up and Go Test in identifying older people who fall: systematic review and meta-analysis. *J Am Geriatr Soc*. 2013;61(2):202-208. doi:[10.1111/jgs.12106](https://doi.org/10.1111/jgs.12106)
51. Kojima G, Masud T, Kendrick D, et al. Does the timed up and go test predict future falls among British community-dwelling older people? prospective cohort study nested within a randomised controlled trial. *BMC Geriatr*. 2015;15:38. doi:[10.1186/s12877-015-0039-7](https://doi.org/10.1186/s12877-015-0039-7)
52. Palumbo P, Becker C, Bandinelli S, Chiari L. Simulating the effects of a clinical guidelines screening algorithm for fall risk in community dwelling older adults. *Aging Clin Exp Res*. 2019;31(8):1069-1076. doi:[10.1007/s40520-018-1051-5](https://doi.org/10.1007/s40520-018-1051-5)
53. Seppala LJ, Petrovic M, Ryg J, et al. STOPPFall (Screening Tool of Older Persons Prescriptions in older adults with high fall risk): a Delphi study by the EuGMS Task and Finish Group on Fall-Risk-Increasing Drugs. *Age Ageing*. 2021;50(4):1189-1199. doi:[10.1093/ageing/afaa249](https://doi.org/10.1093/ageing/afaa249)
54. Fernando E, Fraser M, Hendriksen J, Kim CH, Muir-Hunter SW. Risk factors associated with falls in older adults with dementia: a systematic review. *Physiother Can*. 2017;69(2):161-170. doi:[10.3138/ptc.2016-14](https://doi.org/10.3138/ptc.2016-14)
55. Van Ooteghem K, Musselman K, Gold D, et al. Evaluating mobility in advanced dementia: a scoping review and feasibility analysis. *Gerontologist*. 2019;59(6):e683-e696. doi:[10.1093/geront/gny068](https://doi.org/10.1093/geront/gny068)
56. Deandrea S, Lucenteforte E, Bravi F, Foschi R, La Vecchia C, Negri E. Risk factors for falls in community-dwelling older people: a systematic review and meta-analysis. *Epidemiology*. 2010;21(5):658-668. doi:[10.1097/EDE.0b013e3181e89905](https://doi.org/10.1097/EDE.0b013e3181e89905)
57. Muir SW, Gopaul K, Montero Odasso MM. The role of cognitive impairment in fall risk among older adults: a systematic review and meta-analysis. *Age Ageing*. 2012;41(3):299-308. doi:[10.1093/ageing/afs012](https://doi.org/10.1093/ageing/afs012)
58. Kearney FC, Harwood RH, Gladman JR, Lincoln N, Masud T. The relationship between executive function and falls and gait abnormalities in older adults: a systematic review. *Dement Geriatr Cogn Disord*. 2013;36(1-2):20-35. doi:[10.1159/000350031](https://doi.org/10.1159/000350031)
59. Lipardo DS, Aseron AMC, Kwan MM, Tsang WW. Effect of exercise and cognitive training on falls and fall-related factors in older adults with mild cognitive impairment: a systematic review. *Arch Phys Med Rehabil*. 2017;98(10):2079-2096. doi:[10.1016/j.apmr.2017.04.021](https://doi.org/10.1016/j.apmr.2017.04.021)
60. Montero-Odasso M, Speechley M. Falls in cognitively impaired older adults: implications for risk assessment and prevention. *J Am Geriatr Soc*. 2018;66(2):367-375. doi:[10.1111/jgs.15219](https://doi.org/10.1111/jgs.15219)
61. Hsu CL, Nagamatsu LS, Davis JC, Liu-Ambrose T. Examining the relationship between specific cognitive processes and falls risk in older adults: a systematic review. *Osteoporos Int*. 2012;23(10):2409-2424. doi:[10.1007/s00198-012-1992-z](https://doi.org/10.1007/s00198-012-1992-z)

62. Sandlund M, Skelton DA, Pohl P, Ahlgren C, Melander-Wikman A, Lundin-Olsson L. Gender perspectives on views and preferences of older people on exercise to prevent falls: a systematic mixed studies review. *BMC Geriatr*. 2017;17(1):58. doi:[10.1186/s12877-017-0451-2](https://doi.org/10.1186/s12877-017-0451-2)
63. Stevens JA, Sogolow ED. Gender differences for non-fatal unintentional fall related injuries among older adults. *Inj Prev*. 2005;11(2):115-119. doi:[10.1136/ip.2004.005835](https://doi.org/10.1136/ip.2004.005835)
64. Hämeen-Anttila K, Komulainen J, Enlund H, et al. Incorporating patient perspectives in health technology assessments and clinical practice guidelines. *Res Social Adm Pharm*. 2016;12(6):903-913. doi:[10.1016/j.sapharm.2015.12.005](https://doi.org/10.1016/j.sapharm.2015.12.005)
65. Montero-Odasso M, van der Velde N, Alexander NB, et al; Task Force on Global Guidelines for Falls in Older Adults. New horizons in falls prevention and management for older adults: a global initiative. *Age Ageing*. 2021;50(5):1499-1507. doi:[10.1093/ageing/afab076](https://doi.org/10.1093/ageing/afab076)

#### SUPPLEMENT 1.

eTable 1. Search Syntax

eTable 2. Standardized Data Collection Form

eTable 3. Glossary of Key Terms

eReferences.

#### SUPPLEMENT 2.

Nonauthor Collaborators