National Institute for Health and Care Excellence

Final

Falls: assessment and prevention in older people and people 50 and over at higher risk

Evidence review E: Methods of assessment

NICE guideline NG249

Evidence reviews underpinning recommendations 1.1.1 to 1.1.7, 1.2.1 to 1.2.3 and recommendations for research in the NICE guideline

April 2025

Final

These evidence reviews were developed by NICE

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ISBN: 978-1-4731-6910-4

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1.1. Review question

What methods of assessment are most accurate for identifying individual risk factors for risk of falls?

1.1.1. Introduction

Falls are common in older people with around one third of people aged over 65 experiencing a fall each year. Falls are associated with a range of negative consequences from concern about falling leading to reduced activity levels, to severe injury such as hip fracture or head injury and even death. Falls are not random events but are associated with a complex interaction of different risk factors. Epidemiological research has identified over 400 different risk factors for falls which can be categorised into domains such as medication, medical conditions, sensorimotor function, psychological function and the environment. Where the causes of falls are multi-factorial, understanding these risk factors in each individual older person will support the delivery of more tailored, personalised fall prevention interventions.

In practice, where screening has identified an older person as at higher risk of falling, an assessment of individual risk factors can then be used to determine which evidence-based fall prevention interventions are required to address the identified factors. There have been a number of fall risk assessment tools designed to establish the degree of risk from a range of recognised fall risk factors, spanning different domains. There are also tools that focus on assessment of single risk factors, usually assessments of gait and/or balance function. It is important that such tools can accurately identify each risk factor's association with future falls. A tool that misclassifies an individual could lead to inappropriate tailoring of interventions leading to a lack of effect on fall prevention. However, due to the multi-factorial nature of falls risk, research investigating the prognostic accuracy of single fall risk factors may demonstrate low levels of accuracy if other risk factors are not controlled for. This evidence review will evaluate the accuracy of individual risk factor assessment in identifying the risk of falls in older adults.

1.1.2. Summary of the protocol

For full details see the review protocol in Appendix A

Table 1: PICO characteristics of review question

Population	Inclusion: • People aged 65 and over • People aged 50 to 64 who have a condition or conditions that may put them at higher risk of falling. Exclusion: any age group that does not fit the inclusion criteria Strata: • Age group: people aged 50 to 64 who have a condition or conditions that may put them at higher risk of falling. • Settings (hospitals, community, long-term residential care). The setting is stratified as a lot of the screening tests are not suitable for hospital settings.
Risk tool	Multifactorial assessment instruments/processes administered by health care professionals, including:

	• Home hazard assessment instruments, administered by health care professionals for community-dwelling population. • Minimum data set (MDS) home care and residential assessment instrument for comprehensive assessment Balance and gait assessment tools to be included: • Performance-oriented assessment of mobility problems (Tinetti scale) Tinetti balance assessment tool/POMA (</=18 high; 19-23 moderate; >/=24 low) • Dynamic gait index (19 or less related to increased risk for falling) • Berg balance scale (0-20 points: high risk of falls; 21-40: moderate risk of falls: 41-56 points: low risk of falls). • Mini Balance Evaluation Systems Test (BEST)/Mini-BEST • Physiological profile assessment performance test Gait measurement technologies: • Wearables (gait and balance), inertial measurement unit, gyroscope on wrist, foot, shank or thigh
Patient outcomes	• Falls: an unexpected event in which the participants come to rest on the ground, floor, or lower level.
Statistical outcomes	For balance and gait assessment tools and wearable technology: All outcomes are considered equally important for decision making and therefore have all been rated as critical: Accuracy of estimation of risk of falls: Statistical outputs may include: • Discrimination (sensitivity, specificity, predictive values) • Area under the ROC curve (c-statistic) • Predicted risk versus observed risk (calibration) • Reclassification Other statistical measures: for example, D statistic, R2 statistic and Brier points
Study design	For identifying multifactorial risk assessment factors, we will identify studies that use multifactorial risk assessment as part of their intervention (from interventions for preventing falls reviews 4.1) and extract the components of the risk assessment used in the studies that effectively reduced falls and the cut-off points used in the screening tools for falls risk from Q2.2 accuracy of screening tools for identifying people at risk of falls to inform decisions on what is included as part of a falls assessment. For balance and gait assessment tools and wearable technology: External validation studies (tested on a different study sample to the derivation sample will be included. Prospective cohort studies or systematic reviews of these with a sample size of n=100 or more. Where tests are validated in a UK population, we will not include studies in other countries, otherwise we will include any country. Published NMAs and IPDs will be considered for inclusion. Exclusion:

	• Case-control studies • Cross-sectional studies
Specific groups	Subgroups that will be investigated if heterogeneity is present: • specialist settings

1.1.3. Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in appendix A and the methods document.

Declarations of interest were recorded according to NICE's conflicts of interest policy.

1.1.4. Risk prediction evidence

1.1.4.1. Included studies

22 cohort studies examining a number of different balance and gait assessment tools or wearable technologies to predict risk of falls were included in the review[1-22] these are summarised in below. Evidence from these studies is summarised in the clinical evidence summary below.

See also the study selection flow chart in Appendix A, study evidence tables in Appendix D, forest plots in Appendix E and GRADE tables in X.

Eleven studies were identified in a community setting, seven in a hospital setting and four in a residential care setting. Data for each stratification has been analysed separately. Data was also separated based on the age of the included study population and if patients were under 65 this data was analysed separately to adults over the age of 65. All studies apart from one included a population over 65 years old. Mak 2013[15] included participants with Parkinsons with a mean age of 63 years old.

Studies were set in a range of counties worldwide including Japan, China, Brazil, Czech Republic, Switzerland, Hong Kong, Canada, Belgium and Germany. Two were conducted in the UK, Ireland, Sweden, Italy and Australia and three in the USA.

1.1.4.2. Comprehensive assessment instruments and processes

This part of the review considered the comprehensive assessments, that are conducted as part of interventions to reduce the risk of falls, in order to establish what components (tools and risk factors) are important. Comprehensive assessments must identify an individual's falls risk factors in order to tailor interventions to prevent or reduce falls. As well as assessing gait and balance, a comprehensive assessment would typically include other kinds of assessment, for example, a medication review, cardiovascular examination, cognitive assessments, the person's concern about falling etc, some of which do not have standard tools for undertaking the assessment. Therefore, to identify which individual risk factors should be assessed to tailor prevention interventions accordingly, we looked at the effective multifactorial interventions studies (from the multifactorial review F1 and F2) and looked at what assessments had been carried out to identify risk factors for falls to tailor the intervention to the individual. We extracted the component parts of the assessment, and any tools or instruments used within the multifactorial intervention review and the committee considered these and agreed through consensus what should be included as part of a comprehensive falls assessment. See Appendix M for details of evidence included.

1.1.4.3. Excluded studies

See the excluded studies list in Appendix J.

1.1.5. Summary of studies included in the prognostic evidence

Table 2: Summary of studies included in the evidence review

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
Almeida, 2016[2] Prospective cohort study	Berg Balance Scale (<49 points cut-off point) BEST (<69% cut-off) Mini-BEST (>63% cut-off point) (n=710)	Outpatients attending a movement disorders clinic diagnosed with idiopathic Parkinson's Disease. Age, mean (SD): 70.66 (6.56) Setting: Community setting, Brazil	Area under the curve (AUC) Sensitivity Specificity	84 fallers identified	This study also included: TUG FESI-I, ABC, FGA and Brief-BESTest
Albites-Sanabria 2024[1] Prospective cohort study	Finite-state machine (wearable technology) - Vanilla decision tree Finite-state machine - Under sampling decision tree Finite-state machine - SMOTE Lasso Finite-state machine - Near miss SVM	Community dwelling older adults over 65 years were included. Age, mean (SD): 79.7 (6.6) Setting: Community Italy	Sensitivity Specificity AUC	28 fallers identified	Monitoring using a smartphone embedded with a tri-axial accelerometer and gyroscope (100 Hz sampling frequency), worn on the lower back in a belt. The study is based on data from the 4th follow-up of the InCHIANTI study (clinical trial: NCT01331512).
Andersson, 2006[3] Prospective cohort study	Berg Balance Scale (<45 cut-off) (n=159)	Inpatients being treated in a stroke unit. Age, mean (SD): 73.5 (NR)	Sensitivity Specificity PPV NPV	68 fallers identified	This study also included TUG, diffTUG and Stops Walking When Talking (SWWT) tests.

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
		Setting: Hospital setting, Sweden			
Ashburn, 2008[4] Prospective cohort study	Berg Balance Scale (≤48.5 cut-off) (n=115) Study duration: follow-up: 12 months	Patients assessed at discharge after hospitalisation for a stroke. Age, mean (SD): 70.1 (12.4) Setting: community setting, UK	Sensitivity Specificity PPV NPV	63 fallers identified	This study also included the Functional Reach Test.
Bizovska 2018[5] Prospective cohort study	Tinetti total score (no cut off reported) (n=131) Study duration: one year	Community dwelling over 60s recruited from a university for elderly and clubs for elderly in Olomouc, Czech Republic. Age, mean (SD): 70.8 (6.7) Setting:Community based, Czech Republic	Sensitivity Specificity AUC %	50 fallers identified	
Caronni 2023[6]	Patient history + Gait speed (m/s) Patient history + Walk ratio (cm/number of steps/min)	Patients admitted to an inpatient rehabilitation unit due to a neurological disability in Milan.	AUC Sensitivity Specificity	82 fallers identified and 166 falls	History = five features from the medical history: 1. age (years), 2. gender (male vs. female), 3. acute vs. chronic condition, 4. cognitive impairment (present vs. absent)

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
	Patient history + Mini-BESTest Patient history + TUG duration, s Patient history + sit-to-walk duration, s Patient history + Turn duration, s Patient history + Peak angular velocity, °/s (n=214)	Age, median (IQR): 76.2 (66.8, 81.2) Setting: Hospital setting, Italy			and 5. urinary incontinence (present vs. absent).
Chen, 2005[7]	Falls risk model score at cut offs: (2-3), (3-4), (4-5), (5-6), (>9) (n=225)	Residents who participated in the Fracture Risk Epidemiology in the Elderly. Age, mean (SD): 85.5 (6.86) Setting: Residential care, Australia	Sensitivity Specificity	1,736 falls and 1,107 fallers were recorded	The Falls risk model included the following measures: Cognition Illness severity Incontinence Balance Postural sway Visual contrast sensitivity Proprioception Knee extension strength Reaction time
Dasgupta 2022[8]	Hybrid convolutional recurrent neural network (HCRNN) (n=134)	Community dwelling adults over 60 years old who presented for care to one emergency department in Pittsburgh	Area under the curve (AUC)	14 fallers identified	The HCRNN model of kinematic characteristics of gait and balance with an accelerometer during the TUG was used.

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
		Age, mean (SD): 68.9 (8.1) Setting: Community, USA			
Greene, 2012a[9] Prospective cohort study	Berg Balance Scale (45 cut-off (n=226)	Community-dwelling older adults already part of a larger study on ageing. Community, assessments conducted at an independent living research centre. Age, mean (SD): 71.5 (6.72) years Setting: Community setting, Ireland	Area under the curve (AUC) Sensitivity Specificity PPV NPV	79 falls identified	
Greene, 2012b[10]	Berg Balance Scale (45 cut-off (n=120)	Community-dwelling older adults already part of a larger study on ageing. Community, assessments conducted at an independent living research centre.	Area under the curve (AUC) Sensitivity Specificity PPV NPV	65 falls identified	

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
		Age, mean (SD): 73.7 (5.8) Setting: Community setting, Ireland			
Hars, 2018[12] Prospective cohort study	Tinetti Scale (>2 cut-off) N= 807	Inpatients in a geriatric acute and rehabilitation hospital Age, mean (SD): 85(6.9) Setting: In hospital, Switzerland	Area under the curve (AUC) Sensitivity Specificity PPV NPV Youden Index	329 falls occurred in 189 patients	
Harmon 2023[11] Prospective cohort study	Hester Davis Scale (HDS) (cut offs: 11, 12, 13, 14, 15) Section GG (cut offs; 13, 14, 15) Facility fall risk assessment (cut off 51) (n=1645)	Inpatients in an inpatient rehabilitation facility Age, median (IQR): 71 (66-80) Setting: In hospital, USA	Area under the curve (AUC) Sensitivity Specificity Youden Index	100 fallers identified	
Kelly, 2022[13]	Gait velocity [cm/s] Grip strength [cm/s] Free living accelerometer data (No stopping early and early stopping models) (n=1705)	Participants, all aged exactly 70 years old and from Umeå Sweden took part in the study (817 Female and 888 Male). Age: 70 years	Area under the curve (AUC) Sensitivity Specificity	191 fallers	

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
		Setting: Community, Sweden			
Mahoney, 2017[14]	Anterior-posterior angular displacement (1.88° cut-off) (n=287)	Older adults recruited from the Central Control of Mobility in Aging (CCMA) study. Age, mean (SD): 76.14 (6.8) Setting: Community, USA	Area under the curve (AUC) Sensitivity Specificity	66 fallers reported	Participants wore the Swaystar device system near their centre of mass by their lower back (L3-L5 vertebral body). The Swaystar system contains sensor to record angular deviations of the trunk in anterior-posterior and medial-lateral direction. Participants were asked to stand on a flat surface with eyes open and feet shoulder width apart for 10 seconds while trunk sway was measured and recorded via Bluetooth.
Mak 2013[15]	Five-time-to-stand test. Mini-BESTest (n=110)	Community dwelling adults were recruited from the Hong Kong Parkinson's disease Association if they were between 40 and 85 years old, had a diagnosis of idiopathic Parkinson's disease and were medically stable Age, mean (SD): 63.2 (9.0)	Area under the curve (AUC) Sensitivity Specificity	66 fallers identified	

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
		Setting: Community, Hong Kong			
Muir, 2008[16]	Berg Balance Scale (≤ 45 cut-off), (≤54 cut-off) (n=187)	Veterans living in 3 different communities in Canada. Age, mean (SD): 79.47 (5.8) Setting: Community, Canada	Sensitivity Specificity	80 fallers reported	
Schwesig, 2013[17]	Stride time in seconds (1.19 cut-off Standard deviation landing phase in % (15.3 cut-off) Posturographic frequency range F2-F4 (10.7 cut-off) (n=146)	Participants were recruited from local nursing homes. Age, mean (SD): 82.7 (NR) Setting: Residential care, Germany	Area under the curve (AUC) Sensitivity Specificity	41 fallers reported	Stride time and landing phase: gait parameters were assessed with participants wearing a mobile inertial sensor-based system RehaWatch. Participants wore their own flat shoes and asked to walk straight for 20m at their self-selected speed. Participants performed 3 trials but only data from the 3rd trials was used for analysis. Mean and standard deviations of each gait parameter of all recorded steps were analysed for each participant. Postural regulation: was measured with an interactive balance system consisting of 4 independent force plates to measure postural stability and regulation. Postural regulation was

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
					measured as stability indicator, weight distribution index, synchronisation and sway intensities. Participants performed one trial of 32 seconds for each of 8 standardised barefoot test conditions.
Teranishi 2024[18]	Standing Test for Imbalance and Disequilibrium (SIDE) (cut off 2a/2b) SIDE (cut off 2a/2b) + Adherence assessment (positive/negative) (n=416)	Patients who were admitted to a 45-bed convalescent rehabilitation ward over a 2-year period in Japan. Age, mean (SD): 77.9 (9.6) Setting: residential Japan	Sensitivity Specificity Youden Index	38 fallers were identified	The adherence assessment was developed to identify people who are unable to stop themselves from performing dangerous acts when their movement is restricted. Assessment items were rated on Likert scales and classified as personality, memory and instruction adherence, or impulsiveness items.
Vassallo, 2005[19] Prospective cohort study 2 acute medical wards	Tinetti Scale (medium to high risk) (n=135)	Elderly patients admitted to medical wards for various medical conditions. Age, mean (SD): 83.8 (8.01) Setting: Hospital, UK	Sensitivity Specificity PPV NPV	22 fallers identified	The Tinetti Scale is a fall risk index based on a number of chronic disabilities with the higher the number the higher the likelihood of recurrent falls. Risk indexes include mobility score, morale score, mental status score, distance vision, hearing, postural blood pressure drop, back examination, medications on admission, and admission activity of daily living score.
Vlaeyen 2021[20]	Care Home Falls Screen (CaHFRiS)	Residents in nursing	Sensitivity Specificity PPV	211 fallers identified	

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
	(cut-off score of ≥ 4) Fall Risk Classification Algorithm (FRiCA) (n=399)	homes in Belgium Age, mean (SD): 85.9 (6.9) Setting: Residential, Belgium	NPV AUC % Youden Index		
Vratsistas-Curto 2018[21] Prospective cohort study	Predict FIRST (prediction of falls in rehabilitation settings tool) (n=300)	Inpatients admitted to the general rehabilitation unit at a public hospital in Sydney, Australia were inclusion except those receiving acute medical or palliative care. Age, mean (SD): 80 (11) Setting: Hospital, Australia	AUC %	41 fallers identified	Predict_ FIRST scores were calculated on admission using information from participants' medical records. Male sex was extracted from the file. CNS medication use was defined as taking sedatives/hypnotics, anti-anxiety agents, antipsychotics, antidepressants, anticonvulsants, movement disorder medications or other CNS agents. Falls in the past year was defined as a reported or documented history of falls in the previous 12 months. Frequent toileting was defined as alterations in urination, i.e. frequency, urgency, incontinence and nocturia. Impaired tandem stance was defined as the inability to maintain the tandem stance position for 10 seconds on initial physiotherapy assessment.
Zhou 2023[22]	Composite equilibrium score (n=159)	Elderly people aged 80 years or older who	AUC Sensitivity Specificity	59 fallers and 108 falls were identified	The cut-off points SOTcom in predicting new falls was ≤52 points. SOTcom: Composite

Study	Risk tool	Population	Outcomes (including definitions)	No. of event (n)	Comments
		were treated in the geriatric department of a hospital in China were included. Age, mean (SD): 84 (3.3) Setting: Community setting, China			Equilibrium Score, the weighted average score of sensory integration test under six test conditions; RT: Reaction Time; MVL: Movement Velocity; DCL: Directional Control; EPE: Endpoint Excursion; MXE: Maximum Excursion.

See Appendix D for full evidence tables

1.1.6. Summary of prognostic evidence: Discrimination

Table 3: Summary of results: Sensitivity and Specificity

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
Berg Balance Scale								
Berg Balance Scale (45 cut-off) – community (aged 65 years or older)	3	533	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	Meta-analysis results: Sensitivity= 0.38 (0.13, 0.69)	VERY LOW
						serious imprecision[b]	Specificity= 0.83 (0.58, 0.94)	
Berg Balance Scale (≤ 49 cut-off) – community (aged 65 years or older)	1	226	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	Sensitivity= 0.74 (0.63, 0.83)	LOW
						serious imprecision[b]	Specificity= 0.74 (0.66, 0.81)	
Berg Balance Scale (≤ 54 cut-off) – community (aged 65 years or older)	1	187	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	Sensitivity= 0.61(0.50,0.72)	LOW
						serious imprecision[b]	Specificity= 0.53 (0.43, 0.63)	
Berg Balance Scale (<45 points cut-off point) – hospital (aged 65 years or older)	1	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	Sensitivity= 0.63 (0.51, 0.75)	LOW
						serious imprecision[b]	Specificity= 0.65 (0.54, 0.75)	
Berg Balance Scale ≤48.5 cut-off) - community (aged 65 years or older)	1	115	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.86 (0.75, 0.93)	LOW
						serious imprecision[b]	Specificity= 0.49 (0.38, 0.60)	
BEST test								
BEST (<69% cut-off) - community (aged 65 years or older)	1	187	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	Sensitivity= 0.46 (0.35, 0.57)	LOW
						serious imprecision[b]	Specificity= 0.61 (0.66, 0.81)	

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
Mini-BEST test								
Mini-BEST (>63% cut-off) - community (aged 65 years or older)	1	187	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	Sensitivity= 0.62 (0.51, 0.72)	LOW
						serious imprecision[b]	Specificity= 0.74 (0.66, 0.81)	
Mini-BEST (19 cut off) - community (under 65)	1	110	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	Sensitivity= 0.79 (0.69, 0.87)	VERY LOW
						very serious imprecision[b]	Specificity= 0.67 (0.45, 0.84)	
Mini-BESTest								
Mini-BESTest (cut off 2.94) – hospital (aged 65 years or older)	1	214	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.91 (0.83, 0.96)	MODERATE
						No serious imprecision	Specificity= 0.20 (0.14, 0.28)	
Mini-BESTest								
Mini-BESTest (cut off 0.06) – hospital (aged 65 years or older)	1	214	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.29 (0.20, 0.40)	MODERATE
						No serious imprecision	Specificity= 0.86 (0.79, 0.91)	
Tinetti Scale								
Simplified Tinetti Scale (>2 cut-off) – hospital - (aged 65 years or older)	1	807	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.92 (0.87, 0.95)	MODERATE
						No serious imprecision	Specificity= 0.42 (0.38, 0.46)	
Tinetti Scale (medium to high risk) – hospital (aged 65 years or older)	1	135	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.77 (0.56, 0.90)	LOW
						No serious imprecision	Specificity= 0.31 (0.22, 0.41)	
Tinetti total score - community	1	131		No serious inconsistency	No serious indirectness	serious imprecision[b]	Sensitivity= 0.67 (0.52, 0.80)	LOW

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
			serious risk of bias[a]			No serious imprecision	Specificity= 0.83 (0.73, 0.90)	
Stops Walking When Talking (SWWT)								
Stops Walking When Talking – hospital (aged 65 years or older)	1	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.15 (0.07, 0.26)	MODERATE
						No serious imprecision	Specificity= 0.97 (0.91, 0.99)	
diffTUG								
diffTUG (cut-off >/=4.5 secs) – hospital (aged 65 years or older)	1	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.17 (0.08, 0.30)	MODERATE
						No serious imprecision	Specificity= 0.95 (0.89, 0.98)	
Gait velocity (cm/s)								
Gait velocity (cm/s) – community (aged 65 years or older)	1	1705	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.59 (0.52, 0.66)	MODERATE
						No serious imprecision	Specificity= 0.46 (0.43, 0.49)	
Grip strength (kg)								
Grip strength (kg) – community (aged 65 years or older)	1	1705	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.44 (0.37, 0.52)	LOW
						No serious imprecision	Specificity= 0.60 (0.57, 0.62)	
Falls risk score								
Falls risk score (2-3) – residential (aged 65 years or older)	1 [7]	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.98 (0.92, 1.00)	MODERATE
						No serious imprecision	Specificity= 0.07 (0.02, 0.17)	

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
Falls risk score (3-4) – residential (aged 65 years or older)	1	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.92 (0.85, 0.96)	MODERATE
						No serious imprecision	Specificity= 0.23 (0.16, 0.32)	
Falls risk score (4-5) – residential (aged 65 years or older)	1	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.80 (0.71, 0.88)	MODERATE
						serious imprecision[b]	Specificity= 0.48 (0.38, 0.58)	
Falls risk score (5-6) – residential (aged 65 years or older)	1	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.64 (0.51, 0.76)	LOW
						Serious imprecision[b]	Specificity= 0.69 (0.56, 0.81)	
Falls risk score (>9) – residential (aged 65 years or older)	1	159	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.23 (0.14, 0.35)	MODERATE
						No serious imprecision	Specificity= 0.94 (0.85, 0.98)	
Care Home Falls Screen (CaHFRiS)								
Care Home Falls Screen (CaHFRiS) (cut-off score of ≥ 4) – community (aged 65 years or older)	1	379	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.64 (0.57, 0.71)	LOW
						Serious imprecision[b]	Specificity= 0.68 (0.61, 0.75)	
Fall Risk Classification Algorithm (FRiCA)								
Fall Risk Classification Algorithm (FRiCA) – community (aged 65 years or older	1	398	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.68 (0.61, 0.74)	LOW
						No serious imprecision	Specificity= 0.59 (0.51, 0.66)	
Anterior-posterior angular displacement								
Anterior-posterior angular displacement (1.88° cut-off) – community (aged 65 years or older	1	287	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.32 (0.21, 0.44)	MODERATE
						No serious imprecision	Specificity= 0.77 (0.71, 0.82)	

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
Free living accelerometer data - FLA (No early stopping)								
Free living accelerometer data - FLA (No early stopping) – community (aged 65 years or older)	1	428	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.50 (0.37, 0.63)	LOW
						Serious imprecision[b]	Specificity= 0.64 (0.37, 0.69)	
Free living accelerometer data - FLA (Early stopping)								
Free living accelerometer data - FLA (Early stopping) – community (aged 65 years or older)	1	428	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Very serious imprecision[b]	Sensitivity= 0.61 (0.48, 0.73)	VERY LOW
						Serious imprecision[b]	Specificity= 0.67 (0.62, 0.72)	
Stride time in seconds								
Stride time in seconds (1.19 cut-off) – residential (aged 65 years or older	1	135	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Very serious imprecision[b]	Sensitivity= 0.63 (0.49, 0.75)	VERY LOW
						Very serious imprecision[b]	Specificity= 0.61 (0.49, 0.71)	
Standard deviation landing phase								
Standard deviation landing phase in % (15.3 cut-off) – residential (aged 65 years or older	1	135	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.100 (0.91, 1.00)	LOW
						Serious imprecision[b]	Specificity= 0.42 (0.32, 0.53)	
Posturographic frequency range F2-F4								
Posturographic frequency range F2-F4 (10.7 cut-off) – residential (aged 65 years or older)	1	135	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.88 (0.74, 0.95)	MODERATE
						No serious imprecision	Specificity= 0.39 (0.29, 0.49)	
Standing Test for Imbalance and Disequilibrium (SIDE)								
Standing Test for Imbalance and	1	398		No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.86 (0.71, 0.95)	VERY LOW

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
Disequilibrium (SIDE) (cut off 2a/2b) – residential (aged 65 years or older)			serious risk of bias[a]			Very serious imprecision[b]	Specificity= 0.50 (0.07, 0.93)	
SIDE + Adherence assessment								
SIDE (cut off 2a/2b) + Adherence assessment (positive/negative) (aged 65 years or older)	1	390	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.76 (0.60, 0.88)	LOW
						No serious imprecision	Specificity= 0.64 (0.59, 0.69)	
Turning duration (s)								
Turning duration (cut off 1.91 s) – hospital (aged 65 years or older)	1	214	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.96 (0.90, 0.99)	MODERATE
						No serious imprecision	Specificity= 0.16 (0.10, 0.23)	
Turning duration (s)								
Turning duration (cut off 3.80 s) – hospital (aged 65 years or older)	1	214	serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.24 (0.16, 0.35)	MODERATE
						No serious imprecision	Specificity= 0.87 (0.80, 0.92)	
Composite equilibrium score								
Composite equilibrium score (cut off ≤52) - community (aged 65 years or older)	1	159	No serious risk of bias	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.41 (0.28, 0.54)	LOW
						No serious imprecision	Specificity= 0.85 (0.75, 0.91)	
Hester Davis Scale								
Hester Davis Scale (cut off 11) – hospital (aged 65 years or older)	1	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.78 (0.68, 0.86)	LOW
						No serious imprecision	Specificity= 0.46 (0.43, 0.49)	
	1	1645				Serious imprecision[b]	Sensitivity= 0.70 (0.60, 0.79)	LOW

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
Hester Davis Scale (cut off 12) – hospital (aged 65 years or older)			Serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Specificity= 0.56 (0.53, 0.59)	
Hester Davis Scale (cut off 13) – hospital (aged 65 years or older)	1	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.54 (0.44, 0.64)	LOW
						No serious imprecision	Specificity= 0.64 (0.62, 0.66)	
Hester Davis Scale (cut off 14) – hospital (aged 65 years or older)	1	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.52 (0.42, 0.62)	LOW
						No serious imprecision	Specificity= 0.74 (0.72, 0.76)	
Hester Davis Scale (cut off 15) – hospital (aged 65 years or older)	1	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.42 (0.32, 0.52)	LOW
						No serious imprecision	Specificity= 0.79 (0.77, 0.81)	
Facility fall risk								
Facility falls risk (cut off 13) hospital (aged 65 years or older)	1 [11]	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.82 (0.73, 0.89)	LOW
						No serious imprecision	Specificity= 0.42 (0.40, 0.44)	
Facility fall risk (cut off 14) hospital (aged 65 years or older)	1	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.49 (0.39, 0.59)	LOW
						No serious imprecision	Specificity= 0.76 (0.74, 0.78)	
Section GG scores (cut off 51) hospital (aged 65 years or older)	1	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	Sensitivity= 0.75 (0.65, 0.83)	LOW
						No serious imprecision	Specificity= 0.57 (0.54, 0.59)	
Finite-state machine								
Finite-state machine – (Vanilla decision tree)	1	168				Very serious imprecision[b]	Sensitivity= 0.57 (0.37, 0.76)	VERY LOW

Risk tool	No of studies	n	Risk of bias	Inconsistency	Indirectness	Imprecision	Effect size (95% CI)	Quality
community (aged 65 years or older)			Serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Specificity= 0.84 (0.77, 0.90)	
Finite-state machine – (Under sampling decision tree) community (aged 65 years or older)	1	168	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Very serious imprecision[b]	Sensitivity= 0.66 (0.46, 0.82)	VERY LOW
						Serious imprecision[b]	Specificity= 0.70 (0.62, 0.77)	
Finite-state machine – (SMOTE Lasso) community (aged 65 years or older)	1	168	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Very serious imprecision[b]	Sensitivity= 0.67 (0.48, 0.84)	VERY LOW
						No serious imprecision	Specificity=0.79 (0.71, 0.86)	
Finite-state machine – (Near miss SVM) community (aged 65 years or older)	1	168	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision	Sensitivity= 0.88 (0.72, 0.98)	LOW
						Serious imprecision[b]	Specificity= 0.58 (0.49, 0.66)	

a) *Risk of bias was assessed using the PROBAST checklist. Downgraded by 1 increment as the majority of the evidence was at high risk due to one or more of the following: history of falls included as a predictor, lack of information on predictors, lack of information on missing participants, follow up time frame not provided, lack of information on inclusion/exclusion criteria, missing data and number of participants with outcome <100.*
b) *The judgement of precision was based on the spread of confidence interval across two clinical thresholds: sensitivity and specificity of 50% and 70%. The threshold of 50% marked the boundary between no predictive value better than chance and a predictive value better than chance. The threshold of 70% marked the boundary above which the committee might consider recommendations. If the 95% CIs crossed one of these thresholds a rating of serious imprecision was given and if they crossed both thresholds a rating of very serious imprecision was given*

Table 4: Summary of results: AUC

Risk tool	No of studies	N	Risk of bias	Inconsistency	Indirectness	Imprecision	Area under Curve: Individual study effects (95%CI)	Quality
Berg Balance Scale								

Risk tool	No of studies	N	Risk of bias	Inconsistency	Indirectness	Imprecision	Area under Curve: Individual study effects (95%CI)	Quality
Berg Balance Scale - community (aged 65 years or older)	2	451	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[d]	Median: 0.62 (NR) range: (0.62 to 0.79)	VERY LOW
BEST								
BEST - community (aged 65 years or older)	1	226	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Very serious imprecision[b]	0.68 (0.45 – 0.83)	VERY LOW
Mini-BEST								
Mini-BEST - community (aged 65 years or older)	1	226	serious risk of bias[a]	No serious inconsistency	No serious indirectness	serious imprecision[b]	0.77 (0.55 – 0.89)	LOW
Mini-BEST - community (aged under 65 years)	1	110	No serious risk of bias	No serious inconsistency	No serious indirectness	Incalculable[c]	0.75 (NR)	VERY LOW
Tinetti total score								
Simplified Tinetti Scale (>2 cut-off) – hospital (aged 65 years or older)	1	807	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.69 (NR)	VERY LOW
Tinetti total score - community (aged 65 years or older)	1	131	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.76 (NR)	VERY LOW
Gait velocity (cm/s)								
Gait velocity (cm/s) – community (aged 65 years or older)	1	1705	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.50 (NR)	VERY LOW
Grip strength (kg)								
Grip strength (kg) – community (aged 65 years or older)	1	1705	serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.50 (NR)	VERY LOW
HCRNN model of kinematic characteristics of gait and balance during the TUG								

Risk tool	No of studies	N	Risk of bias	Inconsistency	Indirectness	Imprecision	Area under Curve: Individual study effects (95%CI)	Quality
HCRNN model of kinematic characteristics of gait and balance during the TUG – community (aged 65 years or older)	1	134	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	No serious imprecision[b]	0.98 (0.97 – 0.99)	MODERATE
Stride time in seconds								
Stride time in seconds (1.19 cut-off) - residential (aged 65 years or older	1	135	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.66 (0.50 – 0.82)	LOW
Standard deviation landing phase								
Standard deviation landing phase in % (15.3 cut-off) - residential (aged 65 years or older	1	135	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.70 (0.59 – 0.81)	LOW
Posturographic frequency range								
Posturographic frequency range F2-F4 (10.7 cut-off) - residential (aged 65 years or older	1	135	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.66 (0.53 – 0.81)	LOW
Care Home Falls Screen (CaHFRiS)								
Care Home Falls Screen (CaHFRiS) (cut-off score of ≥ 4) – residential (aged 65 years or older)	1	379	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.66 (0.61 – 0.72)	LOW
Predict_FIRST tool								
Predict_FIRST – hospital (aged 65 years or older)	1	300	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision [b]	0.66 (0.57 – 0.74)	LOW
Patient history + Gait speed (m/s)								
Patient history + Gait speed (m/s) – hospital (aged 65 years or older)	1	214	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.67 (0.6 – 0.74)	LOW

Risk tool	No of studies	N	Risk of bias	Inconsistency	Indirectness	Imprecision	Area under Curve: Individual study effects (95%CI)	Quality
Patient history + Walk ratio								
Patient history + Walk ratio (cm/number of steps/min) – hospital (aged 65 years or older)	1	214	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.67 (0.59 – 0.74)	LOW
Patient history + Mini-BESTest								
Patient history + Mini-BESTest - hospital (aged 65 years or older)	1	214	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.69 (0.62 – 0.76)	LOW
Patient history + TUG duration (s)								
Patient history + TUG duration (s) - hospital (aged 65 years or older)	1	214	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.68 (0.61 – 0.75)	LOW
Patient history + sit-to-walk duration, s								
Patient history + sit-to-walk duration, (s) - hospital (aged 65 years or older)	1	214	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.67 (0.60 – 0.74)	LOW
Patient history + Turn duration, (s)								
Patient history + Turn duration, (s) - hospital (aged 65 years or older)	1	214	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.69 (0.62 – 0.76)	LOW
Patient history + Peak angular velocity, °/s								
Patient history + Peak angular velocity, (°/s) - hospital (aged 65 years or older)	1	214	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.68 (0.60 – 0.75)	LOW
Composite equilibrium score								
Composite equilibrium score – community (aged 65 years or older)	1	159	No serious risk of bias	No serious inconsistency	No serious indirectness	No serious imprecision	0.61 (0.53 – 0.68)	HIGH
Hester Davis Scale (cut off 11) - hospital								

Risk tool	No of studies	N	Risk of bias	Inconsistency	Indirectness	Imprecision	Area under Curve: Individual study effects (95%CI)	Quality
Hester Davis Scale – hospital (aged 65 years or older)	1	1645	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Serious imprecision[b]	0.68 (0.63 – 0.73)	LOW
Finite-state machine (wearable technology)								
Finite-state machine (wearable) - Vanilla decision tree – community (aged 65 years or older)	1	168	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.69 (NR)	VERY LOW
Finite-state machine (wearable) - Under sampling decision tree -community (aged 65 years or older)	1	168	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.69 (NR)	VERY LOW
Finite-state machine (wearable) - SMOTE Lasso - community (aged 65 years or older)	1	168	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.76 (NR)	VERY LOW
Finite-state machine (wearable) - Near miss SVM - community (aged 65 years or older)	1	168	Serious risk of bias[a]	No serious inconsistency	No serious indirectness	Incalculable[c]	0.75 (NR)	VERY LOW

a) *Risk of bias was assessed using the PROBAST checklist. Downgraded by 2 increments as the majority of the evidence was at very high risk due to one or more of the following: lack of information on predictors, lack of information on missing participants, lack of information on inclusion/exclusion criteria, missing data, statistical analysis and issues with categorical data handling*
b) *The judgement of precision was based on the spread of confidence interval across two clinical thresholds: C statistics of 50% and 70%. The threshold of 50% marked the boundary between no predictive value better than chance and a predictive value better than chance. The threshold of 70% marked the boundary above which the committee might consider recommendations. If the 95% CIs crossed one of these thresholds a rating of serious imprecision was given and if they crossed both thresholds a rating of very serious imprecision was given*
c) *No confidence interval reported and primary data not available so unable to calculate imprecision. Downgraded by 2 increments.*

1.1.7. Comprehensive falls assessment

This part of the review considered the comprehensive assessments that are conducted as part of interventions to reduce the risk of falls. Comprehensive falls assessments identify an individual's risk factors to enable interventions to be tailored to prevent or reduce falls.

To identify which individual risk factors should be assessed to tailor prevention interventions accordingly, we looked at the effective multifactorial interventions studies (from the multifactorial review F1 and F2) and looked at what assessments had been carried out to identify risk factors for falls to enable interventions to be tailored to the individual. The component parts of the assessment and any tools or instruments used were extracted from the multifactorial intervention review (see F1 and F2) and the committee considered these and agreed through consensus what should be included as part of a comprehensive falls assessment. See Appendix M for details of evidence included.

The components of assessments within the effective multifactorial interventions studies included:

- No. of falls in the past 12 months/Injury in past 12 months
- Home environmental hazards
- Walks safely in the house/walking speed
- Balance/Gait/muscle testing/range of motion
- Cognitive status
- Drug and alcohol use
- Level of physical activity
- Foot problems/inappropriate footwear
- Incontinence/Nocturia
- Number of medical conditions
- Medications/number of falls risk medications/vaccinations
- Vision/Hearing
- Activities of daily living/Assistance required to perform personal ADLs/Assistance required to perform domestic ADLs
-
- Somatosensory deficit
- Food intake/weight loss/alcohol intake
- Mood/depression
- Social/housing
- Falls self-efficacy
- Blood pressure/Cardiovascular assessment

1.1.8. Economic evidence

1.1.8.1. Included studies

No health economic studies were included.

1.1.8.2. Excluded studies

One economic study relating to this review question was identified but was excluded due to limited applicability. This is listed in Appendix J, with reasons for exclusion given.

See also the health economic study selection flow chart in Appendix G.

1.1.9. Summary of included economic evidence

No health economic studies were included.

1.1.10. Economic model

This review question was not prioritised for new health economic modelling.

1.1.11. Evidence statements

1.1.11.1. Economic

No relevant economic evaluations were identified.

1.1.12. The committee's discussion and interpretation of the evidence

1.1.12.1. The outcomes that matter most

The committee agreed that the clinical outcome the risk assessments should predict was the occurrence of falls. They hoped that risk tools including minimum data set, multifactorial assessments, balance and gait assessments or wearable technologies would identify individual risk factors present in order to be able to tailor interventions to prevent falls. The accuracy of assessments or prediction tools to estimate the risk of falls was measured using the following statistical outputs:

- Discrimination (sensitivity, specificity, predictive values)
- Area under the ROC curve (c-index, c-statistic)
- Predicted risk versus observed risk
- Reclassification
- Other statistical measures: for example, D statistic, R2 statistic and Brier points

The committee agreed that discrimination data is important to correctly classify individuals into risk groups to inform decisions or further interventions, however, all outcomes were considered equally important for decision making.

The committee noted that limited evidence was available for the sensitivity and specificity of the tools at specific thresholds and very limited evidence was available for area under the curve data. No calibration or reclassification statistics were reported.

Clinical thresholds

Clinical decision thresholds were set at default values of sensitivity/specificity 0.7 and 0.7 above which a test would be recommended and 0.5 and 0.5 below which a test is of no clinical use. The committee did not choose to prioritise sensitivity or specificity in their decision making as it would depend on the context of the test.

1.1.12.2. The quality of the evidence

A search was conducted for external validation studies or prospective cohort studies including over 100 participants. Evidence was separated according to the setting and age of the study population and analysed separately. Thirteen studies were identified in a community setting, five in a hospital setting and four in a residential care setting. All studies apart from one included a population over 65 years old. 22 studies were included in the review and due to the separation of evidence according to the above strata, many of the

outcomes only included single study data. Evidence was available for twelve functional gait or balance assessments; five risk prediction tools and five studies looked the use of wearable technologies such as goniometers and accelerometers.

The quality of evidence ranged very low to moderate with the majority being of low quality.

Downgrading of the evidence was mainly due to risk of bias relating to the following: lack of information on predictors or inclusion/exclusion criteria, missing data, poor description of statistical analysis and issues with categorical data handling.

Many outcomes were downgraded for imprecision due to small study sizes and the confidence intervals crossing the decision thresholds of 0.7 and 0.5, above and below which a test would or would not be recommended.

Meta analyses of the data was not possible for the majority of evidence due to the differences in the study settings, populations or cut offs used meaning that outcomes were predominantly based on small individual studies.

1.1.12.3. Benefits and harms

Community setting

Based on the limited AUC data in a community setting several balance and gait assessment tools including the Berg balance scale, Mini-BEST test and Tinetti score all reported values above the threshold of 0.7 suggestive of moderate discriminative ability to predict future risk of falls. Additionally, gait measurement technologies including the Finite-state machine and a model of kinematic characteristics of gait and balance during the timed up and go also reported AUC values over 0.7. The HCRNN model of kinematic characteristic of gait and balance during the timed up and go reported the best AUC value or 0.98 which indicates almost perfect discrimination. However, this study included a fairly small sample of 134 participants with a low event rate and lack of external validation, which likely lead to over-estimation of the predictive ability. Therefore, the committee did not take this outcome into account during their decision making. AUC data for the BEST test, Composite equilibrium score, grip strength and gait velocity all reported values below the threshold of 0.7 indicating a poor discriminative ability.

Sensitivity and specificity data was available for a number of different assessments at various cut points, however, only one study assessing the Berg balance scale with a cut point of <49 reported paired sensitivity and specificity data that reached the thresholds of 0.7 sensitivity and 0.7 specificity. Findings for the other tests all failed to reach the paired sensitivity and specific thresholds indicating a useful test. The committee discussed the one positive outcome for the Berg balance scale; however, this test was also assessed by four additional studies at higher and lower cut points and data for these alternate cut points all fell below the 0.7 threshold. Ultimately, the committee could not recommend the Berg balance scale at the <49 cut off over the other tests as the data was too limited.

The committee suggested that the Berg balance scale, BEST test and Tinetti scale are all widely used in clinical practice and any one of these could be used to test for balance and gait as a contributing factor for falls risk in a community setting, and consequently help to identify individuals who would benefit from strength and balance-based interventions. The committee recommended that people in the community that have fallen in the last year but who do not meet the criteria for a comprehensive falls assessment should have their gait and balance assessed to determine whether further interventions are required.

The committee agreed the evidence did not address which methods of assessment were most useful at predicting risk of falls. They suggested that as these tests were generally only assessing one aspect associated with falls risk such as balance or gait and are not examining other possible predictors such as medications or comorbidities, they would not

expect them to have great predictive ability when used in isolation. The committee suggested these should be used in conjunction with a comprehensive geriatric assessment for those identified at higher risk of falls. Risk screening tools such as the care home falls screen and the falls risk classification algorithm also performed poorly and the committee agreed that this is in alignment with what they see in clinical practice. They explained that these tools alone do not provide enough information to accurately categorise risk. The committee discussed the criteria of people who would go on for further falls assessment and management. The current guideline recommends further assessment for those who have required medical attention because of a fall or have had recurrent falls in the previous year or have gait and balance impairments. The committee broadly agreed with the timeframe of a fall within the previous year, and if a person has been injured or had recurrent falls the recommendation would reflect practice and still apply. They discussed that further detail on the population who would also be identified for further assessment include those that have had a fall and are recognised as being frail, or lost consciousness related to the fall or were unable to get up independently after a fall. They agreed these groups would be at higher risk of further falls. The committee discussed people who have fallen but do not fulfil these criteria, should have their gait and balance assessed and agreed that if an impairment is identified an intervention to address this should be offered.

The committee discussed the results of wearable technologies such as the free-living accelerometer data which again failed to reach the thresholds of clinical importance. The committee suggested that the majority of the current evidence base on wearable technologies are laboratory-based studies and therefore were not included in the current protocol. They agreed that further research in this field is required, specifically in a real-world setting and made a research recommendation (see Appendix L). At the time of publishing this version of the guideline the committee became aware that a wearable technology had become available that aimed to predict a person's falls risk. However, evidence supporting this that fits the risk assessment review guideline protocols was not available for this update. They also suggested that sitting and standing (sedentary behaviour), related to fall risk that is independent of physical activity should be investigated, in order to create more robust recommendations across the different settings.

The committee decided to make consensus recommendations based on their clinical expertise and the multifactorial assessments used within the (4.1) interventions for falls prevention reviews (see comprehensive risk assessments below).

Hospital setting

Only two studies reported AUC data in a hospital setting and these assessed the predict FIRST and the simplified Tinetti test. Both outcomes failed to reach the 0.7 threshold of moderate discrimination. Similarly, for the sensitivity and specificity data, none of the assessments studied (namely the Berg balance scale, stops talking when walking, diffTUG, and The Tinetti scale, Hester Davis scale and patient history combined with gait speed, walk ratio, mini-BESTest, TUG duration, sit-to-walk duration, turn duration, and peak angular velocity) reached the paired sensitivity and specificity thresholds indicating a useful test. The committee again were not surprised by the lack of efficacy demonstrated by these tools as they are only assessing one aspect associated with falls risk such as balance or gait and are not assessing the multifactorial nature of falls which is particularly evident in the acute hospital setting. These findings correlate with the previous NICE recommendations that advise against using falls risk prediction tools in hospital. The committee agreed that in an older population of inpatients who are often undergoing treatments for other conditions, taking new medications or having other assessments, their functional abilities may rapidly change and consequently these assessments may be futile. The Committee recognised that older people in hospital are considered to be at risk of falls and require a comprehensive falls assessment and subsequent management for any fall risk factors identified.

Residential setting

Only two studies reported AUC data in a residential care setting, and these assessed the Care home falls screen and several measures taken from a sensor-based watch and interactive balance system, including: stride time in seconds, standard deviation landing phase % and posturographic frequency range. Only one of these measures reached the threshold of 0.7 indicative of moderate discrimination, which was the standard deviation landing phase. However, this was only based on one small study of low quality and was not enough for the committee to recommend this alone as an effective tool. Three studies reported sensitivity and specificity data in the residential care setting. One examined a risk prediction tool names the Falls risk score, one reported sensitivity and specificity data on the gait and balance measures listed above and one examined the standing Test for Imbalance and Disequilibrium (SIDE). None of the tests paired values reached the thresholds of 0.7 for being a useful test. Again, the committee were not surprised by these findings as care home residents in particular are more likely to require a comprehensive approach to falls assessments due to the presence of comorbidities and more complex presentations beyond the scope of these simplified tools or assessments for only functional abilities. The committee therefore could not recommend a specific tool or gait/balance assessment in this population but agreed older people in residential care settings would be considered at risk of falls and require a comprehensive falls assessment and subsequent management for any fall risk factors identified.

Comprehensive risk assessments

The evidence from this review did not support any recommendations to be made on which methods of assessment to use to predict risk of falls. Therefore, the committee drew upon the components of the multifactorial assessments within the interventions found to be effective in the multifactorial prevention of falls reviews in the community (Evidence reviews F1 and F2). These have been extracted from the review and included in Appendix M below. The committee used this as the basis for recommendations on comprehensive risk assessment.

Many of the assessments included in the studies were similar to those already recommended in the previous NICE Falls guideline (CG161), which had included a risk factor review, and found that multifactorial assessment may include the following:

- Identification of falls history
- Assessment of gait, balance and mobility, and muscle weakness
- Assessment of osteoporosis risk
- Assessment of the older person’s perceived functional ability and fear relating to falling
- Assessment of visual impairment
- Assessment of cognitive impairment and neurological examination
- Assessment of urinary incontinence
- Assessment of home hazards
- Cardiovascular examination and medication review

The committee added to the above list, from the risk assessment components identified within the evidence review or from their expert consensus. They considered the assessments included in the studies and noted the same or similar components that were used within several of the studies, including assessment of footwear and or condition of feet; diet, weight loss and medication review. The committee noted other assessments noted in some studies they thought should be included and reflected their own practice: hearing impairments which can affect a person’s balance; fluid intake as a lack of fluid leads to dehydration and can cause dizziness which can in turn increase the risk of falling; and asking about alcohol intake. They agreed these should also be included as part of a risk assessment.

1.1.12.4. Cost effectiveness and resource use

No published health economic evidence was identified that met the inclusion criteria. In the absence of health economic evidence, the committee was encouraged to discuss current practice and make a judgement regarding the cost and cost-effectiveness of any new recommendations relating to the use of risk prediction, and assessment tools.

The committee noted that in the community, Berg balance scale, BEST test and Tinetti scale are currently widely used and could continue being used as a contributing factor towards identifying those at risk of falls. Therefore, the recommendations are unlikely to have a resource impact. A comprehensive falls assessment for people meeting the criteria reflects current practice and was unlikely to have a resource impact. For all settings the committee acknowledged clinical reasons not to use risk prediction tools and they are currently not being used. Therefore, there will be no change in the resource impact in these settings.

1.1.13. Recommendations supported by this evidence review

This evidence review supports recommendations 1.1.1 to 1.1.7, 1.2.1 to 1.2.3 and recommendations for research in the NICE guideline.

References

1. Albites-Sanabria J, Palumbo P, Helbostad JL, Bandinelli S, Mellone S, Palmerini L et al. Real-World Balance Assessment While Standing for Fall Prediction in Older Adults. IEEE transactions on bio-medical engineering. 2024; 71(3):1076-1083

2. Almeida LRS, Valenca GT, Negreiros NN, Pinto EB, Oliveira-Filho J. Comparison of Self-report and Performance-Based Balance Measures for Predicting Recurrent Falls in People With Parkinson Disease: Cohort Study. Physical Therapy. 2016; 96(7):1074-1084

3. Andersson AG, Kamwendo K, Seiger A, Appelros P. How to identify potential fallers in a stroke unit: validity indexes of 4 test methods. Journal of Rehabilitation Medicine. 2006; 38(3):186-191

4. Ashburn A, Hyndman D, Pickering R, Yardley L, Harris S. Predicting people with stroke at risk of falls. Age and Ageing. 2008; 37(3):270-276

5. Bizovska L, Svoboda Z, Janura M, Bisi MC, Vuillerme N. Local dynamic stability during gait for predicting falls in elderly people: A one-year prospective study. PloS One. 2018; 13(5):e0197091

6. Caronni A, Picardi M, Scarano S, Malloggi C, Tropea P, Gilardone G et al. Pay attention: you can fall! The Mini-BESTest scale and the turning duration of the TUG test provide valid balance measures in neurological patients: a prospective study with falls as the balance criterion. Frontiers in Neurology. 2023; 14:1228302

7. Chen JS, March LM, Schwarz J, Zochling J, Makaroff J, Sitoh YY et al. A multivariate regression model predicted falls in residents living in intermediate hostel care. Journal of Clinical Epidemiology. 2005; 58(5):503-508

8. Dasgupta P, Frisch A, Huber J, Sejdic E, Suffoletto B. Predicting falls within 3 months of emergency department discharge among community-dwelling older adults using self-report tools versus a brief functional assessment. The American journal of emergency medicine. 2022; 53:245-249

9. Greene BR, Doheny EP, Walsh C, Cunningham C, Crosby L, Kenny RA. Evaluation of falls risk in community-dwelling older adults using body-worn sensors. Gerontology. 2012; 58(5):472-480

10. Greene BR, McGrath D, Walsh L, Doheny EP, McKeown D, Garattini C et al. Quantitative falls risk estimation through multi-sensor assessment of standing balance. Physiological Measurement. 2012; 33(12):2049-2063

11. Harmon EY, Cournan MC, Teale AE. Predicting Falls in Rehabilitation: A Comparison of Three Instruments Including Hester Davis. Rehabilitation nursing : the official journal of the Association of Rehabilitation Nurses. 2023; 48(4):124-132

12. Hars M, Audet M-C, Herrmann F, De Chassey J, Rizzoli R, Reny J-L et al. Functional Performances on Admission Predict In-Hospital Falls, Injurious Falls, and Fractures in Older Patients: A Prospective Study. Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research. 2018; 33(5):852-859

13. Kelly D, Condell J, Gillespie J, Munoz Esquivel K, Barton J, Tedesco S et al. Improved screening of fall risk using free-living based accelerometer data. Journal of biomedical informatics. 2022; 131:104116

14. Mahoney JR, Oh-Park M, Ayers E, Verghese J. Quantitative trunk sway and prediction of incident falls in older adults. Gait and Posture. 2017; 58:183-187

15. Mak MKY, Auyeung MM. The mini-BESTest can predict parkinsonian recurrent fallers: a 6-month prospective study. Journal of Rehabilitation Medicine. 2013; 45(6):565-571

16. 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. Physical Therapy. 2008; 88(4):449-459

17. Schwesig R, Fischer D, Lauenroth A, Becker S, Leuchte S. Can falls be predicted with gait analytical and posturographic measurement systems? A prospective follow-up study in a nursing home population. Clinical Rehabilitation. 2013; 27(2):183-190

18. Teranishi T, Suzuki M, Yamada M, Maeda A, Yokota M, Itoh N et al. Prediction of early falls using adherence and balance assessments in a convalescent rehabilitation ward. Fujita medical journal. 2024; 10(1):30-34

19. Vassallo M, Stockdale R, Sharma JC, Briggs R, Allen S. A comparative study of the use of four fall risk assessment tools on acute medical wards. Journal of the American Geriatrics Society. 2005; 53(6):1034-1038

20. Vlaeyen E, Poels J, Colemonts U, Peeters L, Leysens G, Delbaere K et al. Predicting Falls in Nursing Homes: A Prospective Multicenter Cohort Study Comparing Fall History, Staff Clinical Judgment, the Care Home Falls Screen, and the Fall Risk Classification Algorithm. Journal of the American Medical Directors Association. 2021; 22(2):380-387

21. Vratsistas-Curto A, Tiedemann A, Treacy D, Lord SR, Sherrington C. External validation of approaches to prediction of falls during hospital rehabilitation stays and development of a new simpler tool. Journal of Rehabilitation Medicine. 2018; 50(2):216-222

22. Zhou J, Liu B, Ye H, Duan J-P. A prospective cohort study on the association between new falls and balancing ability among older adults over 80 years who are independent. Experimental Gerontology. 2023; 180:112259

Appendices

Appendix A Review protocols

A.1 Review protocol for how accurate are screening tools which quantify or categorise the degree of risk of falling in identifying people at risk of falls?

ID	Field	Content
1.	Review title	What methods of assessment are most accurate for identifying individual risk factors for risk of falls?
2.	Review question	What methods of assessment are most accurate for identifying individual risk factors for risk of falls?
3.	Objective	Which assessments to use to identify individual risk factors in order to tailor interventions to prevent falls. This includes which risk factors should be included in a multifactorial fall risk assessment to be able to tailor fall prevention interventions. The aim of this would be to have a list of what areas should be included in a MFRA.
4.	Searches	The following databases (from inception) will be searched: • Embase • MEDLINE • Epistemonikos Searches will be restricted by: • English language studies Human studies

		The searches may be re-run 6 weeks before the final committee meeting and further studies retrieved for inclusion if relevant. The full search strategies will be published in the final review. Medline search strategy to be quality assured using the PRESS evidence-based checklist (see methods chapter for full details).
5.	Condition or domain being studied	• Falls: an unexpected event in which the participants come to rest on the ground, floor, or lower level.
6.	Population	Inclusion: • people aged 65 and over • people aged 50 to 64 who have a condition or conditions that may put them at higher risk of falling. Exclusion: any age group that does not fit the inclusion criteria Strata: age group: people aged 50 to 64 who have a condition or conditions that may put them at higher risk of falling; settings (hospitals, community, long-term residential care). The setting is stratified as a lot of the screening tests are not suitable for hospital settings.
7.	Risk prediction tool	• Multifactorial assessment instruments/processes administered by health care professionals, including: • Home hazard assessment instruments, administered by health care professionals for community-dwelling population • Minimum data set (MDS) home care and residential assessment instrument for comprehensive assessment

		These components will come from the falls risk assessment tools from 4.1. Balance and gait assessment tools to be included: • Performance-oriented assessment of mobility problems (Tinetti scale) Tinetti balance assessment tool/POMA (</=18 high; 19-23 moderate; >/=24 low) • Dynamic gait index (19 or less related to increased risk for falling) • Berg balance scale (0-20 points: high risk of falls; 21-40: moderate risk of falls: 41-56 points: low risk of falls). • Mini Balance Evaluation Systems Test (BEST)/Mini-BEST • Physiological profile assessment performance test Gait measurement technologies • Wearables (gait and balance), inertial measurement unit, gyroscope on wrist, foot, shank or thigh
8.	Target condition	• Falls: an unexpected event in which the participants come to rest on the ground, floor, or lower level.
9.	Types of study to be included	For identifying multifactorial risk assessment factors, we will identify studies that use multifactorial risk assessment as part of their intervention (from intervention review 4.1) and extract the components used in the studies that effectively reduced falls and the cut-off points for falls risk from Q2.2 to inform decisions on what is included as part of a MFRA. For balance and gait assessment tools and wearable technology: External validation studies (tested on a different study sample to the derivation sample will be included. Prospective cohort studies or systematic reviews of these with a sample size of n=100 or more. Where tests are validated in a UK population, we will not include studies in other countries, otherwise we will include any country. Published NMAs and IPDs will be considered for inclusion. **Exclusion:** • Case-control studies

		• Cross-sectional studies
10.	Other exclusion criteria	Non-English language studies. Exclude wearables that just look at physical activity.
11.	Context	All healthcare settings
12.	Primary outcomes (critical outcomes)	For balance and gait assessment tools and wearable technology: *All outcomes are considered equally important for decision making and therefore have all been rated as critical:* *Accuracy of estimation of risk of falls:* Statistical outputs may include: • Discrimination (sensitivity, specificity, predictive values) • Area under the ROC curve (c-statistic) • Predicted risk versus observed risk (calibration) • Reclassification Other statistical measures: for example, D statistic, R^2 statistic and Brier points
13.	Data extraction (selection and coding)	EndNote will be used for reference management, sifting, citations and bibliographies. All references identified by the searches and from other sources will be uploaded into EPPI reviewer and de-duplicated. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. The full text of potentially eligible studies will be retrieved and will be assessed in line with the criteria outlined above.

		A standardised form will be used to extract data from studies (see Developing NICE guidelines: the manual section 6.4). 10% of all evidence reviews are quality assured by a senior research fellow. This includes checking: • papers were included /excluded appropriately. • a sample of the data extractions. • correct methods are used to synthesise data. • a sample of the risk of bias assessments. Disagreements between the review authors over the risk of bias in particular studies will be resolved by discussion, with involvement of a third review author where necessary. Study investigators may be contacted for missing data where time and resources allow.
14.	Risk of bias (quality) assessment	For balance and gait assessment tools and wearable technology: Risk of bias will be assessed using the PROBAST checklist as described in Developing NICE guidelines: the manual.
15.	Strategy for data synthesis	For balance and gait assessment tools and wearable technology: Analyses with and without accounting for competing risks will be included. Discrimination, calibration, and re-classification data will be reported separately. If appropriate, C statistic and net reclassification index data will be meta-analysed (if at least 3 studies reporting data at the same threshold) in RevMan. Summary outcomes will be reported from the meta-analyses with their 95% confidence intervals in adapted GRADE tables. Sensitivity and specificity data will be meta-analysed using a Bayesian approach (using WinBugs software) if 3 or more data points are found.

		Heterogeneity between the studies in effect measures will be assessed using visual inspection of the sensitivity/specificity or net reclassification index RevMan 5 plots, or summary area under the curve (AUC) plots. If data are pooled, an I^2 of 50-74% will be deemed serious inconsistency and an I^2 of 75% or above very serious inconsistency. If meta-analysis is not possible, data will be presented, and quality assessed as individual values in adapted GRADE profile tables and plots of un-pooled sensitivity and specificity from RevMan software. Publication bias will be considered with the guideline committee, and if suspected will be tested for when there are more than 5 studies for that outcome. The risk of bias across all available evidence will be evaluated for each outcome using an adaptation of the 'Grading of Recommendations Assessment, Development and Evaluation (GRADE) toolbox' developed by the international GRADE working group http://www.gradeworkinggroup.org/	
16.	Analysis of sub-groups	Subgroups that will be investigated if heterogeneity is present: specialist settings	
17.	Type and method of review	☐	Intervention
		☐	Diagnostic
		☒	Prognostic
		☐	Qualitative
		☐	Epidemiologic
		☐	Service Delivery
		☐	Other (please specify)
18.	Language	English	
19.	Country	England	
20.	Anticipated or actual start date		

21.	Anticipated completion date			
22.	Stage of review at time of this submission	Review stage	Started	Completed
		Preliminary searches	☑	☐
		Piloting of the study selection process	☐	☐
		Formal screening of search results against eligibility criteria	☐	☐
		Data extraction	☐	☐
		Risk of bias (quality) assessment	☐	☐
		Data analysis	☐	☐
23.	Named contact	5a. Named contact Guideline Development Team NGC 5b Named contact e-mail Guidelines8@nice.org.uk 5e Organisational affiliation of the review National Institute for Health and Care Excellence (NICE)		
24.	Review team members	From NICE: Gill Ritchie [Guideline Lead] Julie Neilson [Senior systematic reviewer] Annette Chalker [Systematic reviewer] Madelaine Zucker [Systematic reviewer]		

		Sophia Kemmis-Betty [Senior Health economist] Steph Armstrong [Health economist] Joseph Runicles [Information specialist] Tamara Diaz [Project Manager]
25.	Funding sources/sponsor	Development of this systematic review is being funded by NICE.
26.	Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
27.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: [NICE guideline webpage].
28.	Other registration details	
29.	Reference/URL for published protocol	[Give the citation and link for the published protocol, if there is one.]
30.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as: • notifying registered stakeholders of publication • publicising the guideline through NICE's newsletter and alerts • issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE.
31.	Keywords	

32.	Details of existing review of same topic by same authors	N/A	
33.	Current review status	x	Ongoing
		☐	Completed but not published
		☐	Completed and published
		☐	Completed, published and being updated
		☐	Discontinued
34.	Additional information		
35.	Details of final publication	www.nice.org.uk	

A.2 Health economic review protocol

Table 5: Health economic review protocol

Review question	All questions – health economic evidence
Objectives	To identify health economic studies relevant to any of the review questions.
Search criteria	• Populations, interventions and comparators must be as specified in the clinical review protocol above. • Studies must be of a relevant health economic study design (cost–utility analysis, cost-effectiveness analysis, cost–benefit analysis, cost–consequences analysis, comparative cost analysis). • Studies must not be a letter, editorial or commentary, or a review of health economic evaluations. (Recent reviews will be ordered although not reviewed. The bibliographies will be checked for relevant studies, which will then be ordered.) • Unpublished reports will not be considered unless submitted as part of a call for evidence. • Studies must be in English.
Search strategy	A health economic study search will be undertaken using population-specific terms and a health economic study filter – see appendix B below.
Review strategy	Studies not meeting any of the search criteria above will be excluded. Studies published before 2007, abstract-only studies and studies from non-OECD countries or the USA will also be excluded. Studies published after 2007 that were included in the previous guideline(s) will be reassessed for inclusion and may be included or selectively excluded based on their relevance to the questions covered in this update and whether more applicable evidence is also identified. Each remaining study will be assessed for applicability and methodological limitations using the NICE economic evaluation checklist which can be found in appendix H of Developing NICE guidelines: the manual (2014).[7] **Inclusion and exclusion criteria** • If a study is rated as both 'Directly applicable' and with 'Minor limitations', then it will be included in the guideline. A health economic evidence table will be completed, and it will be included in the health economic evidence profile. • If a study is rated as either 'Not applicable' or with 'Very serious limitations', then it will usually be excluded from the guideline. If it is excluded, then a health economic evidence table will not be completed, and it will not be included in the health economic evidence profile. • If a study is rated as 'Partially applicable', with 'Potentially serious limitations' or both then there is discretion over whether it should be included. **Where there is discretion** The health economist will make a decision based on the relative applicability and quality of the available evidence for that question, in discussion with the guideline committee if required. The ultimate aim is to include health economic studies that are helpful for decision-making in the context of the guideline and the current NHS setting. If several studies are considered of sufficiently high applicability and methodological quality that they could all be included, then the health economist, in discussion with the committee if required, may decide to include only the most applicable studies and to selectively exclude the remaining studies. All studies excluded on the basis of applicability or methodological limitations will be listed with explanation in the excluded health economic studies appendix below.

	The health economist will be guided by the following hierarchies. *Setting:* • UK NHS (most applicable). • OECD countries with predominantly public health insurance systems (for example, France, Germany, Sweden). • OECD countries with predominantly private health insurance systems (for example, Switzerland). • Studies set in non-OECD countries or in the USA will be excluded before being assessed for applicability and methodological limitations. *Health economic study type:* • Cost–utility analysis (most applicable). • Other type of full economic evaluation (cost–benefit analysis, cost-effectiveness analysis, cost–consequences analysis). • Comparative cost analysis. • Non-comparative cost analyses including cost-of-illness studies will be excluded before being assessed for applicability and methodological limitations. *Year of analysis:* • The more recent the study, the more applicable it will be. • Studies published in 2007 or later (including any such studies included in the previous guideline(s)) but that depend on unit costs and resource data entirely or predominantly from before 2007 will be rated as 'Not applicable'. • Studies published before 2007 (including any such studies included in the previous guideline(s)) will be excluded before being assessed for applicability and methodological limitations. *Quality and relevance of effectiveness data used in the health economic analysis:* • The more closely the clinical effectiveness data used in the health economic analysis match with the outcomes of the studies included in the clinical review the more useful the analysis will be for decision-making in the guideline.

Appendix B Literature search strategies

The literature searches for this review are detailed below and complied with the methodology outlined in Developing NICE guidelines: the manual (2014)

For more information, please see the Methodology review published as part of the accompanying documents for this guideline.

B.1.1 Clinical search literature search strategy

Searches were constructed using a PICO framework where population (P) terms were combined with Intervention (I) and in some cases Comparison (C) terms. Outcomes (O) are rarely used in search strategies as these concepts may not be indexed or described in the title or abstract and are therefore difficult to retrieve. Search filters were applied to the search where appropriate.

Table 6: Database parameters, filters and limits applied

Database	Dates searched	Search filter used
Medline ALL (OVID)	**01-01-1946 - 07-05-2024**	Systematic reviews Internal or external validation studies

Database	Dates searched	Search filter used
		Exclusions (animal studies, letters, comments, editorials, news, historical articles, anecdotes, case studies/reports) English language
Embase (OVID)	**01-01-1974 - 07-05-2024**	Systematic reviews Internal or external validation studies Exclusions (animal studies, letters, comments, editorials, case studies/reports, conference abstracts or papers) English language
The Cochrane Library (Wiley)	Cochrane CDSR to 2024 Issue 5 of 12	
Epistemonikos (The Epistemonikos Foundation)	No date limits applied (searched 07/05/2024)	

Medline (Ovid) search terms

1	Accidental Falls/	27810
2	(fall or falls or falling or faller* or fallen or slip* or trip* or collapse*).ti,ab.	564533
3	or/1-2	571120
4	letter/	1207695
5	editorial/	636283
6	news/	216742
7	exp historical article/	409342
8	Anecdotes as Topic/	4747
9	comment/	994163
10	case report/	2316692
11	(letter or comment*).ti.	184942
12	or/4-11	4870580
13	randomized controlled trial/ or random*.ti,ab.	1520274
14	12 not 13	4838999
15	animals/ not humans/	5054620
16	exp Animals, Laboratory/	947075

17	exp Animal Experimentation/	10289
18	exp Models, Animal/	636704
19	exp Rodentia/	3510868
20	(rat or rats or mouse or mice or rodent*).ti.	1452296
21	or/14-20	10784533
22	3 not 21	414888
23	limit 22 to english language	390152
24	((risk* or frail* or screen* or gait or balance) adj2 (assess* or test* or tool* or scale* or process* or procedure* or protocol* or guide* or chart* or index or score*)).ti,ab,kf.	339527
25	"timed up and go".ti,ab,kf.	6653
26	(gait adj2 (technolog* or app or apps or measure*)).ti,ab,kf.	2962
27	"gait speed".ti,ab,kf.	7138
28	((Tinetti or Berg) and balance).ti,ab,kf.	3411
29	"functional reach test*".ti,ab,kf.	676
30	("performance oriented" or "performance orientated").ti,ab,kf.	434
31	"turn 180 degrees".ti,ab,kf.	8
32	("PRISMA-7" or (morse adj2 scale) or "downton fall risk index" or "FRAT").ti,ab,kf.	282
33	(clinical adj (assess* or check* or examination* or test* or observ*)).ti,ab,kf.	133813
34	((history or historical or prior or previous or repeat* or fear* or worry* or worries or worried or scared or frequent or frequency or severity) adj2 (question* or asking or observ*)).ti,ab,kf.	61961
35	or/24-34	539911
36	23 and 35	14836
37	Meta-Analysis/	174941
38	exp Meta-Analysis as Topic/	26390
39	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.	261847
40	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.	347858
41	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.	53125
42	(search strategy or search criteria or systematic search or study selection or data extraction).ab.	78508
43	(search* adj4 literature).ab.	93724

44	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.	346009
45	cochrane.jw.	16211
46	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.	3714
47	or/37-46	664572
48	exp Cohort studies/	2441747
49	(cohort adj (study or studies or analys* or data)).ti,ab.	312699
50	((longitudinal or retrospective or prospective) and (study or studies or review or analys* or cohort* or data)).ti,ab.	1527061
51	or/48-50	2986298
52	predict.ti.	61289
53	(validat* or rule*).ti,ab.	883109
54	(predict* and (outcome* or risk* or model*)).ti,ab.	1107306
55	((history or variable* or criteria or scor* or characteristic* or finding* or factor*) and (predict* or model* or decision* or identif* or prognos*)).ti,ab.	3961681
56	decision*.ti,ab. and Logistic models/	5827
57	(decision* and (model* or clinical*)).ti,ab.	232371
58	(prognostic and (history or variable* or criteria or scor* or characteristic* or finding* or factor* or model*)).ti,ab.	279769
59	(stratification or discrimination or discriminate or c statistic or "area under the curve" or AUC or calibration or indices or algorithm or multivariable).ti,ab.	1037404
60	ROC curve/	70313
61	or/52-60	5631996
62	36 and (47 or 51 or 61)	9052

Embase (Ovid) search terms

1	falling/	52317
2	(fall or falls or falling or faller* or fallen or fell or slip* or trip* or stumble* or tumble*).ti,ab.	770362
3	or/1-2	789618
4	letter.pt. or letter/	1327978
5	note.pt.	984282

6	editorial.pt.	805117
7	case report/ or case study/	3072399
8	(letter or comment*).ti.	244793
9	(conference abstract or conference paper).pt.	5887746
10	or/4-9	11382707
11	randomized controlled trial/ or random*.ti,ab.	2182136
12	10 not 11	10841632
13	animal/ not human/	1217302
14	nonhuman/	7710642
15	exp Animal Experiment/	3178638
16	exp Experimental Animal/	849783
17	animal model/	1787157
18	exp Rodent/	4138214
19	(rat or rats or mouse or mice or rodent*).ti.	1672392
20	or/12-19	19363512
21	3 not 20	418528
22	limit 21 to english language	386472
23	((risk* or frail* or screen* or gait or balance) adj2 (assess* or test* or tool* or scale* or process* or procedure* or protocol* or guide* or chart* or index or score*)).ti,ab,kf.	550666
24	timed up and go.ti,ab,kf.	11200
25	(gait adj2 (technolog* or app or apps or measure*)).ti,ab,kf.	4532
26	gait speed.ti,ab,kf.	11914
27	((Tinetti or Berg) and balance).ti,ab,kf.	5885
28	functional reach test*.ti,ab,kf.	1017
29	("performance oriented" or "performance orientated").ti,ab,kf.	605
30	turn 180 degrees.ti,ab,kf.	14
31	("PRISMA-7" or (morse adj2 scale) or "downton fall risk index" or "FRAT").ti,ab,kf.	503
32	(clinical adj (assess* or check* or examination* or test* or observ*)).ti,ab,kf.	205866
33	((history or historical or prior or previous or repeat* or fear* or worry* or worries or worried or scared or frequent or frequency or severity) adj2 (question* or asking or observ*)).ti,ab,kf.	90488

34	or/23-33	853407
35	22 and 34	18169
36	systematic review/	465074
37	meta-analysis/	314718
38	(meta analy* or metanaly* or metaanaly* or meta regression).ti,ab.	387026
39	((systematic* or evidence*) adj3 (review* or overview*)).ti,ab.	489001
40	(reference list* or bibliograph* or hand search* or manual search* or relevant journals).ab.	70454
41	(search strategy or search criteria or systematic search or study selection or data extraction).ab.	108785
42	(search* adj4 literature).ab.	134521
43	(medline or pubmed or cochrane or embase or psychlit or psyclit or psychinfo or psycinfo or cinahl or science citation index or bids or cancerlit).ab.	488565
44	cochrane.jw.	25079
45	((multiple treatment* or indirect or mixed) adj2 comparison*).ti,ab.	7537
46	or/36-45	1004834
47	cohort analysis/	1156211
48	follow-up/	2182739
49	cohort*.ti,ab.	1570591
50	48 and 49	361042
51	(cohort adj (study or studies or analys* or data)).ti,ab.	525288
52	((longitudinal or retrospective or prospective or cross sectional) and (study or studies or review or analys* or cohort* or data)).ti,ab.	3231316
53	or/47,50-52	3938992
54	predict.ti.	103594
55	(validat* or rule*).ti,ab.	1388382
56	(predict* and (outcome* or risk* or model*)).ti,ab.	1738435
57	((history or variable* or criteria or scor* or characteristic* or finding* or factor*) and (predict* or model* or decision* or identif* or prognos*)).ti,ab.	6072043
58	decision*.ti,ab. and Statistical model/	8192
59	(decision* and (model* or clinical*)).ti,ab.	385291
60	(prognostic and (history or variable* or criteria or scor* or characteristic* or finding* or factor* or model*)).ti,ab.	477054

61	(stratification or discrimination or discriminate or c statistic or "area under the curve" or AUC or calibration or indices or algorithm or multivariable).ti,ab.	1559951
62	Receiver operating characteristic/	229651
63	or/54-62	8441348
64	35 and (46 or 53 or 63)	11358

Cochrane Database of Systematic Reviews search terms

#1	MeSH descriptor: [Accidental Falls] explode all trees	2160
#2	(fall or falls or falling or faller* or fallen or slip* or trip* or collapse*):ti,ab	50239
#3	#1 or #2	50408
#4	((risk* or frail* or screen* or gait or balance) near/2 (assess* or test* or tool* or scale* or process* or procedure* or protocol* or guide* or chart* or index or score*)):ti,ab	40704
#5	timed up and go:ti,ab	4256
#6	(gait near/2 (technolog* or app or apps or measure*)):ti,ab	852
#7	gait speed:ti,ab	2588
#8	((Tinetti or Berg) and balance):ti,ab	3101
#9	functional reach test*:ti,ab	1994
#10	("performance oriented" or "performance orientated"):ti,ab	121
#11	turn 180 degrees:ti,ab	6
#12	("PRISMA-7" or (morse near/2 scale) or "downton fall risk index" or "FRAT"):ti,ab	55
#13	(clinical near/1 (assess* or check* or examination* or test* or observ*)):ti,ab	30590
#14	((history or historical or prior or previous or repeat* or fear* or worry* or worries or worried or scared or frequent or frequency or severity) near/2 (question* or asking or observ*)):ti,ab	8619
#15	(or #4-#14)	83872

Epistemonikos search terms

(title:((title:((fall OR falls OR falling OR faller* OR fallen OR slip* OR trip* OR collapse*)) OR abstract:((fall OR falls OR falling OR faller* OR fallen OR slip* OR trip* OR collapse*)))) OR abstract:((title:((fall OR falls OR falling OR faller* OR fallen OR slip* OR trip* OR collapse*)) OR abstract:((fall OR falls OR falling OR faller* OR fallen OR slip* OR trip* OR collapse*)))))

B.2 Health Economics literature search strategy

Health economic evidence was identified by applying economic evaluation and quality of life filters to the clinical literature search strategy in Medline and Embase. The following databases were also searched: NHS Economic Evaluation Database (NHS EED - this ceased to be updated after 31st March 2015), Health Technology Assessment database (HTA - this ceased to be updated from 31st March 2018) and The International Network of Agencies for Health Technology Assessment (INAHTA)

Table 7: Database parameters, filters and limits applied

Database	Dates searched	Search filters and limits applied
Medline (OVID)	Health Economics 1 January 2014 – 8 May 2024	Health economics studies Quality of Life studies Exclusions (animal studies) English language
	Quality of Life 1 January 2004 to – 8 May 2024	
Embase (OVID)	Health Economics 1 January 2014 – 8 May 2024	Health economics studies Quality of Life studies Exclusions (animal studies) English language
	Quality of Life 1 January 2004 to – 8 May 2024	
NHS Economic Evaluation Database (NHS EED) (Centre for Research and Dissemination - CRD)	Inception – 31 March 2015 (database no longer updated as of this date)	
Health Technology Assessment Database (HTA) (Centre for Research and Dissemination – CRD)	Inception – 31 March 2018 (database no longer updated as of this date)	
The International Network of Agencies for Health Technology Assessment (INAHTA)	Inception - 8 May 2024	English language

Medline (Ovid) search terms

1	Accidental Falls/
2	(fall or falls or falling or faller* or fallen or slip* or trip or trips or tripped or tripping or tumbl*).ti,ab.
3	or/1-2

4	letter/
5	editorial/
6	news/
7	exp historical article/
8	Anecdotes as Topic/
9	comment/
10	case report/
11	(letter or comment*).ti.
12	or/4-11
13	randomized controlled trial/ or random*.ti,ab.
14	12 not 13
15	animals/ not humans/
16	exp Animals, Laboratory/
17	exp Animal Experimentation/
18	exp Models, Animal/
19	exp Rodentia/
20	(rat or rats or mouse or mice or rodent*).ti.
21	or/14-20
22	3 not 21
23	limit 22 to english language
24	limit 23 to yr="2004 -Current"
25	23 and 24
26	Economics/
27	Value of life/
28	exp "Costs and Cost Analysis"/
29	exp Economics, Hospital/
30	exp Economics, Medical/
31	Economics, Nursing/
32	Economics, Pharmaceutical/
33	exp "Fees and Charges"/
34	exp Budgets/
35	budget*.ti,ab.
36	cost*.ti.

37	(economic* or pharmaco?economic*).ti.
38	(price* or pricing*).ti,ab.
39	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.
40	(financ* or fee or fees).ti,ab.
41	(value adj2 (money or monetary)).ti,ab.
42	or/26-41
43	quality-adjusted life years/
44	sickness impact profile/
45	(quality adj2 (wellbeing or well being)).ti,ab.
46	sickness impact profile.ti,ab.
47	disability adjusted life.ti,ab.
48	(qal* or qtime* or qwb* or daly*).ti,ab.
49	(euroqol* or eq5d* or eq 5*).ti,ab.
50	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
51	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
52	(hui or hui1 or hui2 or hui3).ti,ab.
53	(health* year* equivalent* or hye or hyes).ti,ab.
54	discrete choice*.ti,ab.
55	rosser.ti,ab.
56	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
57	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
58	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
59	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
60	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
61	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
62	or/43-61
63	25 and 42
64	limit 63 to yr="2014 -Current"
65	25 and 62

Embase (Ovid) search terms

1	falling/

2	(fall or falls or falling or faller* or fallen or slip* or trip or trips or tripped or tripping or tumbl*).ti,ab.
3	or/1-2
4	letter.pt. or letter/
5	note.pt.
6	editorial.pt.
7	case report/ or case study/
8	(letter or comment*).ti.
9	(conference abstract or conference paper).pt.
10	or/4-9
11	randomized controlled trial/ or random*.ti,ab.
12	10 not 11
13	animal/ not human/
14	nonhuman/
15	exp Animal Experiment/
16	exp Experimental Animal/
17	animal model/
18	exp Rodent/
19	(rat or rats or mouse or mice or rodent*).ti.
20	or/12-19
21	3 not 20
22	limit 21 to english language
23	limit 22 to yr="2004 -Current"
24	health economics/
25	exp economic evaluation/
26	exp health care cost/
27	exp fee/
28	budget/
29	funding/
30	budget*.ti,ab.
31	cost*.ti.
32	(economic* or pharmaco?economic*).ti.
33	(price* or pricing*).ti,ab.
34	(cost* adj2 (effective* or utilit* or benefit* or minimi* or unit* or estimat* or variable*)).ab.

35	(financ* or fee or fees).ti,ab.
36	(value adj2 (money or monetary)).ti,ab.
37	or/24-36
38	quality adjusted life year/
39	"quality of life index"/
40	short form 12/ or short form 20/ or short form 36/ or short form 8/
41	sickness impact profile/
42	(quality adj2 (wellbeing or well being)).ti,ab.
43	sickness impact profile.ti,ab.
44	disability adjusted life.ti,ab.
45	(qal* or qtime* or qwb* or daly*).ti,ab.
46	(euroqol* or eq5d* or eq 5*).ti,ab.
47	(qol* or hql* or hqol* or h qol* or hrqol* or hr qol*).ti,ab.
48	(health utility* or utility score* or disutilit* or utility value*).ti,ab.
49	(hui or hui1 or hui2 or hui3).ti,ab.
50	(health* year* equivalent* or hye or hyes).ti,ab.
51	discrete choice*.ti,ab.
52	rosser.ti,ab.
53	(willingness to pay or time tradeoff or time trade off or tto or standard gamble*).ti,ab.
54	(sf36* or sf 36* or short form 36* or shortform 36* or shortform36*).ti,ab.
55	(sf20 or sf 20 or short form 20 or shortform 20 or shortform20).ti,ab.
56	(sf12* or sf 12* or short form 12* or shortform 12* or shortform12*).ti,ab.
57	(sf8* or sf 8* or short form 8* or shortform 8* or shortform8*).ti,ab.
58	(sf6* or sf 6* or short form 6* or shortform 6* or shortform6*).ti,ab.
59	or/38-58
60	23 and 37
61	limit 60 to yr="2014 -Current"
62	23 and 59

NHS EED and HTA (CRD) search terms

1	MeSH DESCRIPTOR Accidental Falls EXPLODE ALL TREES
2	((fall or falls or falling or faller* or fallen or slip* or trip or trips or tripped or tripping or tumbl*))

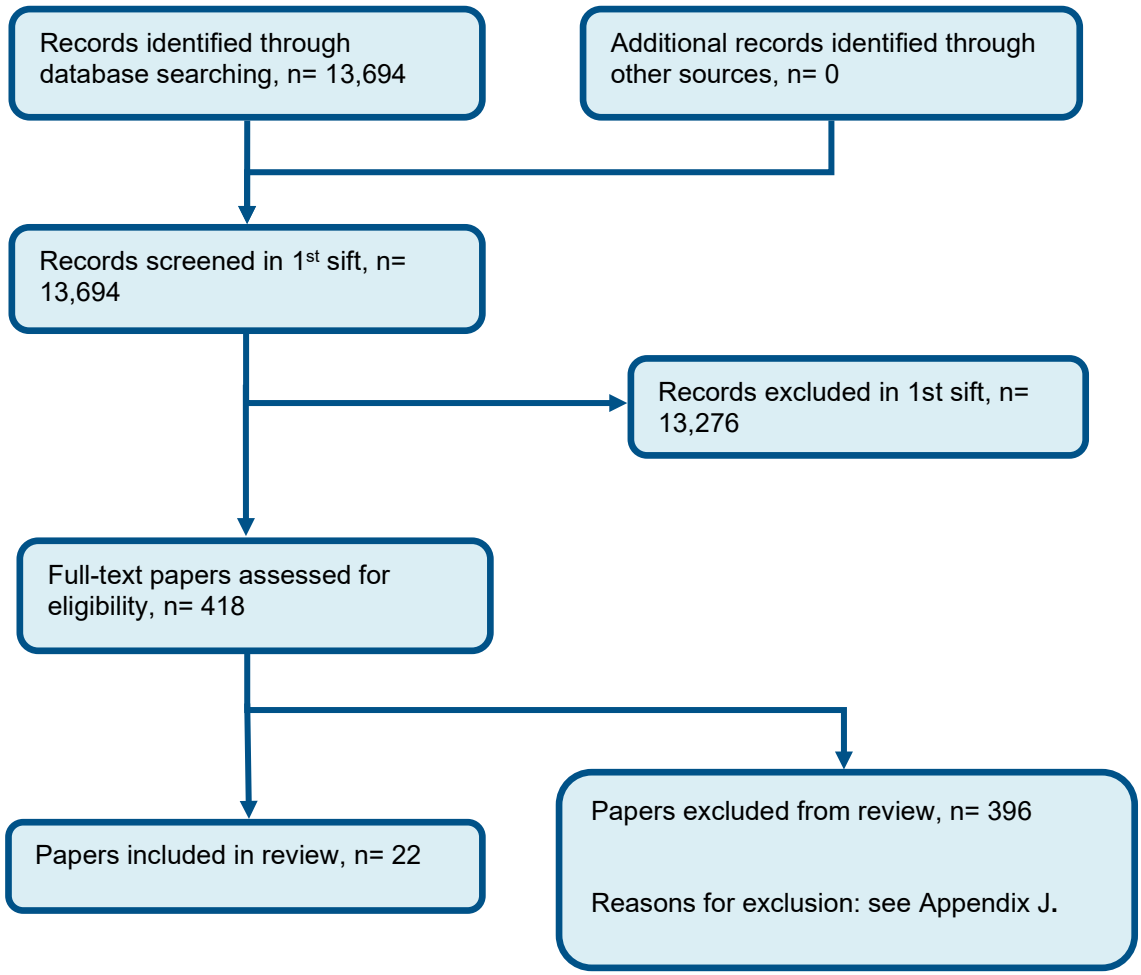
3	#1 OR #2
4	(#3) IN NHSEED
5	(#3) IN HTA

INAHTA search terms

1	("Accidental Falls"[mh]) OR (fall or falls or falling or faller* or fallen or slip* or trip or trips or tripped or tripping or tumbl*)
2	limit to english language
3	2004 - current

Appendix C Prognostic evidence study selection

Figure 1: Flow chart of clinical study selection for the review of methods of assessment for identifying individual risk factors for risk of falls



Appendix D Prognostic evidence

Albites-Sanabria, 2024

Bibliographic Reference	**Albites-Sanabria, Jose; Palumbo, Pierpaolo; Helbostad, Jorunn L; Bandinelli, Stefania; Mellone, Sabato; Palmerini, Luca; Chiari, Lorenzo; Real-World Balance Assessment While Standing for Fall Prediction in Older Adults.; IEEE transactions on bio-medical engineering; 2024; vol. 71 (no. 3); 1076-1083**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	InCHIANTI study (clinical trial: NCT01331512)
Study type	Prospective cohort study
Study location	Italy
Study setting	Community based Italy
Study dates	NR
Sources of funding	NR

Study sample	The study is based on data from the 4th follow-up of the InCHIANTI study (clinical trial: NCT01331512). One hundred and sixty-eight community dwelling older adults over 65 years (79.7±6.6) were included.
Inclusion criteria	NR
Exclusion criteria	NR
Population subgroups	NR
Risk tool(s)	Finite-state machine - Vanilla decision tree Finite-state machine - Under sampling decision tree Finite-state machine - SMOTE Lasso Finite-state machine - Near miss SVM
Predictors	NR
Model development and validation	NR
Outcome	Prospective fall incidence was ascertained through monthly telephone interviews for 6 months and at the 12th month from the start of continuous monitoring.
Duration of follow-up	6 and 12 months

Indirectness	NR
Additional comments	NR

Study arms

Finite-state machine - Vanilla decision tree (N = 168)

Monitoring using a smartphone embedded with a tri-axial accelerometer and gyroscope (100 Hz sampling frequency), worn on the lower back in a belt. The predictive performance of balance features obtained from real-world recordings were evaluated by fitting four machine learning classification models: Logistic Regression, Lasso Regression, Support Vector Machine (SVM), and Decision Tree.

Finite-state machine - Under sampling decision tree (N = 168)

Finite-state machine - SMOTE Lasso (N = 168)

Finite-state machine - Near miss SVM (N = 168)

Characteristics

Study-level characteristics

Characteristic	Study (N = 168)
% Female Sample size	% = 50.9
Mean age (SD) Mean (SD)	79.7 (6.6)

Outcomes

Prognostic data

Outcome	Finite-state machine - Vanilla decision tree, N = 168	Finite-state machine - Under sampling decision tree, N = 168	Finite-state machine - SMOTE Lasso, N = 168	Finite-state machine - Near miss SVM, N = 168
AUC Mean (SD)	0.69 (NR)	0.69 (NR)	0.76 (NR)	0.75 (NR)
Sensitivity Mean (SD)	0.56 (NR)	0.66 (NR)	0.67 (NR)	0.88 (NR)
Specificity Mean (SD)	0.84 (NR)	0.7 (NR)	0.79 (NR)	0.58 (NR)

Critical appraisal - PROBAST tool 2.1

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(Due to lack of information on inclusion/exclusion and missing data. <100 pts with the outcome reported.)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Almeida, 2016

Bibliographic Reference	**Almeida, Lorena R S; Valenca, Guilherme T; Negreiros, Nadja N; Pinto, Elen B; Oliveira-Filho, Jamary; Comparison of Self-report and Performance-Based Balance Measures for Predicting Recurrent Falls in People with Parkinson Disease: Cohort Study.; Physical therapy; 2016; vol. 96 (no. 7); 1074-84**

Study details

Secondary publication of another included study- see primary study for details	No additional information
Other publications associated with this study included in review	No additional information
Trial name / registration number	No additional information
Study type	Prospective cohort study
Study location	Brazil
Study setting	Movement disorders clinic
Study dates	April 2010 - June 2013
Sources of funding	No additional information
Study sample	710 outpatients were screened for potential inclusion, with 324 approached for participation, 229 undergoing baseline assessments, and 225 completing the study and being included in the analysis

Inclusion criteria	Able to walk with or without an assistive device or assistive person Diagnosed with idiopathic Parkinson's Disease
Exclusion criteria	Neurological conditions other than Parkinson's Disease Cognitive impairment (MMSE using cut-offs specific to education level) Dementia Severe visual disturbance Vestibular dysfunction Comorbidities that could affect locomotion or balance
Population subgroups	No additional information
Risk tool(s)	Berg Balance Scale (BBS) BBS is used to assess static and dynamic standing balance and consists of 14 items related to functional movements. Tasks include balance control with or without change of support, with scores ranging from 0-4 (4 is best) and total scores ranging from 0 - 56 points. BEST No information provided Mini-BEST

	No information provided
Predictors	Not specified
Model development and validation	To select the best-fitting model for predicting recurrent falls, a 3-step model building process was followed. ROC curves were developed for each self-report and performance-based balance measure as a predictor of recurrent falls. This approach was chosen because cutoff scores that were previously developed for elderly people (although not specifically people with PD) were reported to have low sensitivity for people with PD. In the present study, optimal cutoff points were chosen on the basis of the Youden Index. Noninferiority tests were used to compare the AUCs of the self-report measures with each other and with those of each performance-based measure and, therefore, to determine whether the accuracy of each self-report measure was not inferior to that of the performance-based measures. Each combination of 1, 2, and 3 dichotomous scales to be used as a predictor was evaluated with a separate logistic regression model, with recurrent falls as the dependent variable. The Akaike information criterion (AIC) was calculated for each model. The model with the lowest AIC value was chosen as the best-fitting model for predicting recurrent falls
Outcome	Participants were classified as recurrent fallers if they had ≥2 falls, or non-recurrent fallers if they had ≤1 fall in the 12-month follow-up period
Duration of follow-up	12 months
Indirectness	None
Additional comments	No additional comments

Study arms

Berg Balance Scale (<49 points cut-off point) (N = 225)

BEST (<69% cut-off) (N = 225)

Mini-BEST (>63% cut-off point) (N = 225)

Characteristics

Study-level characteristics

Characteristic	Study (N = 225)
% Female Sample size	n = 103; % = 45.8
Mean age (SD) Mean (SD)	70.66 (6.56)

Outcomes

Study timepoints

12-month

Prognostic Accuracy for Recurrent Falls (2 or more)

Outcome	Berg Balance Scale (<49 points cut-off point), 12-month, N = 225	BEST (<69% cut-off), 12-month, N = 225	Mini-BEST (>63% cut-off point), 12-month, N = 225
AUC (95% CI) Mean (95% CI)	0.79 (0.73 to 0.84)	0.68 (0.45 to 0.83)	0.77 (0.55 to 0.89)
Sensitivity (%) Mean (95% CI)	0.74 (0.63 to 0.83)	0.46 (0.2 to 0.74)	0.62 (0.32 to 0.85)
Specificity % Mean (95% CI)	0.74 (0.66 to 0.81)	0.74 (0.57 to 0.91)	0.74 (0.53 to 0.88)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(High risk of bias due to predictor information not being described)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Andersson, 2006

Bibliographic Reference	**Andersson, Asa G; Kamwendo, Kitty; Seiger, Ake; Appelros, Peter; How to identify potential fallers in a stroke unit: validity indexes of 4 test methods.; Journal of rehabilitation medicine; 2006; vol. 38 (no. 3); 186-91**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	NA
Study type	Prospective cohort study
Study location	Sweden
Study setting	Hospital setting
Study dates	Not reported
Sources of funding	Research Funds of Oerebro County Council
Study sample	Patients staying at the stroke unit
Inclusion criteria	Not reported

Exclusion criteria	Not reported
Population subgroups	None
Risk tool(s)	Berg Balance Scale (BBS) No information provided
Predictors	Not reported
Model development and validation	Not reported
Outcome	Falls
Duration of follow-up	12 months
Indirectness	None
Additional comments	None

Study arms

Berg Balance Scale (<45 cut-off) (N = 159)

Stops Walking When Talking (SWWT) (N = 159). In this study patients were considered as test positive if they stopped walking when they talked

diffTUG (cut-off >/=4.5 secs) (N = 159). In the present study TUG was performed twice. The second time the patient carried a glass of water. The difference between the 2 performances is called diffTUG. Persons with a diffTUG >/= 4.5 seconds are considered to be distracted by a second task.

Characteristics

Study-level characteristics

Characteristic	Study (N = 159)
% Female Nominal	45
Mean age (SD) Mean (SD)	73.5 (NR)

Outcomes

Study timepoints

12-month

Risk prediction outcomes

Outcome	Berg Balance Scale (<45 cut-off), 12-month, N = 159	Stops Walking When Talking (SWWT), 12-month, N = 159	diffTUG (cut-off >/=4.5 secs), 12-month, N = 159
Sensitivity (%) Nominal	63	15	17
Specificity % Nominal	65	97	95
PPV % Nominal	58	78	63
NPV % Nominal	69	61	70

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(No predictor information provided)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Ashburn, 2008

Bibliographic Reference	**Ashburn, A; Hyndman, D; Pickering, R; Yardley, L; Harris, S; Predicting people with stroke at risk of falls.; Age and ageing; 2008; vol. 37 (no. 3); 270-6**

Study details

Secondary publication of another included study- see primary study for details	No additional information
Other publications associated with this study included in review	No additional information
Trial name / registration number	No additional information
Study location	UK
Study setting	Assessed at discharge after hospitalisation for a stroke
Study dates	No additional information
Sources of funding	The Stroke Association
Study sample	Consecutively hospitalised patients with a stroke in the were recruited at the point of discharge from hospital
Inclusion criteria	Independently mobile prior to the stroke and were able to give informed consent
Exclusion criteria	None reported

Population subgroups	No additional information
Risk tool(s)	Berg Balance Scale (BBS) No information provided
Predictors	Demographic data (age, gender, time in hospital, side of lesion and Oxford Stroke Classification of cerebral infarct) Information on impaired vision, hearing, and musculoskeletal and vestibular deficits History of previous strokes Other neurological conditions
Model development and validation	Predictive scores based on the selected variables and on all variables emerging from the initial screening were created using regression estimates. The accuracy of individual variables and the two predictive scores was examined using sensitivity, specificity, positive and negative predictive values at cut-points chosen to optimise sensitivity and specificity
Outcome	Fall data was collected whilst participants had returned to the community. Diaries were kept that recorded when falls occurred. A fall was defined as 'an event that results in a person coming to rest unintentionally on the ground or other lower level, not as a result of a major intrinsic event or overwhelming hazard'. Participants were classified as repeat fallers if they experienced ≥2 falls in the following year, and as single fallers if they had one fall.
Duration of follow-up	12 months
Indirectness	None
Additional comments	None

Study arms

Berg Balance Scale (≤48.5 cut-off) (N = 115)

Characteristics

Study-level characteristics

Characteristic	Study (N = 115)
% Female Sample size	n = 38; % = 33
Mean age (SD) Mean (SD)	70.1 (12.4)

Outcomes

Study timepoints

12-month

Prognostic accuracy of repeat falls

Outcome	Berg Balance Scale (≤48.5 cut-off), 12-month, N = 115
Sensitivity (%) Mean (95% CI)	85 (73 to 93)
Specificity % Mean (95% CI)	49 (38 to 61)
PPV % Mean (95% CI)	55 (43 to 65)
NPV % Mean (95% CI)	83 (68 to 91)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(High risk of bias due to exclusion criteria was not specified)*
Overall Risk of bias and Applicability	Concerns for applicability	High

Bizovska, 2018

Bibliographic Reference	**Bizovska, Lucia; Svoboda, Zdenek; Janura, Miroslav; Bisi, Maria Cristina; Vuillerme, Nicolas; Local dynamic stability during gait for predicting falls in elderly people: A one-year prospective study.; PloS one; 2018; vol. 13 (no. 5); e0197091**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	NA
Study type	Prospective cohort study
Study location	Czech Republic
Study setting	University for elderly and clubs for elderly in Olomouc
Study dates	Not reported
Sources of funding	Authors received a research grant from Czech Science Foundation
Study sample	Elderly population

Inclusion criteria	Age 60 years and above, no known neurological or musculoskeletal problem that my affect gait or balance abilities, able to stand and walk without any assistance and assisting device
Exclusion criteria	Any injury or surgery on the musculoskeletal system during the last two years before the baseline measurement
Population subgroups	NR
Risk tool(s)	Tinetti score (balance and gait combined)
Predictors	Not reported
Model development and validation	Not reported
Outcome	Subjects with no falls. Subjects with one fall. Subjects with two and more falls.
Duration of follow-up	1 year follow up
Indirectness	No indirectness
Additional comments	Study also reported Tinetti balance and gait components separately. Gait assessment completed but gait speed and stride frequency did not differ between any of the groups and only Trunk short term Lyapunov exponent (stLE), medial lateral (ML) was analysed for AUC, sensitivity and specificity as had lowest p values when comparing groups (no falls, one fall, more than 2 falls). Discrimination of multiple fallers from non-fallers was carried out using combinations of Tinetti components and Trunk stLE ML.

Study arms

Tinetti total score (N = 131)

Study setting
Population subgroups
Outcome
Additional comments

Characteristics

Study-level characteristics

Characteristic	Study (N = 131)
% Female Sample size	n = 109; % = 83.2
Mean age (SD) Mean (SD)	70.8 (6.7)

Outcomes

Study timepoints

1 year

No falls compared to 2 or more falls

Outcome	Tinetti total score, 1 year, N = 131
AUC Custom value	0.757
Sensitivity Custom value	0.67
Specificity Custom value	0.83

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	Unclear
Overall Risk of bias and Applicability	Concerns for applicability	Low

Caronni, 2023

Bibliographic Reference	**Caronni, Antonio; Picardi, Michela; Scarano, Stefano; Malloggi, Chiara; Tropea, Peppino; Gilardone, Giulia; Aristidou, Evdoxia; Pintavalle, Giuseppe; Redaelli, Valentina; Antoniotti, Paola; Corbo, Massimo; Pay attention: you can fall! The Mini-BESTest scale and the turning duration of the TUG test provide valid balance measures in neurological patients: a prospective study with falls as the balance criterion.; Frontiers in neurology; 2023; vol. 14; 1228302**

Study details

Secondary publication of another included study- see primary study for details	NR
Other publications associated with this study included in review	NR
Trial name / registration number	NR
Study type	Prospective cohort study
Study location	Italy
Study setting	Inpatient rehabilitation unit of Casa di Cura del Policlinico (Milan, Italy)
Study dates	October 2018 to September 2020
Sources of funding	The in-house resources of the Casa di Cura del Policlinico Spa supported the project and data collection. The research was also funded by the Italian Ministry of Health – Ricerca Corrente (IRCCS Istituto Auxologico Italiano, RESET project, 24C822_2018).

Study sample	Participants were recruited among those admitted to the inpatient rehabilitation unit of Casa di Cura del Policlinico (Milan, Italy) because of a neurological disability.
Inclusion criteria	Inclusion criteria: - Age>18years; - Hemiparesis secondary to a stroke (ischemic or hemorrhagic), peripheral neuropathy of the lower limbs, Parkinson's disease, or vascular parkinsonism; - Consent to participate in the study.
Exclusion criteria	Exclusion criteria - Concomitance of two neurological diagnoses (e.g., hemiparesis and Parkinson's disease); - The inability to complete the TUG test and the 10m walking test without touching assistance on admission and discharge; - A TUG duration longer than 30s on discharge; - Severe visual impairment or hearing loss; - Rare neurological diseases.
Population subgroups	NR
Risk tool(s)	Patient history + Gait speed (m/s) Patient history + Walk ratio (cm/number of steps/min) Patient history + Mini-BESTest Patient history + TUG duration, s Patient history + sit-to-walk duration, s Patient history + Turn duration, s Patient history + Peak angular velocity, °/s
Predictors	History included five features from the medical history: 1. age (years), 2. gender (male vs. female), 3. acute vs. chronic condition, 4. cognitive impairment (present vs. absent) and 5. urinary incontinence (present vs. absent).
Model development and validation	NR
Outcome	Falls, i.e., events "during which a person inadvertently comes to rest on the ground or other lower level" (1), were recorded 9 months after the rehabilitation discharge

Duration of follow-up	9 months
Indirectness	NA
Additional comments	NA

Study arms

Patient history + Gait speed (m/s) (N = 214)

History included five features from the medical history: 1. age (years), 2. gender (male vs. female), 3. acute vs. chronic condition, 4. cognitive impairment (present vs. absent) and 5. urinary incontinence (present vs. absent).

Patient history + Walk ratio (cm/number of steps/min) (N = 214)

Patient history + Mini-BESTest (N = 214)

Patient history + TUG duration, s (N = 214)

Patient history + sit-to-walk duration, s (N = 214)

Patient history + Turn duration, s (N = 214)

Patient history + Peak angular velocity, °/s (N = 214)

Mini-BESTest (2.94) (N = 214)

Mini-BESTest (0.06) (N = 214)

Turning duration (1.91 s) (N = 214)

Turning duration (3.80 s) (N = 214)

Characteristics: Study-level characteristics

Characteristic	Study (N = 214)
% Female Sample size	n = 90 ; % = 42.1
Mean age (SD) Median (IQR)	76.2 (66.8 to 81.2)

Outcomes: Prognostic accuracy

Outcome	Patient history + Gait speed (m/s), , N = 214	Patient history + Walk ratio (cm/number of steps/min), , N = 214	Patient history + Mini-BESTest, , N = 214	Patient history + TUG duration, s, , N = 214	Patient history + sit-to-walk duration, s, , N = 214	Patient history + Turn duration, s, , N = 214	Patient history + Peak angular velocity, °/s, , N = 214	Mini-BESTest (2.94), , N = 214	Mini-BESTest (0.06), , N = 214	Turning duration (1.91 s), , N = 214	Turning duration (3.80 s), , N = 214
AUC (95% CI) Mean (95% CI)	0.67 (0.6 to 0.74)	0.67 (0.59 to 0.74)	0.69 (0.62 to 0.76)	0.68 (0.61 to 0.75)	0.67 (0.6 to 0.74)	0.69 (0.62 to 0.76)	0.68 (0.6 to 0.75)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)

Sensitivity and specificity

Outcome	Patient history + Gait speed (m/s), , N = NA	Patient history + Walk ratio (cm/number of steps/min), , N = NA	Patient history + Mini-BESTest, , N = NA	Patient history + TUG duration, s, , N = NA	Patient history + sit-to-walk duration, s, , N = NA	Patient history + Turn duration, s, , N = NA	Patient history + Peak angular velocity, °/s, , N = NA	Mini-BESTest (2.94), , N = 214	Mini-BESTest (0.06), , N = 214	Turning duration (1.91 s), , N = 214	Turning duration (3.80 s), , N = 214
Sensitivity (%) Mean (95% CI)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	0.92 (NR to NR)	0.29 (NR to NR)	0.96 (NR to NR)	0.24 (NR to NR)
Specificity % Mean (95% CI)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	NR (NR to NR)	0.2 (NR to NR)	0.86 (NR to NR)	0.16 (NR to NR)	0.87 (NR to NR)

Critical appraisal - PROBAST tool 2.1

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(Due to missing data)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Chen, 2005

Bibliographic Reference	**Chen, J S; March, L M; Schwarz, J; Zochling, J; Makaroff, J; Sitoh, Y Y; Lau, T C; Lord, S R; Cameron, I D; Cumming, R G; Sambrook, P N; A multivariate regression model predicted falls in residents living in intermediate hostel care.; Journal of clinical epidemiology; 2005; vol. 58 (no. 5); 503-8**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	Not reported
Study location	Australia
Study setting	Nursing home setting
Study dates	Not reported
Sources of funding	Not reported
Study sample	Hostel residents who participated in the Fracture Risk Epidemiology in the Elderly.
Inclusion criteria	Not reported

Exclusion criteria	Not reported
Population subgroups	None
Risk tool(s)	Falls risk model. The Falls risk model included the following measures: Cognition: Assessed via the Mini-Mental Status Examination. Illness severity: Assessed via a modified version of the Implicit Illness Severity Scale. Participants were assessed on a 4-point scale with 1 indicating no symptoms. Incontinence: Assessed via 3 questions asking participants about urinary incontinence Balance: Assessed via the static balance test with eyes open. Scores ranged from Grade 1 to Grade 5 with a higher grade indicating better balance. Postural sway: Assessed via the static balance test with a pen attached to participants waists. Visual contrast sensitivity: Assessed using the Melbourne Edge Test Proprioception: Assessed using a lower limb-matching task. Knee extension strength: Assessed with subjects seated and the angles of the hip and knee joints positioned at 90º. Reaction time: Assessed using a light as the stimulus and a finger-press as the response
Predictors	Not reported
Model development and validation	Cox proportional hazard regression was used as a model to predict falls. Risk factors in the final model were selected based on their significance level, ease of assessment in a primary care setting, and whether they were unlikely to change in a short time period
Outcome	Falls assessed via records provided by nurses.
Duration of follow-up	12 months
Indirectness	None

Study arms

Falls risk score (2-3) (N = 133)

Falls risk score (3-4) (N = 225)

Falls risk score (4-5) (N = 205)

Falls risk score (5-6) (N = 119)

Falls risk score (>9) (N = 129)

Characteristics

Study-level characteristics

Characteristic	Study (N = 1107)
% Female Nominal	844
Mean age (SD) Mean (SD)	85.5 (6.86)

Outcomes

Study timepoints

12-month

Prognostic accuracy of falls

Outcome	Falls risk score (2-3), 12-month, N = 133	Falls risk score (3-4), 12-month, N = 225	Falls risk score (4-5), 12-month, N = 205	Falls risk score (5-6), 12-month, N = 119	Falls risk score (>9), 12-month, N = 129
Sensitivity (%) Nominal	97.8	92.4	79.7	64.2	22.8
Specificity % Nominal	7.2	23.1	47.7	68.5	

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(High risk of bias as no inclusion or exclusion criteria described and no predictor information available.)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Dasgupta, 2022

Bibliographic Reference	**Dasgupta, Pritika; Frisch, Adam; Huber, James; Sejdic, Ervin; Suffoletto, Brian; Predicting falls within 3 months of emergency department discharge among community-dwelling older adults using self-report tools versus a brief functional assessment.; The American journal of emergency medicine; 2022; vol. 53; 245-249**

Study details

Secondary publication of another included study- see primary study for details	NR
Other publications associated with this study included in review	NR
Trial name / registration number	NR
Study type	Prospective cohort study
Study location	USA
Study setting	Community
Study dates	May - Jan 2019
Sources of funding	National Library of Medicine under the training grant 4T15LM007059-30, University of Pittsburgh Claude D. Pepper Center Pilot Grant, and by the Pittsburgh Older Americans Independence Centre (NIA P30 AG024827)

Study sample	This study was conducted among patients who presented for care to one ED in Pittsburgh, PA. A convenience sample of participants from May 9, 2019 and October 28, 2019 were recruited.
Inclusion criteria	Age 60 years and older, community-dwelling
Exclusion criteria	Not medically stable, not able to provide informed consent, walk with ambulation aid, patients being admitted to hospital.
Population subgroups	NR
Risk tool(s)	HCRNN model of kinematic characteristics of gait and balance during the TUG. The HCRNN model of kinematic characteristics of gait and balance during the TUG was used. The authors first parsed the accelerometer data into 5 segments. For the purposes of this study, a model using only the raw 3-axis accelerometer signals (raw) and another model using the 24 generated features (gen) were examined and found to have a p-value<0.05 on the Wald test. Prior to starting the TUG, the RA affixed a research smartphone to the lower back (i.e. midline L4 vertebrae) of the participant using an elastic band. The smartphone ran the phyphox app (www.phyphox.org), collecting accelerometer data from 3-axes (i.e. mediolateral (ML), vertical (V), and anterior-posterior (AP) directions) at 100 Hz.
Predictors	NR
Model development and validation	NR
Outcome	The primary outcome for prediction was any fall or fall-related care encounter within 3 months post-enrollment. At 1- and 3-months post enrolment, an RA blinded to ED-based data called participants to collect outcome data on falls since last assessment. Phone follow-ups: Consistent with international consensus recommendations, authors defined self-reported falls as “an unexpected event in which the participants come to rest on the ground floor or lower level”.

	Medical record review: Authors first identified all ED and hospitalization encounters that occurred between the day after enrolment and 3 months post-enrolment. They defined encounters where an individual has any ICD-10 code of fall (W00-W19) or ICD-10 code of injury (S00-S99) with the term “fall” in the nursing or physician history with related injury.
Duration of follow-up	3 months
Indirectness	NR
Additional comments	NR

Study arms

HCRNN model of kinematic characteristics of gait and balance during the TUG (N = 134)

For the HCRNN model of kinematic characteristics of gait and balance during the TUG, authors first parsed the accelerometer data into 5 segments. For the purposes of this study, a model using only the raw 3-axis accelerometer signals (raw) and another model using the 24 generated features (gen) were examined and found to have a p-value<0.05 on the Wald test.

Characteristics

Study-level characteristics

Characteristic	Study (N = 134)
% Female Sample size	n = 54; % = 40.3
Mean age (SD) Mean (SD)	68.9 (8.1)

Outcomes

Accuracy in discriminating fallers from non-fallers

Outcome	HCRNN model of kinematic characteristics of gait and balance during the TUG, , N = 134
AUC (95% CI) Mean (95% CI)	0.98 (0.97 to 0.99)
HCRNN (gen) Mean (95% CI)	0.99 (0.98 to 1)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(Due to lack of detail provided around the analysis and no external validation)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Greene, 2012

Bibliographic Reference	**Greene, Barry R; Doheny, Emer P; Walsh, Cathal; Cunningham, Clodagh; Crosby, Lisa; Kenny, Rose A; Evaluation of falls risk in community-dwelling older adults using body-worn sensors.; Gerontology; 2012; vol. 58 (no. 5); 472-80**

Study details

Secondary publication of another included study- see primary study for details	No additional information
Other publications associated with this study included in review	No additional information
Trial name / registration number	No additional information
Study type	Prospective cohort study
Study location	Ireland
Study setting	Community, assessments conducted at an independent living research centre
Study dates	No additional information
Sources of funding	Funded by Intel Corporation, the Industrial Development Agency Ireland and GE Healthcare, with operational and laboratory support from St. James's Hospital, Dublin.
Study sample	Community-dwelling older adults as part of a larger study on ageing. Forty-seven participants (13.47%) were referred to the TRIL Clinic from the Emergency Department, 36 (10.32%) from the Falls and Blackout Unit, 19 referred by their family

	practitioner and 13 (5.44%) by a specialist outpatient clinic. The remainder of the participants (234, 67.05%) was self-referred.
Inclusion criteria	≥60 years of age Able to walk independently with or without a walking aid Cognitively intact
Exclusion criteria	None specified
Population subgroups	No additional information
Risk tool(s)	Berg Balance Scale No information provided Sensor worn data during TUG Kinematic data was collected with participants performing the TUG wearing 2 inertial sensors attached to the mid-point of the anterior shin. Movement of each participant was evaluated using quantitative movement parameters which derived from angular velocity signals which were grouped into 4 categories: temporal gait parameters, spatial gait parameters, tri-axial angular velocity parameters and turn parameters.
Predictors	No additional information
Model development and validation	The classification accuracy is defined as the percentage of participants correctly identified by the system as being a faller or a non-faller. The sensitivity is defined as the percentage of fallers correctly identified by the system. The specificity is defined as the percentage of non-fallers correctly identified as such by the algorithm. The area under the receiver operator characteristic (ROC) curve is used as an additional metric of algorithm performance as it has been shown to provide a reliable overall index of diagnostic performance. Positive and negative predictive values were also calculated to provide a measure of the predictive power of positive and negative (faller and non-faller) classifications.

Outcome	Participants were contacted by telephone approximately 2 years following their baseline assessment and asked to complete a survey on their falls history subsequent to their initial assessment. Falling was defined as a sudden, unintentional change in position causing an individual to land at a lower level, on an object, the floor, the ground or other surface. Falls outcome data were verified using collateral history from relatives as well as comparison with hospital records. Participants with two or more falls in the follow-up period were deemed recurrent fallers.
Duration of follow-up	2 years
Indirectness	None
Additional comments	None

Study arms

Berg Balance Scale (45 cut-off) (N = 226)

Body worn sensor data during TUG (15.25 cut-off) (N = 226)

Characteristics

Study-level characteristics

Characteristic	Study (N = 226)
% Female Sample size	n = 164; % = 72.6
Mean age (SD) Mean (SD)	71.51 (6.7)

Outcomes

Study timepoints

2-year

Prognostic accuracy for falls

Outcome	Berg Balance Scale (45 cut-off), 2-year, N = 226	Body worn sensor data during TUG (15.25 cut-off), 2-year, N = 226
Sensitivity (%) Nominal	43	56
Specificity % Nominal	82.93	95.95
PPV % Nominal	55.13	85.82
NPV % Nominal	74.89	82.09
AUC Nominal	0.62	

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(No predictors information or exclusion criteria information provided)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Greene, 2012b

Bibliographic Reference	**Greene, Barry R; McGrath, Denise; Walsh, Lorcan; Doheny, Emer P; McKeown, David; Garattini, Chiara; Cunningham, Clodagh; Crosby, Lisa; Caulfield, Brian; Kenny, Rose A; Quantitative falls risk estimation through multi-sensor assessment of standing balance.; Physiological measurement; 2012; vol. 33 (no. 12); 2049-63**

Study details

Secondary publication of another included study- see primary study for details	NR
Other publications associated with this study included in review	Greene 2012a. Barry R. Greene, Emer P. Doheny, Cathal Walsh, Clodagh Cunningham, Lisa Crosby, Rose A. Kenny; Evaluation of Falls Risk in Community-Dwelling Older Adults Using Body-Worn Sensors. *Gerontology* 1 August 2012; 58 (5): 472–480
Trial name / registration number	NR
Study location	Ireland
Study setting	Technology Research for Independent Living (TRIL) Clinic, St. James's Hospital, Dublin, Ireland. This study was conducted as part of a larger study on aging
Study dates	NR
Sources of funding	The TRIL Clinic is funded by Intel Corporation, the Industrial Development Agency Ireland and GE Healthcare, with operational and laboratory support from St. James's Hospital, Dublin.

Study sample	This study was conducted as part of a larger study on aging, a portion of which aims to develop technologies to enhance the clinical assessment of falls risk. The inclusion criteria were persons aged 60 and over, who were able to walk independently with or without walking aid, cognitively intact and able to provide informed consent.
Inclusion criteria	The inclusion criteria were persons aged 60 and over, who were able to walk independently with or without walking aid, cognitively intact and able to provide informed consent.
Exclusion criteria	NR
Risk tool(s)	Berg Balance Scale - cut-off = 45
Predictors	NR
Model development and validation	NR
Outcome	Participants were contacted by telephone approximately 2 years following their baseline assessment and asked to complete a survey on their falls history subsequent to their initial assessment.
Duration of follow-up	2 years
Indirectness	NR
Additional comments	NR

Study arms

Berg Balance Scale (cut-off 45) (N = 120)

Characteristics

Study-level characteristics

Characteristic	Study (N = 226)
Mean age (SD) Mean (SD)	73.7 (5.8)

Outcomes

Study timepoints: 2-year: Prognostic accuracy for falls

Outcome	Berg Balance Scale (cut-off 45), 2-year, N = 120
Sensitivity (%) Nominal	45.54
Specificity % Nominal	75.82
PPV % Nominal	69
NPV Nominal	54.09

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(No predictors information or exclusion criteria information provided)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Hars, 2018

Bibliographic Reference	**Hars, Melany; Audet, Marie-Claude; Herrmann, Francois; De Chassey, Jean; Rizzoli, Rene; Reny, Jean-Luc; Gold, Gabriel; Ferrari, Serge; Trombetti, Andrea; Functional Performances on Admission Predict In-Hospital Falls, Injurious Falls, and Fractures in Older Patients: A Prospective Study.; Journal of bone and mineral research : the official journal of the American Society for Bone and Mineral Research; 2018; vol. 33 (no. 5); 852-859**

Study details

Secondary publication of another included study- see primary study for details	No additional information
Other publications associated with this study included in review	No additional information
Trial name / registration number	No additional information
Study location	Switzerland
Study setting	Geriatric acute and rehabilitation hospital
Study dates	Ongoing from June 2015
Sources of funding	Supported by the Geneva University Hospitals Private Foundation.
Study sample	Consecutively admitted in-patients who received a battery of functional tests
Inclusion criteria	None specified

Exclusion criteria	Too medically unwell to complete tests Unable to follow simple instructions
Population subgroups	No additional information
Risk tool(s)	Tinetti Scale The Tinetti test assesses gait and balance including 7 items which are rated either as normal or abnormal. Scores can range from 0-7 with lower score indicating better performances.
Predictors	Non specified
Model development and validation	The area under the receiver operating characteristic curve from regression models was used as a measure of the overall predictive accuracy for incident in-hospital falls and injurious falls outcomes. Sensitivity, specificity and the Youden index were also calculated.
Outcome	Participants' falls were prospectively collected until discharge using standardised computer-based incident report forms completed after each fall by nurses and electronic patients' case notes or medical reports. A fall was defined as an event that resulted in a participant unintentionally coming to rest on the ground, floor, or other lower levels. Injurious falls were defined as falls that resulted in contusions, abrasions, lacerations, sprains or strains, pain, head injuries, other unspecified injuries, or any serious injury.
Duration of follow-up	Duration of stay in centre (median (IQR) = 23 (14-36) days)
Indirectness	None
Additional comments	None

Study arms

Tinetti Scale (>2 cut-off) (N = 807)

Characteristics

Study-level characteristics

Characteristic	Study (N = 807)
% Female Sample size	n = 545; % = 67.5
Mean age (SD) Mean (SD)	85 (6.9)

Outcomes

Prognostic accuracy for falls

Outcome	Tinetti Scale (>2 cut-off), N = 807
Sensitivity (%) Nominal	92.4
Specificity % Nominal	41.6
PPV % Nominal	24.4
NPV % Nominal	96.4

Outcome	Tinetti Scale (>2 cut-off), N = 807
Youden Index Nominal	0.34
AUC Nominal	69

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(No predictors or inclusion criteria defined.)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Kelly, 2022

Bibliographic Reference	**Kelly, D; Condell, J; Gillespie, J; Munoz Esquivel, K; Barton, J; Tedesco, S; Nordstrom, A; Akerlund Larsson, M; Alamaki, A; Improved screening of fall risk using free-living based accelerometer data.; Journal of biomedical informatics; 2022; vol. 131; 104116**

Study details

Secondary publication of another included study- see primary study for details	NR
Other publications associated with this study included in review	NR
Trial name / registration number	NR
Study location	Sweden
Study setting	Community setting. No further details provided.
Study dates	NR
Sources of funding	This research was funded by the European Union Interreg Northern Periphery and Arctic 2014-2020 program. We are grateful for access to the Tier 2 High Performance Computing resources provided by the Northern Ireland High Performance Computing (NI-HPC) facility, funded by the UK Engineering and Physical Sciences Research Council (EPSRC), Grant No. EP/T022175/1.

Study sample	1705 Participants, all aged exactly 70 years old and from Umeå Sweden, took part in the study (817 Female and 888 Male). Participants had an average weight of 76.9 kg (±14.1 Kg) and an average Body Mass Index of 26.5 (±4.08).
Inclusion criteria	No details
Exclusion criteria	No details
Population subgroups	NR
Risk tool(s)	gait velocity grip strength free living accelerometer data
Predictors	NR
Model development and validation	NR
Outcome	Falls. Six and twelve months after the examination session, follow-up telephone interviews were conducted to ask whether participants have experienced a fall since their examination session. A fall was defined as an event which results in a person coming to rest inadvertently on the ground or floor or other lower level.
Duration of follow-up	6 and 12 months
Indirectness	NR
Additional comments	NR

Study arms

Gait velocity cm/s (N = 1705)

Gait Velocity was measured during a 6 Meter Walk Test

Grip strength [kg] (N = 1705)

Non-Dominant Hand Grip Strength

Free-living accelerometer data (N = 1705)

After the examination session, participants were provided with a hip mounted tri-axial accelerometer (GT9X Actigraph,Actigraph LLC, USA) which they were asked to wear for 7 consecutive days. Acceleration for x, y and z axis were recorded for the duration of the 7 days at 30 Hz.

Characteristics

Study-level characteristics

Characteristic	Study (N = 1705)
% Female Sample size	n = 817; % = 48
Mean age (SD) Mean (SD)	70 (NR)

Outcomes

Prospective data

Outcome	Gait velocity cm/s, N = 1705	Grip strength [kg], N = 1705	Free-living accelerometer data, N = 1705
Sensitivity Mean (95% CI)	0.59 (NR to NR)	0.44 (NR to NR)	NR (NR to NR)
No early stopping Mean (95% CI)	NR (NR to NR)	NR (NR to NR)	0.5 (0.37 to 0.63)
Early stopping Mean (95% CI)	NR (NR to NR)	NR (NR to NR)	0.61 (0.49 to 0.71)
Specificity % Mean (95% CI)	0.46 (NR to NR)	0.6 (NR to NR)	NR (NR to NR)
No early stopping Mean (95% CI)	NR (NR to NR)	NR (NR to NR)	0.64 (0.59 to 0.69)
Early stopping Mean (95% CI)	NR (NR to NR)	NR (NR to NR)	0.66 (0.61 to 0.71)
AUC (95% CI) Mean (95% CI)	0.5 (NR to NR)	0.5 (NR to NR)	NR (NR to NR)

Critical appraisal - PROBAST tool 3.1

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(Due to no details on sample selection or inclusion/exclusion criteria. Lack of information on missing data.)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Mahoney, 2017

Bibliographic Reference	**Mahoney, Jeannette R; Oh-Park, Mooyeon; Ayers, Emmeline; Verghese, Joe; Quantitative trunk sway and prediction of incident falls in older adults.; Gait & posture; 2017; vol. 58; 183-187**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	Not reported
Study location	USA
Study setting	Community setting
Study dates	June 2011 and March 2013
Sources of funding	National Institute on Aging and the Resnick Gerontology Centre at the Albert Einstein College of Medicine
Study sample	Older adults were recruited from the Central Control of Mobility in Aging (CCMA) study at the Albert Einstein College of Medicine in Bronx.
Inclusion criteria	65 years and older

	English speaking participants were identified from a population list of lower Westchester County, NY
Exclusion criteria	Dementia Significant loss of vision or hearing Inability to ambulate independently even by using a walking device Current or past history of neurological or psychiatric disorders or medical procedures that may affect mobility Parkinson's disease
Population subgroups	None
Risk tool(s)	Trunk sway Participants wore the Swaystar device system near their centre of mass by their lower back (L3-L5 vertebral body). The Swaystar system contains sensor to record angular deviations of the trunk in anterior-posterior and medial-lateral direction. Participants were asked to stand on a flat surface with eyes open and feet shoulder width apart for 10 seconds while trunk sway was measured and recorded via Bluetooth. Peak to peak measures of angular displacement in both planes were recorded with bias being removed using 90% range of excursion values.
Predictors	None reported
Model development and validation	NA
Outcome	Falls - recorded via a falls history questionnaire
Duration of follow-up	12 months
Indirectness	None

Study arms

Anterior-posterior angular displacement (1.88° cut-off) (N = 287)

Characteristics

Study-level characteristics

Characteristic	Study (N = 287)
% Female Sample size	n = 155; % = 54
Mean age (SD) Mean (SD)	76.14 (6.82)
White Sample size	n = 251; % = 88

Outcomes: Study timepoints: 12-month: Prognostic accuracy of falls

Outcome	Anterior-posterior angular displacement (1.88° cut-off), 12-month, N = 287
Sensitivity (%) Nominal	31.8
Specificity % Nominal	77.4
AUC Mean (95% CI)	0.6 (0.53 to 0.68)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(High risk of bias due to missing predictor information.)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Mak, 2013

Bibliographic Reference	**Mak, Margaret K Y; Auyeung, Mandy M; The mini-BESTest can predict parkinsonian recurrent fallers: a 6-month prospective study.; Journal of rehabilitation medicine; 2013; vol. 45 (no. 6); 565-71**

Study details

Secondary publication of another included study- see primary study for details	No additional information
Other publications associated with this study included in review	No additional information
Trial name / registration number	No additional information
Study type	Prospective cohort study
Study location	Hong Kong
Study setting	Outpatients from movement disorder clinics or self-help groups for Parkinson's disease
Study dates	No additional information
Sources of funding	The study was supported by Hong Kong Parkinson’s disease Foundation (5-ZH76)
Study sample	Subjects were recruited from the Hong Kong Parkinson’s disease Association, a patient self-help group, and from Movement disorders clinics. Posters were sent to the Association and clinics, and patients were invited to join the study on a voluntary basis.

Inclusion criteria	Subjects were included if they were between 40 and 85 years old, had a diagnosis of idiopathic Parkinson's disease (PD) according to the UK Parkinson's disease Society Brain Bank criteria, were medically stable, community-dwelling and could independently walk a minimum distance of 7 m, 3 times with or without walking aids.
Exclusion criteria	Participants were excluded if they had neurological conditions other than PD; communication deficits or cognitive impairment (Mini-Mental State Examination; MMSE < 20); postural hypotension; visual or vestibular dysfunction; or significant cardiovascular or musculoskeletal disorders that affected balance and locomotion.
Population subgroups	No additional information
Risk tool(s)	Mini-BEST. The Mini-BEStest includes 14 items representing 4 domains of dynamic balance: (i) anticipatory postural adjustments (items 1–3 consisting of sit-to-stand, rise to toes, stand on right and left leg); (ii) postural responses (items 4–6 consisting of compensatory stepping in 4 different directions); (iii) sensory orientation (items 7–9 consisting of stance with eyes open, foam surface with eye closed, inclined surface with eyes closed); and (iv) balance during gait (items 10–14 consisting of gait during change speed, head turns, pivot turns, obstacles, time “get up and go” with dual tasks). the Mini-BEStest items are rated on a 3-point scale from 0 to 2 and the total score ranges from 0 to 28 with a higher score indicating better balance performance.
Predictors	No additional information
Model development and validation	No additional information
Outcome	Falls. After the baseline measurement, the subjects were instructed to complete a fall diary and were also contacted by telephone on a monthly basis to record all the falls in the 6-month follow-up period. A subject was classified as a recurrent faller (RF) if they had more than one fall within the 6-month follow-up period.
Duration of follow-up	6 months
Indirectness	No additional information
Additional comments	No additional information

Study arms

Mini-BEST (19 cut-off) (N = 110)

The Five-time-Sit-to-Stand test (FtStS) (N = 159)

Subjects were instructed to cross their arms over their chest and to sit on a chair with their back against the back-support. during the test, the subjects had to, as quickly as possible, fully stand up and then sit down with their buttocks touching the chair. the time taken from the beginning of the test until the subjects had assumed the sitting position for the fifth time was recorded in seconds.

Characteristics

Study-level characteristics

Characteristic	Study (N = 110)
% Female Sample size	n = 44; % = 48
Mean age (SD) Mean (SD)	63.2 (9)

Outcomes

Prognostic Accuracy for Recurrent Falls (more than 1)

Outcome	Mini-BEST (19 cut-off), N = 110
AUC (95% CI) Mean (95% CI)	0.75 (NR to NR)
Sensitivity (%) Mean (95% CI)	0.79 (NR to NR)
Specificity % Mean (95% CI)	0.67 (NR to NR)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	Low
Overall Risk of bias and Applicability	Concerns for applicability	Low

Muir, 2008

Bibliographic Reference	**Muir, Susan W; Berg, Katherine; Chesworth, Bert; Speechley, Mark; Use of the Berg Balance Scale for predicting multiple falls in community-dwelling elderly people: a prospective study.; Physical therapy; 2008; vol. 88 (no. 4); 449-59**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	Not reported
Study location	Canada
Study setting	Community setting
Study dates	Not reported
Sources of funding	Veterans Affairs Canada and Health Canada.
Study sample	Participants were Veterans living in 3 different communities in southwestern Canada.
Inclusion criteria	Not specified

Exclusion criteria	Not specified
Population subgroups	Not reported
Risk tool(s)	Berg Balance Scale (BBS) The Berg Balance Scale consists of 14 items each scored from 0-4 (4 being better) with a total possible score of 56 indicating no balance difficulties.
Predictors	Not reported
Model development and validation	Not reported
Outcome	Falls identified as coming to rest unintentionally on the floor or ground and recorded in a falls diary.
Duration of follow-up	12 months
Indirectness	None
Additional comments	

Study arms

Berg Balance Scale (≤ 45 cut-off) (N = 187)

Berg Balance Scale (≤54 cut-off) (N = 187)

Characteristics

Study-level characteristics

Characteristic	Study (N = 187)
% Female Nominal	35
Mean age (SD) Mean (SD)	79.47 (5.83)

Outcomes: Study timepoints: 12-month: Prognostic Accuracy for Falls

Outcome	Berg Balance Scale (≤ 45 cut-off), 12-month, N = 187	Berg Balance Scale (≤54 cut-off), 12-month, N = 187
Sensitivity (%) Mean (95% CI)	25 (16 to 36)	61 (50 to 72)
Specificity % Mean (95% CI)	87 (79 to 92)	53 (43 to 63)
AUC (95% CI) Mean (95% CI)	0.59 (NR to NR)	NA (NA to NA)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(High risk of bias as no inclusion, exclusion criteria and predictors described.)*
Overall Risk of bias and Applicability	Concerns for applicability	Unclear

Schwesig, 2013

Bibliographic Reference	**Schwesig, Rene; Fischer, David; Lauenroth, Andreas; Becker, Stephan; Leuchte, Siegfried; Can falls be predicted with gait analytical and posturographic measurement systems? A prospective follow-up study in a nursing home population.; Clinical rehabilitation; 2013; vol. 27 (no. 2); 183-90**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	Not reported
Study location	Germany
Study setting	Nursing homes
Study dates	Not reported
Sources of funding	Investitions bank Sachsen-Anhalt, Germany
Study sample	Participants were recruited from local nursing homes.
Inclusion criteria	Aged above 60 years

	Absence of neurological impairment affecting gait and posture (e.g. Parkinson's disease, cerebellar diseases)
Exclusion criteria	Inability to stand or walk independently
Population subgroups	None
Risk tool(s)	Stride time and landing phase. Gait parameters were assessed with participants wearing a mobile inertial sensor-based system RehaWatch. Participants wore their own flat shows and asked to walk straight for 20m at their self-selected speed. Participants performed 3 trials but only data from the 3rd trials was used for analysis. Mean and standard deviations of each gait parameter of all recorded steps were analysed for each participant. Postural regulation Postural regulation was measured with an interactive balance system consisting of 4 independent force plates to measure postural stability and regulation. Postural regulation was measured as stability indicator, weight distribution index, synchronisation and sway intensities. Participants performed one trial of 32 seconds for each of 8 standardised barefoot test conditions.
Predictors	Not reported
Model development and validation	NA
Outcome	Falls - recorded by caregivers using a standardised falls protocol. Falls were defined as an unexpected event in which the subject comes to rest on the ground, floor or lower level.
Duration of follow-up	12 months
Indirectness	None
Additional comments	146 participants were recruited, but only 135 were able to perform both tests.

Study arms

Stride time in seconds (1.19 cut-off) (N = 135)

Standard deviation landing phase in % (15.3 cut-off) (N = 135)

Posturographic frequency range F2-F4 (10.7 cut-off) (N = 135)

Characteristics

Study-level characteristics

Characteristic	Study (N = 146)
% Female Nominal	113
Mean age (SD) Mean (SD)	82.7 (NR)
Cardiovascular disease Sample size	n = 130; % = 89
Neurological condition Sample size	n = 79; % = 54
Orthopaedic disease or condition Sample size	n = 49; % = 34

Outcomes

Study timepoints

12-month

Prognostic accuracy of falls

Outcome	Stride time in seconds (1.19 cut-off), 12-month, N = 135	Standard deviation landing phase in % (15.3 cut-off), 12-month, N = 135	Posturographic frequency range F2-F4 (10.7 cut-off), 12-month, N = 135
Sensitivity (%) Nominal	63	100	88
Specificity % Nominal	61	42	39
AUC Mean (95% CI)	0.66 (0.5 to 0.82)	0.7 (0.59 to 0.81)	0.53 to 0.81)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(High risk of bias due to missing outcome data, and no information regarding predictors provided.)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Teranishi, 2024

Bibliographic Reference	**Teranishi, Toshio; Suzuki, Megumi; Yamada, Masayuki; Maeda, Akiko; Yokota, Motomi; Itoh, Naoki; Tanimoto, Masanori; Osawa, Aiko; Kondo, Izumi; Prediction of early falls using adherence and balance assessments in a convalescent rehabilitation ward.; Fujita medical journal; 2024; vol. 10 (no. 1); 30-34**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NR
Trial name / registration number	NR
Study type	Prospective cohort study
Study location	Japan
Study setting	Convalescent rehabilitation ward
Study dates	April 1, 2015, and March 31, 2017
Sources of funding	This research was funded by a Grant-in-Aid for Scientific Research.

Study sample	This study included all 416 patients admitted to a 45- bed convalescent rehabilitation ward between April 1, 2015, and March 31, 2017. The participants comprised 416 patients (154 males and 262 females) with a mean (standard deviation) age of 77.9 (9.6) years (range: 38–102 years). The underlying pathologies/histories of the patients included femoral neck fracture (n=65), cerebral hemorrhage (n=49), cerebral infarction (n=98), spinal cord injury (n=8), vertebral compression fracture (n=46), and other (n=150).
Inclusion criteria	This study included all 416 patients who were admitted to a 45-bed convalescent rehabilitation ward over a 2-year period. No inclusion criteria reported.
Exclusion criteria	not reported
Population subgroups	NR
Risk tool(s)	Standing Test for Imbalance and Disequilibrium (SIDE) SIDE + Adherence assessment
Predictors	NR
Model development and validation	NR
Outcome	Falls were defined as “when a part other than the sole of the feet touches the floor or ground against one’s own will”.

Duration of follow-up	2 weeks
Indirectness	NR
Additional comments	NR

Study arms

Standing Test for Imbalance and Disequilibrium (SIDE) (cut off 2a/2b) (N = 416)

(cut off 2a/2b)

SIDE (cut off 2a/2b) + Adherence assessment (positive/negative) (N = 416)

The adherence assessment was developed to identify people who are unable to stop themselves from performing dangerous acts when their movement is restricted. Seven experienced professionals (one physiatrist, two physical therapists, two occupational therapists, and two nurses) and one coordinator used the nominal group technique and devised assessment items and methods. After lengthy discussions, assessment items were rated on Likert scales and classified as personality, memory and instruction adherence, or impulsiveness items. Items for which classification agreement was low were the subject of further discussion. Regarding personality items, on the basis of interviews with the patient's family, the patient was characterised as "reserved" or "impatient." Memory and instruction adherence was assessed by asking the patient to inform the nursing center when the test was over; participants were classified according to their ability to do this. Finally, patients were classified as impulsive if they looked back in response to the following instruction: "Keep looking forward and don't look back."

Characteristics

Study-level characteristics

Characteristic	Study (N = 416)
% Female Sample size	n = 262; % = 63
Mean age (SD) Mean (SD)	77.9 (9.6)

Outcomes

Prognostic Accuracy for Falls

Outcome	Standing Test for Imbalance and Disequilibrium (SIDE) (cut off 2a/2b), , N = 398	SIDE (cut off 2a/2b) + Adherence assessment (positive/negative), , N = 390
Sensitivity (%) Mean (95% CI)	0.86 (NR to NR)	0.75 (NR to NR)
Specificity % Mean (95% CI)	0.42 (NR to NR)	0.64 (NR to NR)
Youden Index Mean (p value)	0.28 (NR)	0.39 (NR)

Critical appraisal - PROBAST tool 2.1

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High
Overall Risk of bias and Applicability	Concerns for applicability	Low

Vassallo, 2005

Bibliographic Reference	**Vassallo M; Stockdale R; Sharma JC; Briggs R; Allen S; A comparative study of the use of four fall risk assessment tools on acute medical wards.; Journal of the American Geriatrics Society; 2005; vol. 53 (no. 6)**

Study details

Secondary publication of another included study- see primary study for details	NA
Other publications associated with this study included in review	NA
Trial name / registration number	NA
Study type	Prospective cohort study
Study location	UK
Study setting	Hospital setting
Study dates	Not reported
Sources of funding	Not reported
Study sample	Participants were elderly patients admitted to medical wards for various medical conditions.
Inclusion criteria	Not reported

Exclusion criteria	Not reported
Population subgroups	None
Risk tool(s)	Tinetti Scale The Tinetti Scale is a fall risk index based on a number of chronic disabilities with the higher the number the higher the likelihood of recurrent falls. Risk indexes include mobility score, morale score, mental status score, distance vision, hearing, postural blood pressure drop, back examination, medications on admission, and admission activity of daily living score.
Predictors	Not reported
Model development and validation	NA
Outcome	Falls
Duration of follow-up	Not reported
Indirectness	None
Additional comments	None

Study arms: Tinetti Scale (medium to high risk) (N = 135): Characteristics: Study-level characteristics

Characteristic	Study (N = 135)
% Female Nominal	67
Mean age (SD) Mean (SD)	83.8 (8.01)

Outcomes

Prognostic accuracy of falls

Outcome	Tinetti Scale (medium to high risk), , N = 135
Sensitivity (%) Nominal	77.3
Specificity % Nominal	30.9
PPV % Nominal	17.9
NPV % Nominal	87.5

Critical appraisal - PROBAST tool 3.1

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(High risk of bias due to inclusion and exclusion criteria not being specified)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Vlaeyen, 2021

Bibliographic Reference	**Vlaeyen E; Poels J; Colemonts U; Peeters L; Leysens G; Delbaere K; Dejaeger E; Dobbels F; Milisen K; Predicting Falls in Nursing Homes: A Prospective Multicenter Cohort Study Comparing Fall History, Staff Clinical Judgment, the Care Home Falls Screen, and the Fall Risk Classification Algorithm.; Journal of the American Medical Directors Association; 2021; vol. 22 (no. 2)**

Study details

Secondary publication of another included study- see primary study for details	NR
Other publications associated with this study included in review	NR
Trial name / registration number	NR
Study type	Prospective cohort study
Study location	Belgium
Study setting	Residential care, nursing homes
Study dates	November 2014 and 33 January 2016
Sources of funding	This study was funded by the Flemish Ministry of Welfare, Public Health and Family, and the Universiteit Derde Leeftijd Leuven vzw. The funding agencies had no role in the design, data collection, analysis, study results interpretation, article writing or article submission for publication.

Study sample	All nursing homes in Flanders, Belgium, were invited to participate (n=757). Eligible nursing homes had to commit to register falls during the follow-up period and could not simultaneously participate in other research. The researchers sent an invitation letter to all Flemish nursing homes, which could subsequently indicate their interest in participation. The researchers contacted interested nursing homes by telephone and checked eligibility. After inclusion, structured study information and related materials were provided. Nursing home staff identified eligible residents. Researchers subsequently screened these residents for inclusion.
Inclusion criteria	Residents were eligible if they met the following inclusion criteria: residing permanently in the nursing home, able to walk independently with or without walking aid and able to speak Flemish.
Exclusion criteria	Residents were excluded if they were bedridden, completely wheelchair-bound, terminally ill, not able to understand Flemish or to understand simple instructions.
Population subgroups	NR
Risk tool(s)	Care Home Falls Screen (CaHFRiS) The CaHFRiS is a multifactorial measurement evaluation tool, assessing seven risk factors including cognitive functioning, impulsivity, balance, the use of a walking frame or rollator, fall history, the use of antidepressants and the use of hypnotics or anxiolytics. Presence of these factors was ascertained by means of the Mini-Mental State Examination (MMSE) test, staffs' responses on six impulsivity-statements and data from the resident record. The total number of risk factors was calculated and linked to a percentage risk of a fall in the next six months, ranging from no factor (0% fall risk) to six or more factors (100% fall risk). Fall Risk Classification Algorithm (FRiCA). The FRiCA is a step-by-step procedure to determine if a resident has a high or low fall risk.18 71 First, researchers observed whether residents could stand unaided. If not, the presence of the following factors was assessed (yes/no): fall history, low care dependency and polypharmacy (i.e., ≥9 medications). If one factor was present, the residents had a high fall risk. Second, for residents who could stand unaided, researchers observed whether they could stand on a standardized foam mat. If not, they had a high fall risk. If the residents could stand on a foam mat, the presence of the following factors was assessed (yes/no): fall history (i.e., ≥ 1 falls in the past 12 months), high care dependency (using the Katz Index of Activities of Daily Living24 78) and urinary incontinence (yes/no). If two or more of these factors were present, the residents had a high fall risk. To determine the presence of fall history, care dependency, urinary incontinence and polypharmacy, the resident records were consulted, or staff was solicited.

Predictors	NR
Model development and validation	NR
Outcome	The main outcome was the number of fallers, i.e., residents having at least one fall during a six-month follow-up period. Falls were defined as “an unexpected event in which the resident comes to rest on the ground, floor, or lower level”. Nursing home staff documented falls prospectively from baseline until the end of the study with one month being defined as 30 consecutive calendar days. For each resident, falls were recorded per month on a standardised fall calendar. After each month, a researcher collected the fall calendar, and a new monthly calendar was provided. To further improve the falls documentation, nursing homes were asked to share the results of their existing internal fall registration. The research team merged the observations documented on the fall calendars with the internal registration of each participating resident.
Duration of follow-up	6 months
Indirectness	NR
Additional comments	NR

Study arms

Care Home Falls Screen (CaHFRiS) (cut-off score of ≥ 4) (N = 399): The CaHFRiS is a multifactorial measurement evaluation tool, assessing seven risk factors including cognitive functioning, impulsivity, balance, the use of a walking frame or rollator, fall history, the use of antidepressants and the use of hypnotics or anxiolytics. Presence of these factors was ascertained by means of the Mini-Mental State Examination (MMSE) test, staffs' responses on six impulsivity-statements and data from the resident record. The total number of risk factors was calculated and linked to a percentage risk of a fall in the next six months, ranging from no factor (0% fall risk) to six or more factors (100% fall risk).

Fall Risk Classification Algorithm (FRiCA) (N = 399): The FRiCA is a step-by-step procedure to determine if a resident has a high or low fall risk.18 71 First, researchers observed whether residents could stand unaided. If not, the presence of the following factors was assessed (yes/no): fall history, low care dependency and polypharmacy (i.e., ≥9 medications). If one factor was present, the residents had a high fall risk. Second, for residents who could stand unaided, researchers observed whether they could stand on a standardized foam mat. If not, they had a high fall risk. If the residents could stand on a foam mat, the presence of the following factors was assessed (yes/no): fall history (i.e., ≥ 1 falls in the past 12 months), high care dependency (using the Katz Index of Activities of Daily Living24 78) and urinary incontinence (yes/no). If two or more of these factors were present, the residents had a high fall risk. To determine the presence of fall history, care dependency, urinary incontinence and polypharmacy, the resident records were consulted, or staff was solicited.

Characteristics

Study-level characteristics

Characteristic	Study (N = 420)
% Female Sample size	n = 308; % = 73.3
Mean age (SD) Mean (SD)	85.9 (6.9)

Outcomes: Study timepoints: 6-month: Predictive accuracy of falls

Outcome	Care Home Falls Screen (CaHFRiS) (cut-off score of ≥ 4), 6-month, N = 379	Fall Risk Classification Algorithm (FRiCA), 6-month, N = 398
Sensitivity (%) Mean (95% CI)	64.4 (57.2 to 71.2)	67.8 (60.9 to 74.2)
Specificity % Mean (95% CI)	68.1 (60.9 to 74.7)	58.7 (51.4 to 65.6)
PPV % Mean (95% CI)	67.2 (61.9 to 72.2)	62.8 (58.3 to 67.2)
NPV % Mean (95% CI)	65.3 (60.3 to 67)	63.9 (58.4 to 69.1)
Youden's J statistic Nominal	0.33	0.27
AUC (95% CI) Mean (95% CI)	0.66 (0.61 to 0.72)	NR (NR to NR)

Critical appraisal - PROBAST tool 3.1

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(Due to missing data)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Vratsistas-Curto, 2018

Bibliographic Reference	**Vratsistas-Curto, Angela; Tiedemann, Anne; Treacy, Daniel; Lord, Stephen R; Sherrington, Cathie; External validation of approaches to prediction of falls during hospital rehabilitation stays and development of a new simpler tool.; Journal of rehabilitation medicine; 2018; vol. 50 (no. 2); 216-222**

Study details

Secondary publication of another included study- see primary study for details	NR
Other publications associated with this study included in review	NR
Trial name / registration number	NR
Study type	Prospective cohort study
Study location	Australia
Study setting	General rehabilitation unit in a public hospital
Study dates	NR
Sources of funding	This study was supported by an infrastructure grant from the Ingham Institute for Applied Medical Research. AT, SL and CS are supported by Fellowships from the Australian National Health and Medical Research Council.

Study sample	A consecutive sample of 300 inpatients admitted to the general rehabilitation unit at a public hospital in Sydney, Australia participated in the study. Recruitment occurred between April 2010 and May 2011.
Inclusion criteria	All admitted patients were considered for inclusion except those who were not receiving rehabilitation, e.g. acute medical or palliative care patients.
Exclusion criteria	NR
Population subgroups	NR
Risk tool(s)	Predict_FIRST (prediction of falls in rehabilitation settings tool)
Predictors	NR
Model development and validation	
Outcome	Number of falls during rehabilitation stay. A fall was defined as unintentionally coming to rest on the ground or other lower surface without overwhelming external force or major internal event. Falls were monitored and recorded by the lead author (AV) during the admission from incidents reported in medical records and the ward's fall incidents book, both completed as part of usual care.
Duration of follow-up	Length of rehabilitation stay
Indirectness	NR
Additional comments	NR

Study arms

Predict_FIRST (N = 300)

Predict_ FIRST scores were calculated on admission using information from participants' medical records. Male sex was extracted from the file. CNS medication use was defined as taking sedatives/hypnotics, anti-anxiety agents, antipsychotics, antidepressants, anticonvulsants, movement disorder medications or other CNS agents. Falls in the past year was defined as a reported or documented history of falls in the previous 12 months. Frequent toileting was defined as alterations in urination, i.e. frequency, urgency, incontinence and nocturia. Impaired tandem stance was defined as the inability to maintain the tandem stance position for 10 seconds on initial physiotherapy assessment.

Characteristics

Study-level characteristics

Characteristic	Study (N = 300)
% Female Sample size	n = 178; % = 58
Mean age (SD) Mean (SD)	80 (11)

Outcomes

Prognostic accuracy of falls

Outcome	Predict_FIRST N = 300
AUC (95% CI) Mean (95% CI)	0.66 (0.57 to 0.74)

Critical appraisal - PROBAST tool

Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	High *(due to issues with categorical data handling)*
Overall Risk of bias and Applicability	Concerns for applicability	Low

Zhou, 2023

Bibliographic Reference	**Zhou, Jian; Liu, Bo; Ye, Hui; Duan, Jin-Ping; A prospective cohort study on the association between new falls and balancing ability among older adults over 80 years who are independent.; Experimental gerontology; 2023; vol. 180; 112259**

Study details

Secondary publication of another included study- see primary study for details	NR
Other publications associated with this study included in review	NR
Trial name / registration number	NR
Study type	Prospective cohort study
Study location	China
Study setting	The geriatric outpatient department of the Beijing Tongren Hospital
Study dates	April to October 2021
Sources of funding	This study was funded by the Central Health Care Research Project (2020YB48).

Study sample	160 elderly people aged 80 years or older who were treated in the geriatric outpatient department of the Beijing Tongren Hospital from April to October 2021, were enrolled. 104 males (65.0 %) and 56 females (35.0 %), with an average age of 84.9 ± 3.3 years (80–94 years) were included. All of them were residents of Beijing.
Inclusion criteria	Inclusion criteria: Those aged ≥80 years, able to live completely or moderately independently, and willing and able to cooperate to complete the relevant assessments.
Exclusion criteria	Exclusion criteria: Those with New York Heart Association (NYHA) grade III–IV cardiac function, chronic kidney disease stage 4–5, chronic obstructive pulmonary disease (COPD) stage 4, decompensated liver cirrhosis, and malignant tumors.
Population subgroups	NR
Risk tool(s)	Composite equilibrium score
Predictors	NR
Model development and validation	NR
Outcome	The outcome observed in this study, “new fall, “was defined as new falls that occurred within the 12 months from the start of the study.
Duration of follow-up	12 months. The participants were followed up monthly by telephone or during outpatient consultations for 12 months to check for new falls and injuries.
Indirectness	NA
Additional comments	NA

Study arms: Composite equilibrium score (N = 159): The cut-off points of SOTcom in predicting new falls was ≤52 points. SOTcom: Composite Equilibrium Score, the weighted average score of sensory integration test under six test conditions; RT: Reaction Time; MVL: Movement Velocity; DCL: Directional Control; EPE: Endpoint Excursion; MXE: Maximum Excursion.

Characteristics: Study-level characteristics

Characteristic	Study (N = 159)
% Female Sample size	n = 56; % = 35
Mean age (SD) Mean (SD)	84.9 (3.3)

Outcomes: Prognostic Accuracy for Falls

Outcome	Composite equilibrium score, N = 159
Sensitivity (%) Mean (95% CI)	NR (NR to NR)
Sensitivity (%) Mean (p value)	40.7 (NR)
Specificity % Mean (95% CI)	84 (NR to NR)
AUC Mean (95% CI)	0.61 (0.53 to 0.68)

Critical appraisal - PROBAST tool 2.1

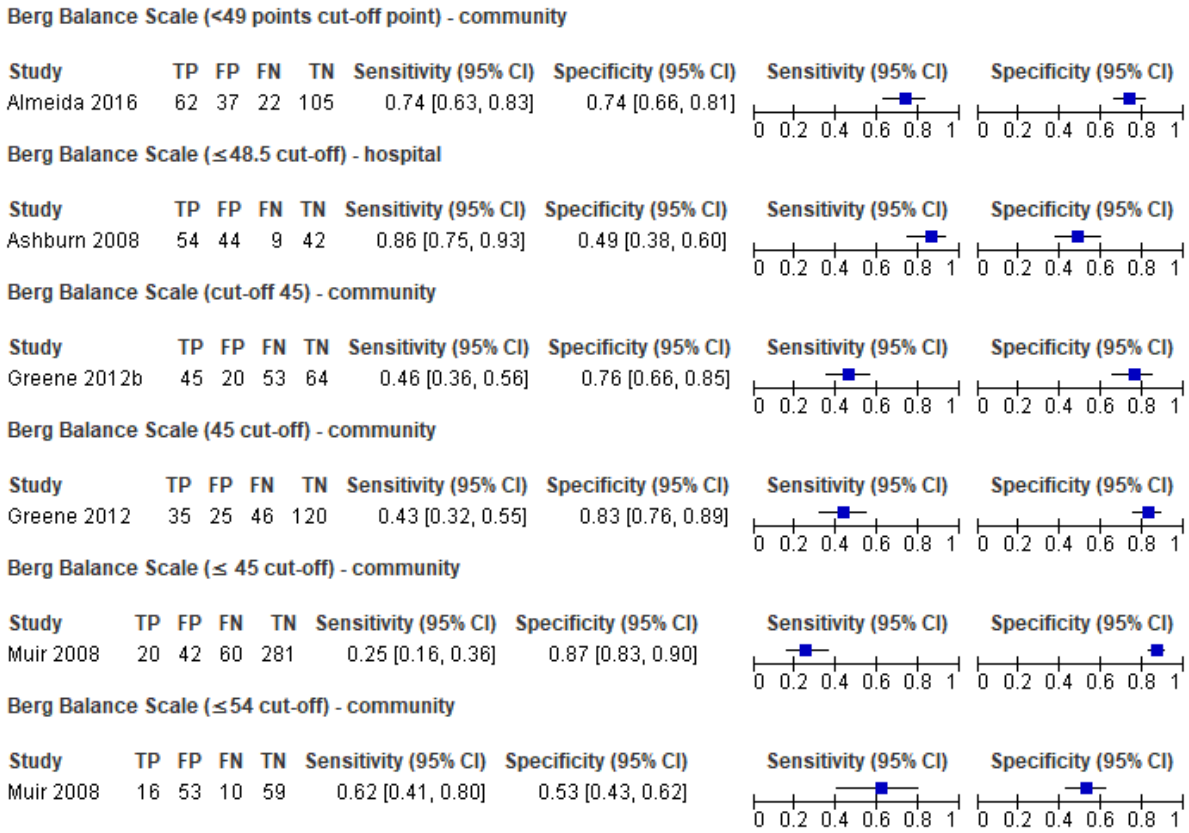
Section	Question	Answer
Overall Risk of bias and Applicability	Risk of bias	Low
Overall Risk of bias and Applicability	Concerns for applicability	Low

Appendix E Forest plots

E.1 Community setting

E.1.1 Berg Balance Scale

Figure 2: Berg Balance Scale – community setting (aged over 65 years)



Berg balance scale (45 cut off) community – meta analysis SROC plot

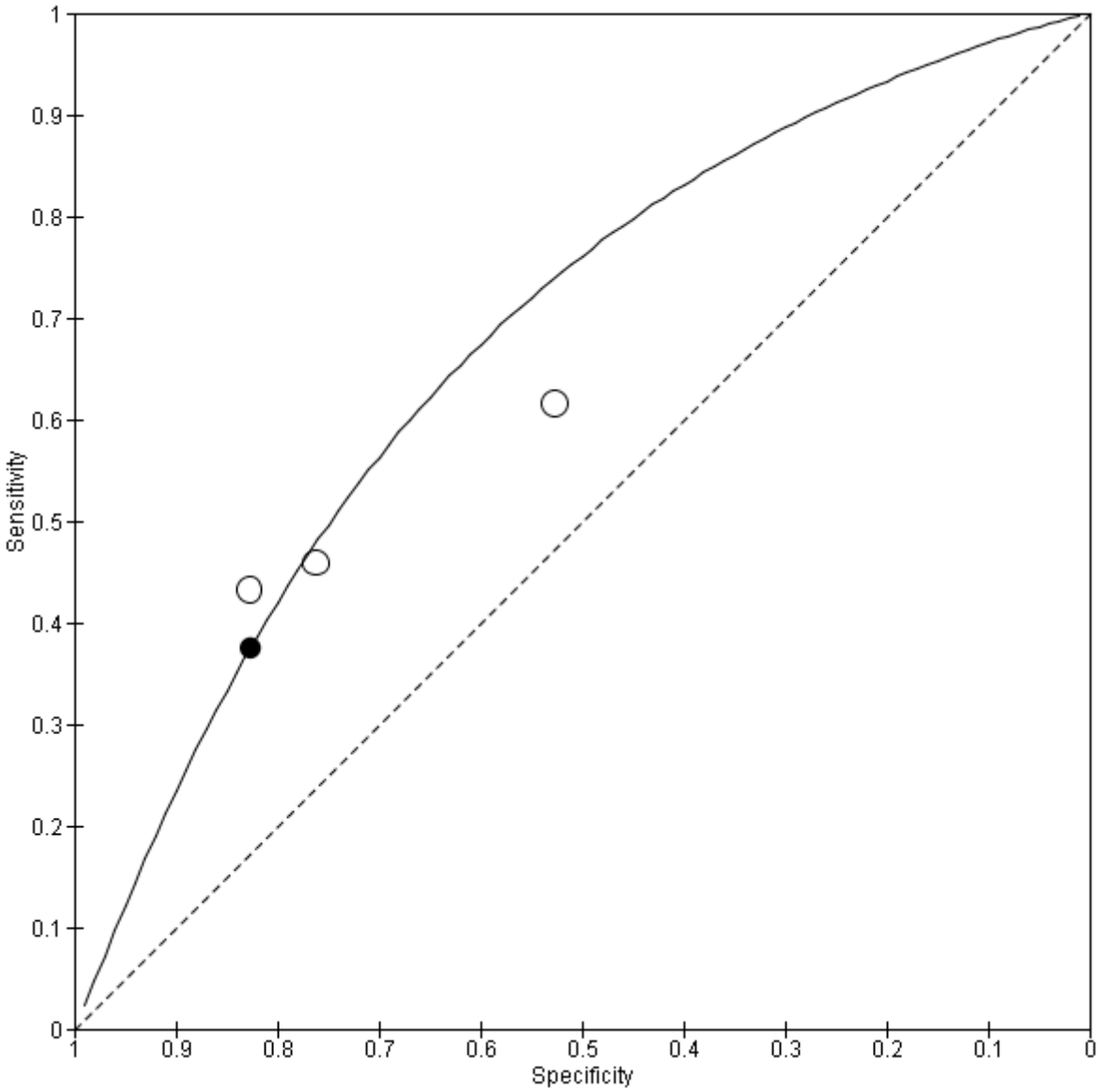


Figure 3: Best test– community setting (aged over 65 years)

BEST test (<69% cut-off) - community

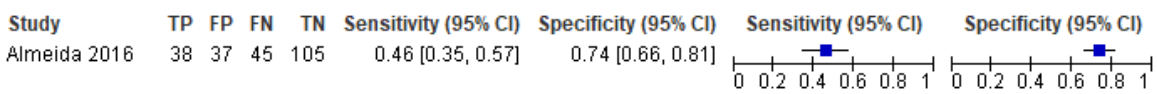


Figure 4: Mini-BEST – community setting (aged over and under 65 years)

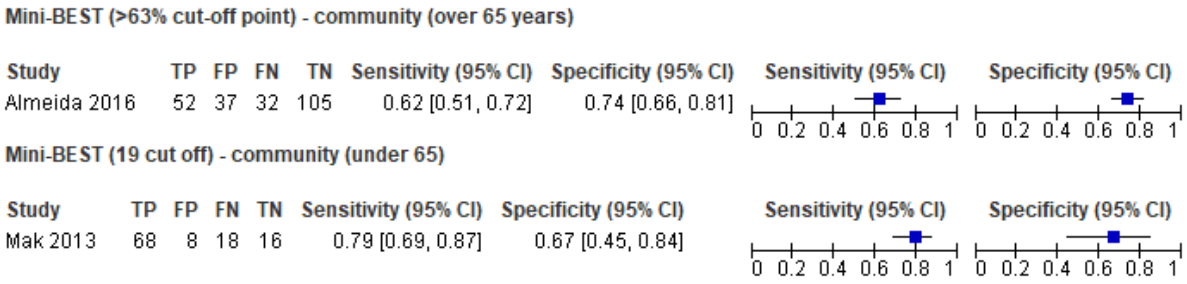


Figure 5: Tinetti total score – community setting (aged over 65 years)

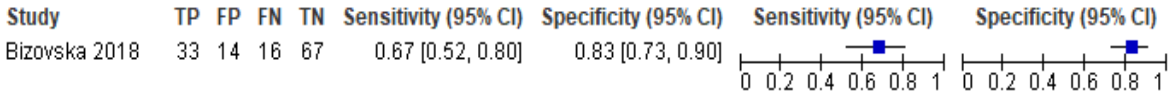


Figure 6: Care Home Falls Screen - CaHFRiS (cut-off score of ≥ 4) – community setting

(aged over 65 years)

Figure 7: Fall Risk Classification Algorithm (FRiCA) - Community (aged over 65 years)

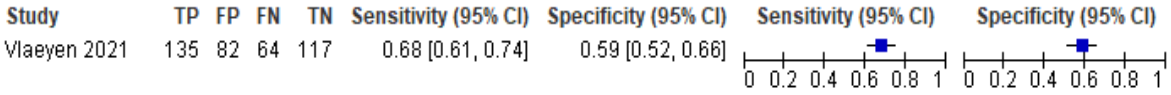


Figure 8: Anterior-posterior angular displacement (1.88° cut-off) – community (aged 65 years

or older

Figure 9: Gait velocity (cm/s) – community (aged over 65 years)

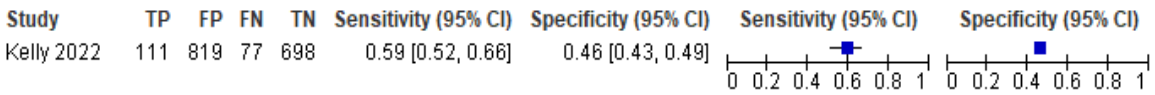


Figure 10: Grip strength (kg) – community (aged over 65 years)

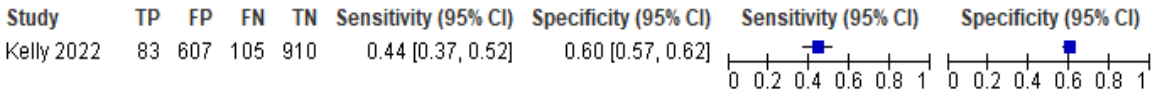


Figure 11: Free living accelerometer data - FLA (No early stopping) – community (aged over 65 years)

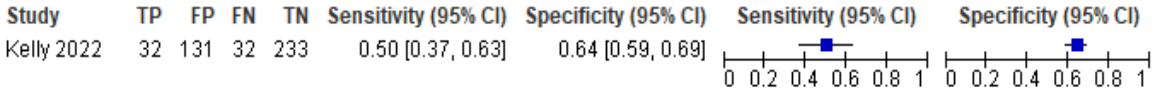


Figure 12: Free living accelerometer data - FLA (Early stopping) – community (aged over 65 years)

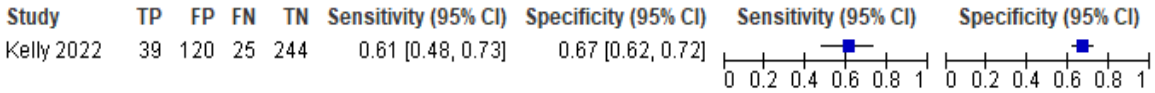


Figure 13: Composite equilibrium score (<52 cut off) - community (aged over 65 years)

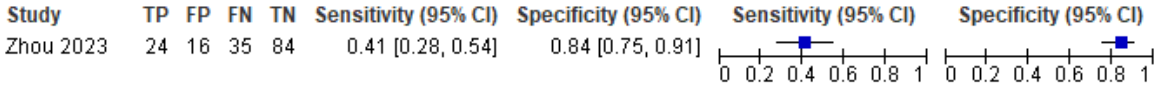


Figure 14: Finite-state machine (wearable) - Vanilla decision tree - community (aged over 65 years)

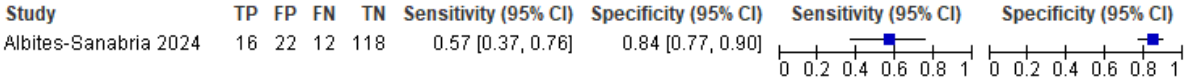


Figure 15: Finite-state machine (wearable) – Under sampling decision tree - community (aged over 65 years)

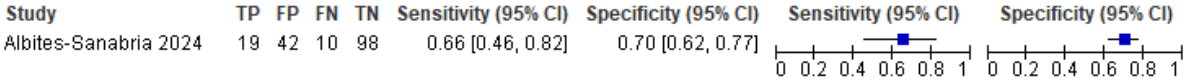


Figure 16: Finite-state machine (wearable) - SMOTE Lasso- community (aged over 65 years)

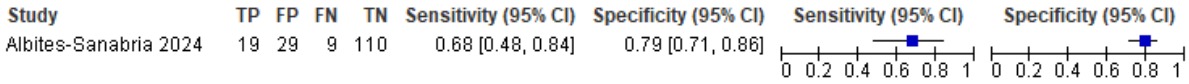
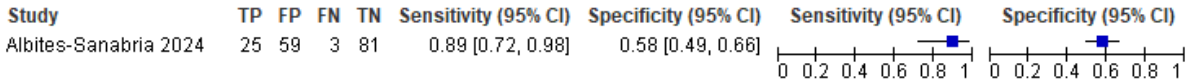


Figure 17: Finite-state machine (wearable) – near miss SVM - community (aged over 65 years)



○ Hospital setting

Figure 18: Berg Balance scale – hospital setting

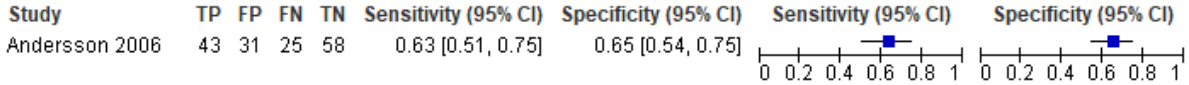


Figure 19: Tinetti Scale – hospital setting - (aged 65 years or older)

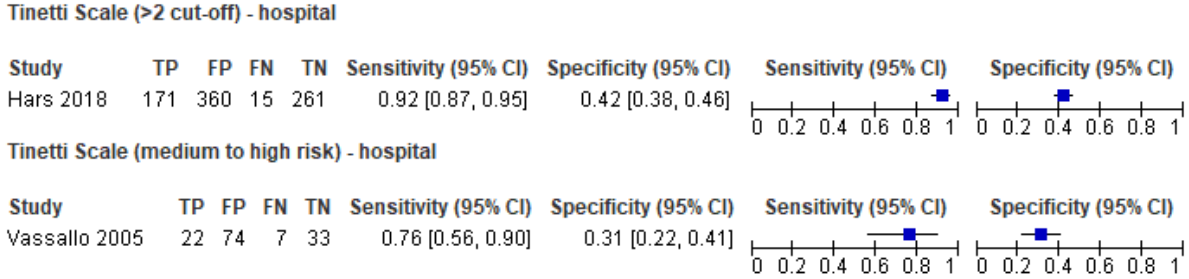


Figure 20: Stops Walking When Talking (SWWT) – hospital (aged 65 years or older)

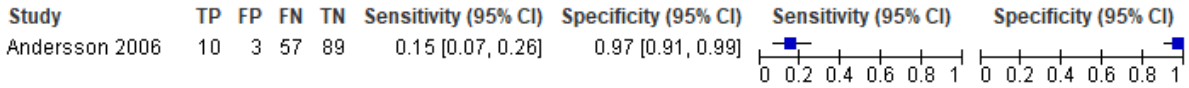


Figure 21: diffTUG (cut-off >/=4.5 secs) – hospital (aged 65 years or older)

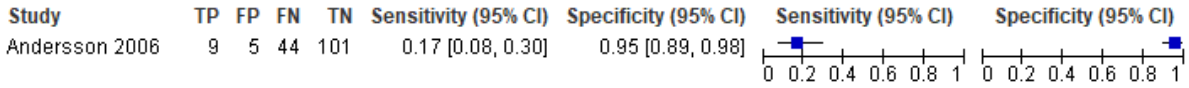


Figure 22: Mini-BESTest (cut off 2.94) - hospital (aged 65 years or older)

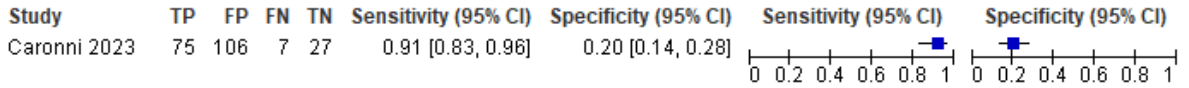


Figure 23: Mini-BESTest (cut off 0.06) - hospital (aged 65 years or older)

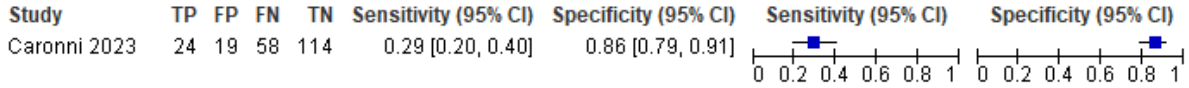


Figure 24: Turning duration (cut off 1.91 s) - hospital (aged 65 years or older)

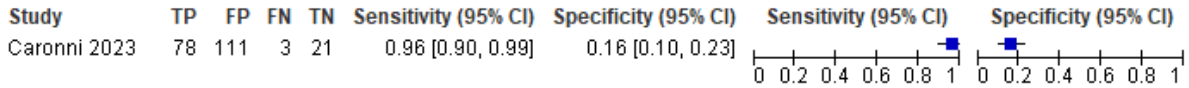


Figure 25: Turning duration (cut off 3.80 s) - hospital (aged 65 years or older)

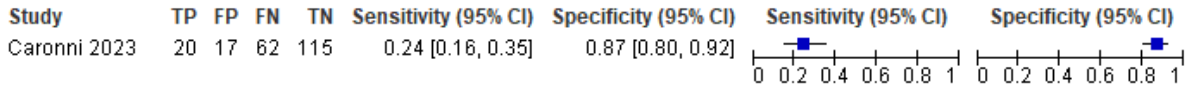


Figure 26: Hester Davis Scale (cut off 11) - hospital (aged 65 years or older)

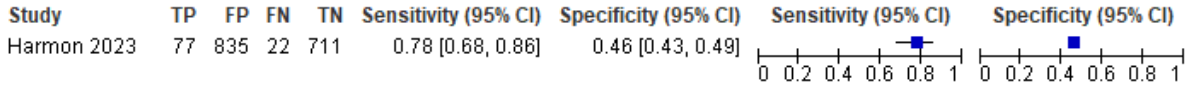


Figure 27: Hester Davis Scale (cut off 12) - hospital (aged 65 years or older)

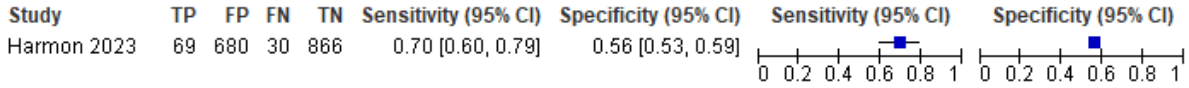


Figure 28: Hester Davis Scale (cut off 13) - hospital (aged 65 years or older)

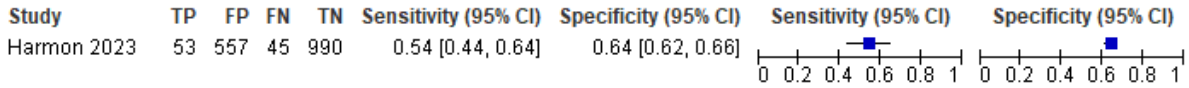


Figure 29: Hester Davis Scale (cut off 14) - hospital (aged 65 years or older)

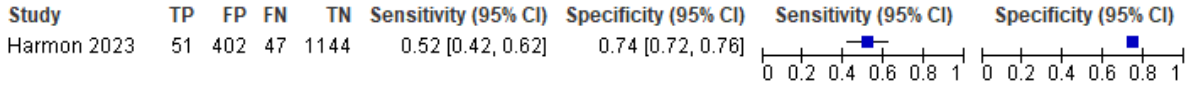


Figure 30: Hester Davis Scale (cut off 15) - hospital (aged 65 years or older)

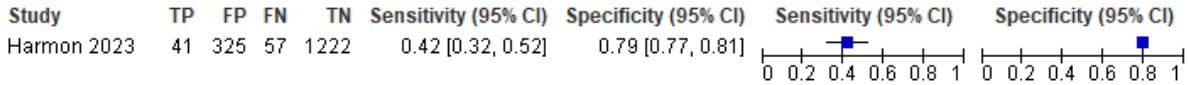


Figure 31: Facility fall risk (cut off 13)- hospital (aged 65 years or older)

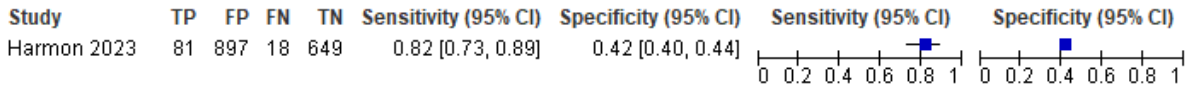


Figure 32: Facility fall risk (cut off 14)- hospital (aged 65 years or older)

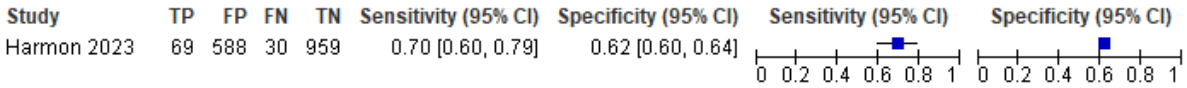


Figure 33: Facility fall risk (cut off 15)- hospital (aged 65 years or older)

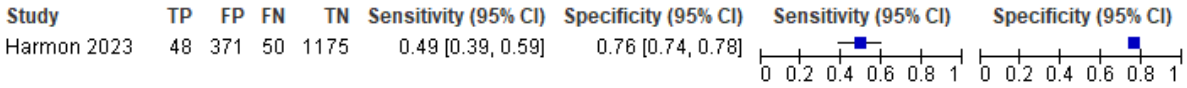
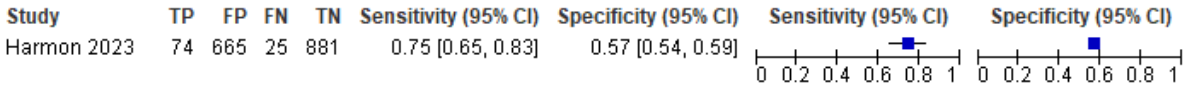


Figure 34: Section GG scores (cut off 51)- hospital (aged 65 years or older)



E.1.2 Residential care setting

Figure 35: Falls risk score – residential care (aged 65 years or older)

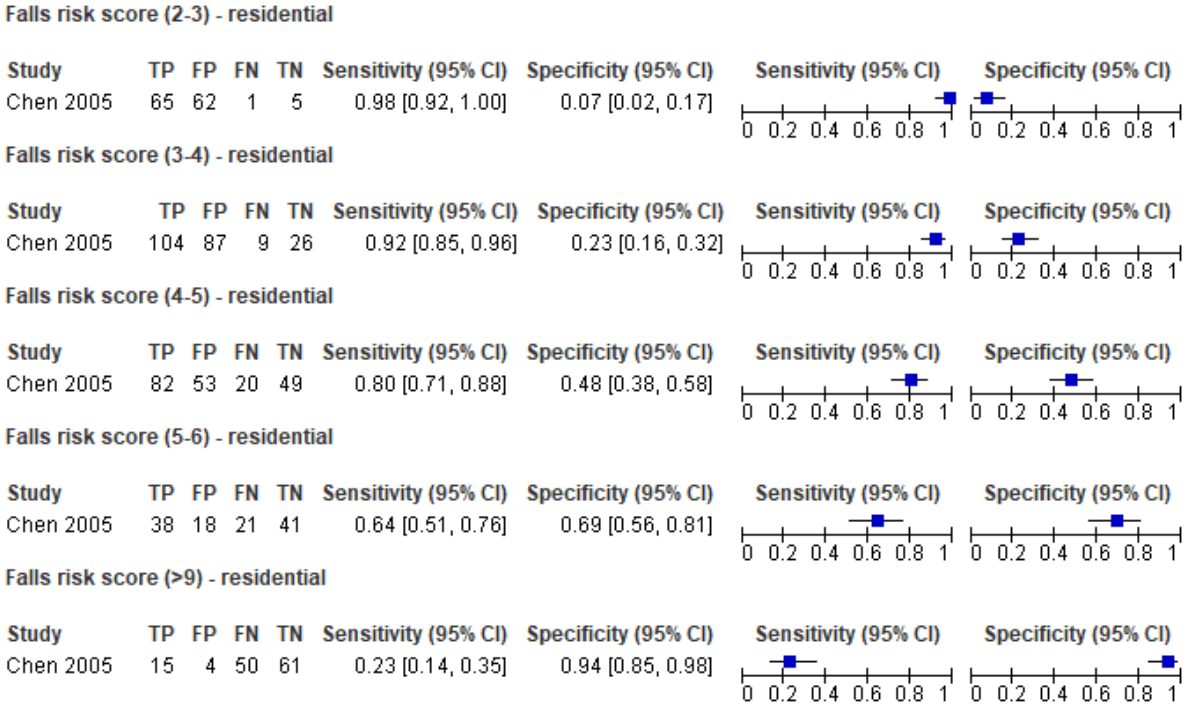


Figure 36: Stride time in seconds (1.19 cut-off) – residential (aged 65 years or older)

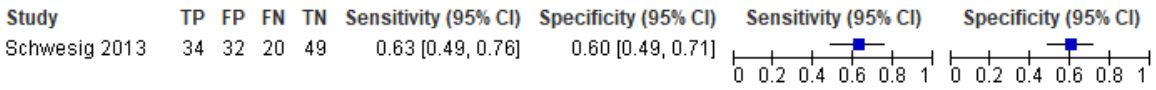


Figure 37: Standard deviation landing phase in % (15.3 cut-off) – residential (aged 65 years or older

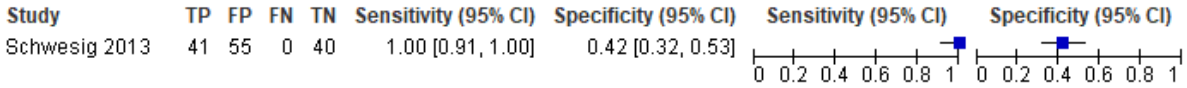


Figure 38: Posturographic frequency range F2-F4 (10.7 cut-off) – residential (aged 65 years or older

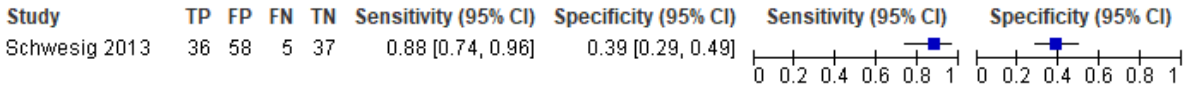


Figure 39: Standing Test for Imbalance and Disequilibrium (SIDE) (2a/2b cut off) - residential (aged 65 years or older)

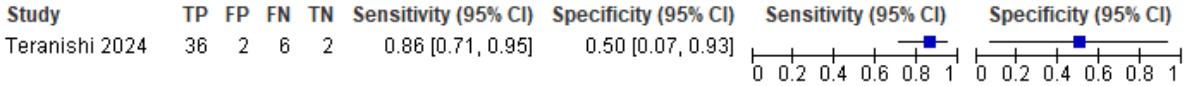
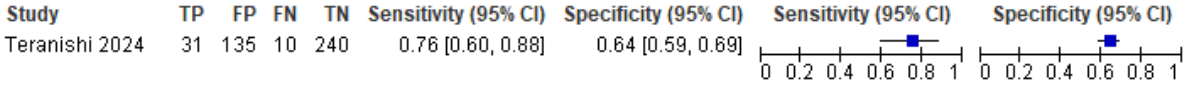


Figure 40: SIDE (cut off 2a/2b) + Adherence assessment (positive/negative) - residential (aged 65 years or older)



Appendix F AUC plots

F.1 Community setting

Figure 41: Berg balance scale – community setting (aged 65 years or older)

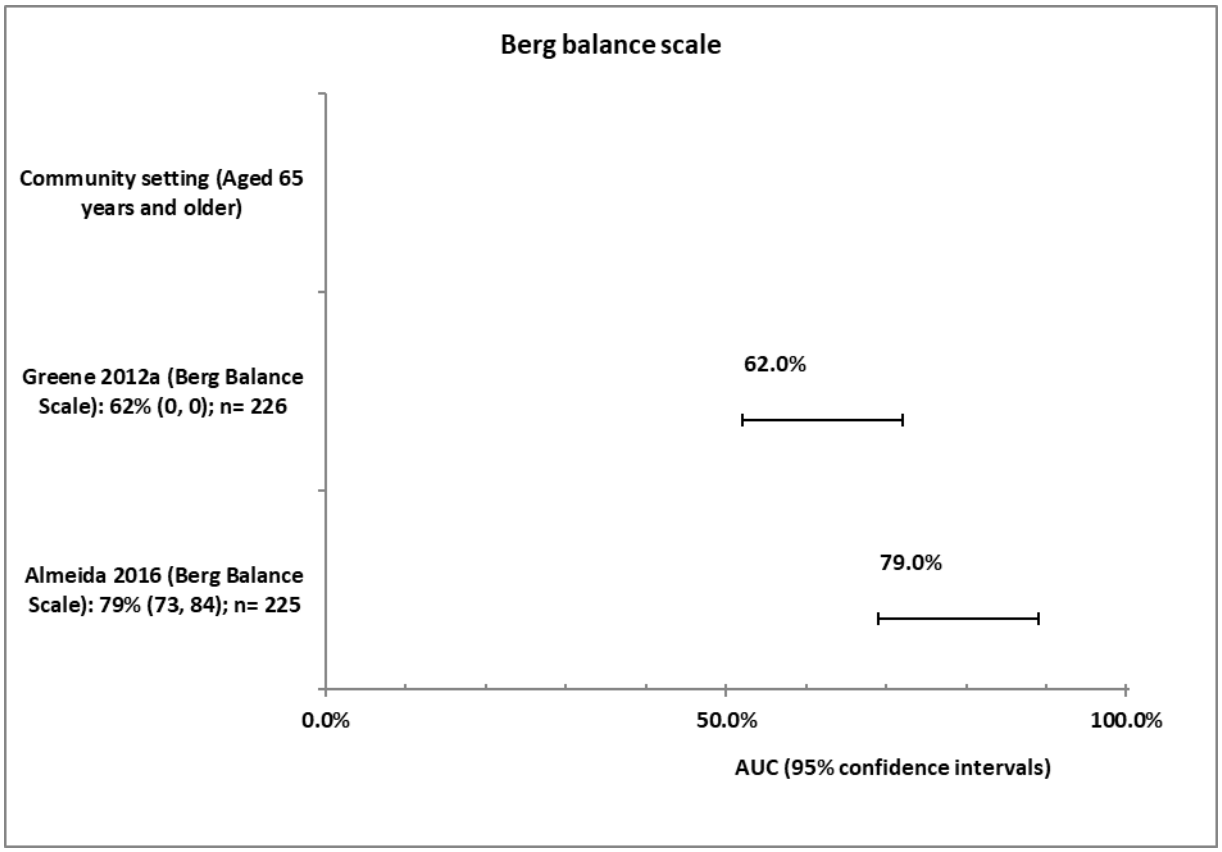


Figure 42: BEST – community setting (aged 65 years or older)

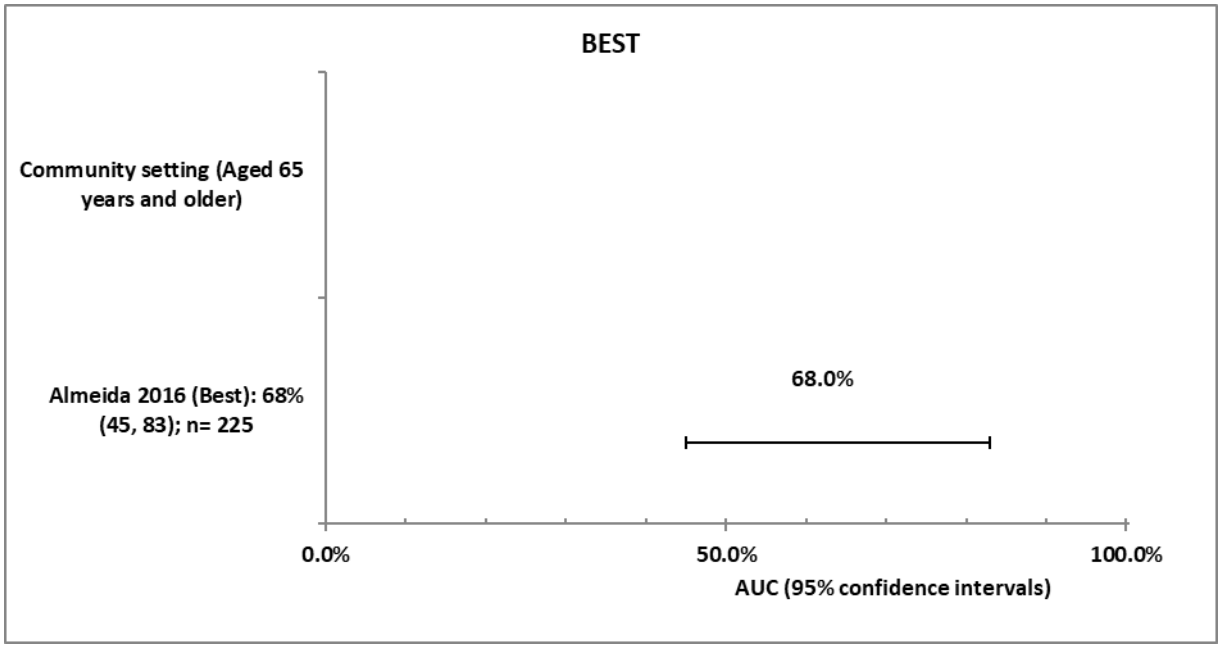


Figure 43: Mini-BEST – community setting (aged 65 years or older)

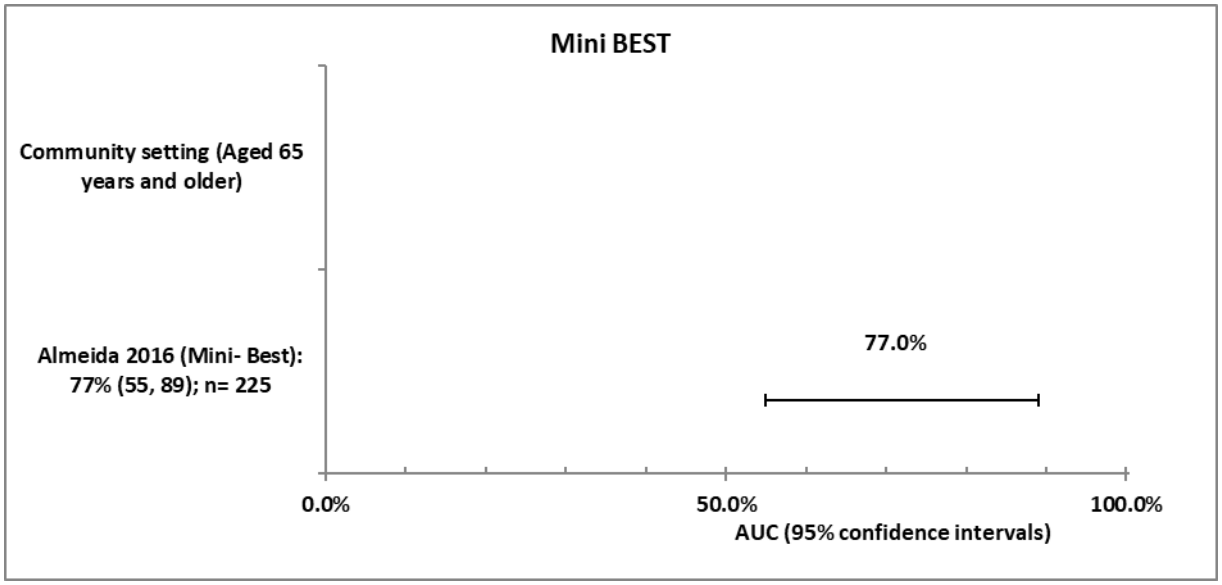


Figure 44: Tinetti score – community setting (aged 65 years or older)

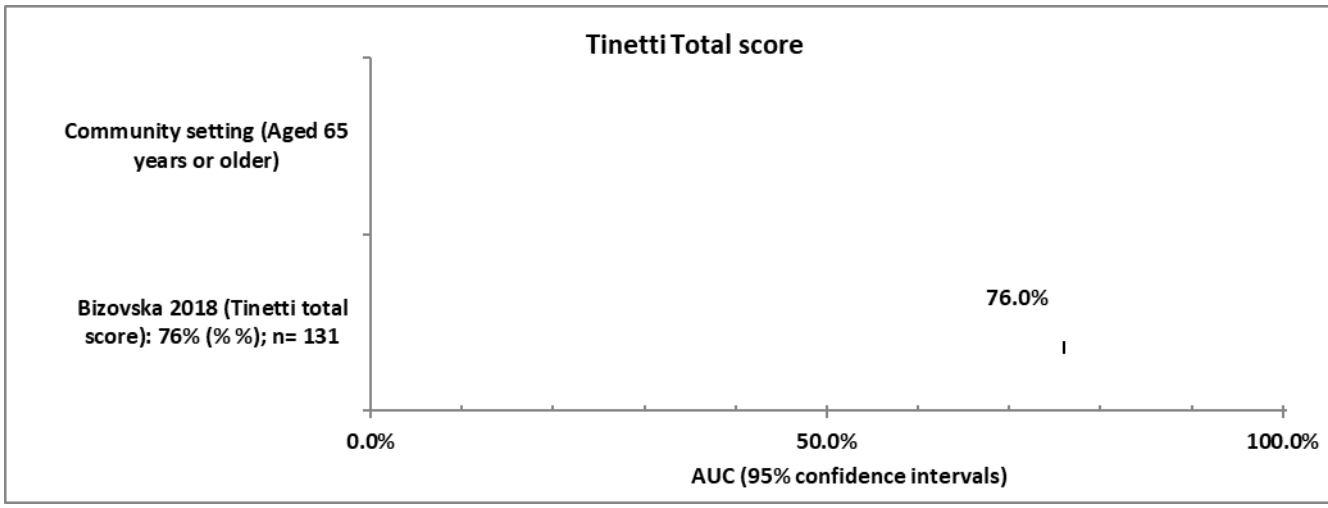


Figure 45: Gait velocity (cm/s)– community setting (aged 65 years or older)

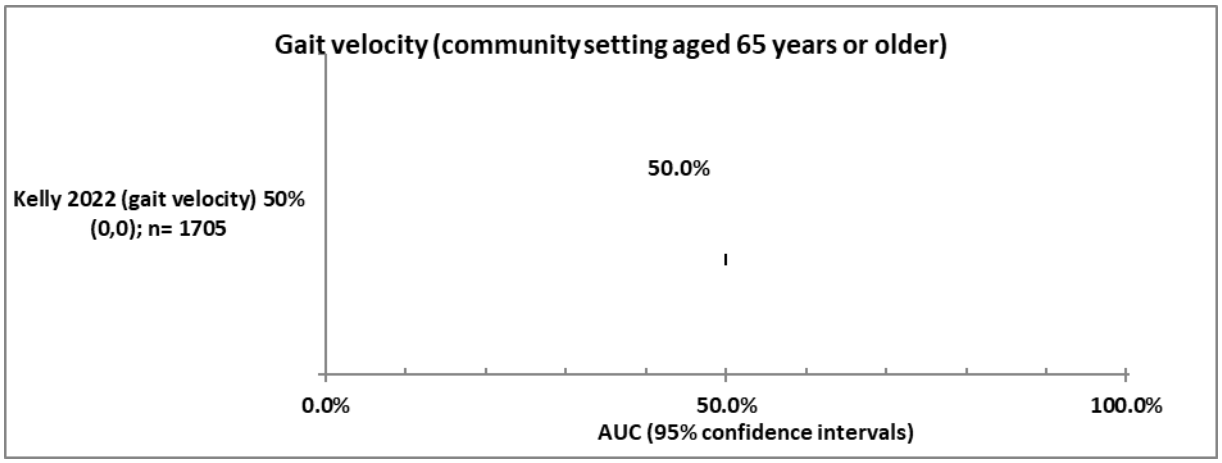


Figure 46: Grip strength (kg) - community setting (aged 65 years or older)

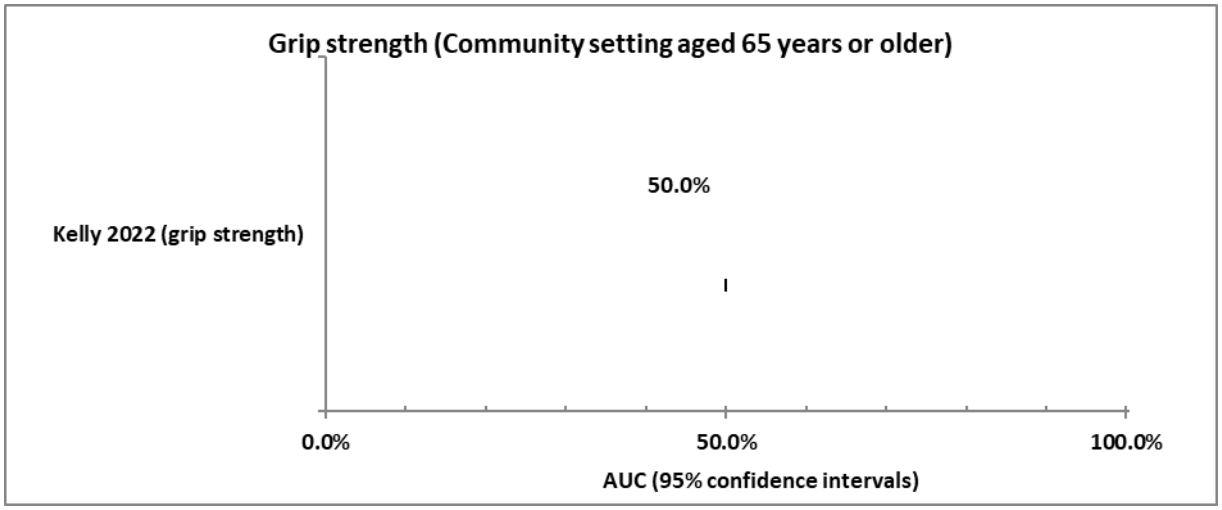


Figure 47: HCRNN model of kinematic characteristics of gait and balance during the TUG - community setting (aged 65 years or older)

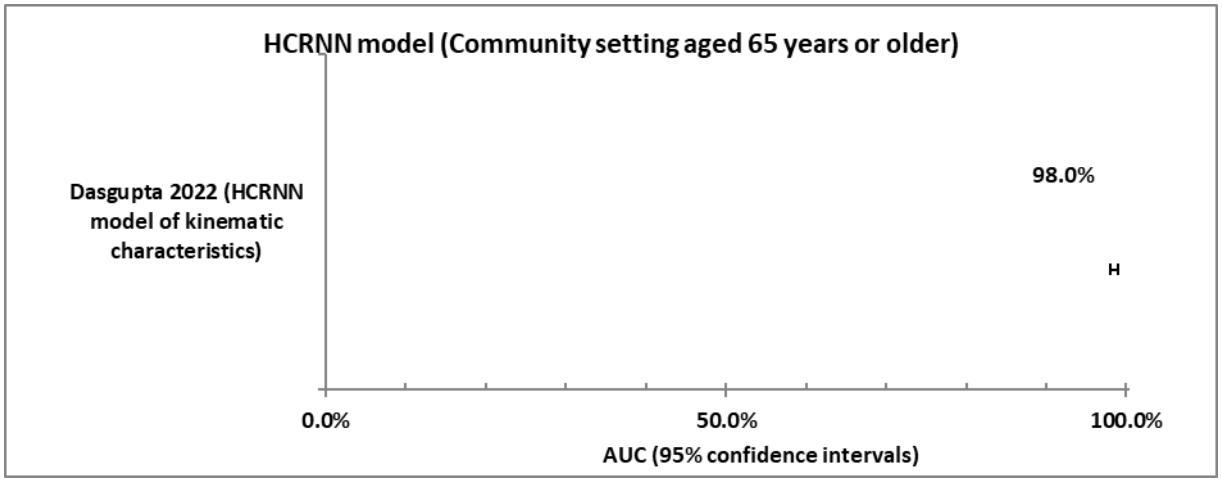


Figure 48: Composite equilibrium score - community setting (aged 65 years or older)

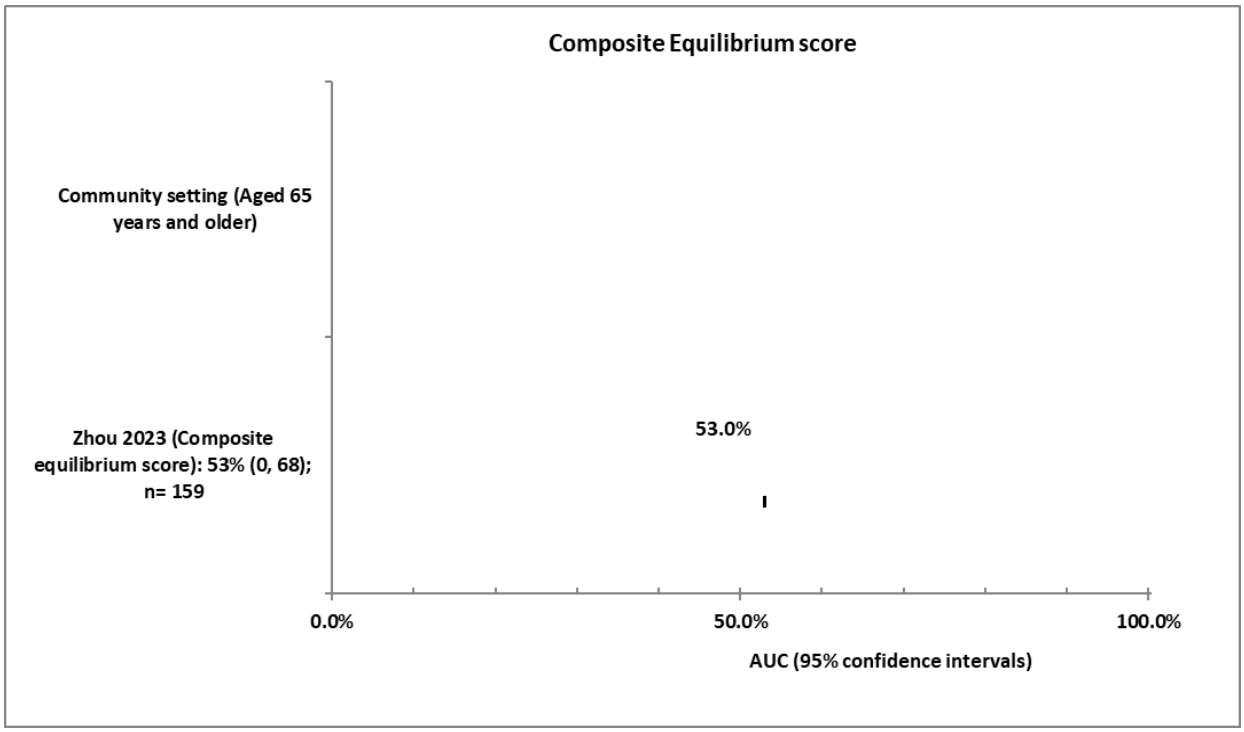


Figure 49: **Finite-state machine (wearable technology) – community setting (aged 65 years or older)**

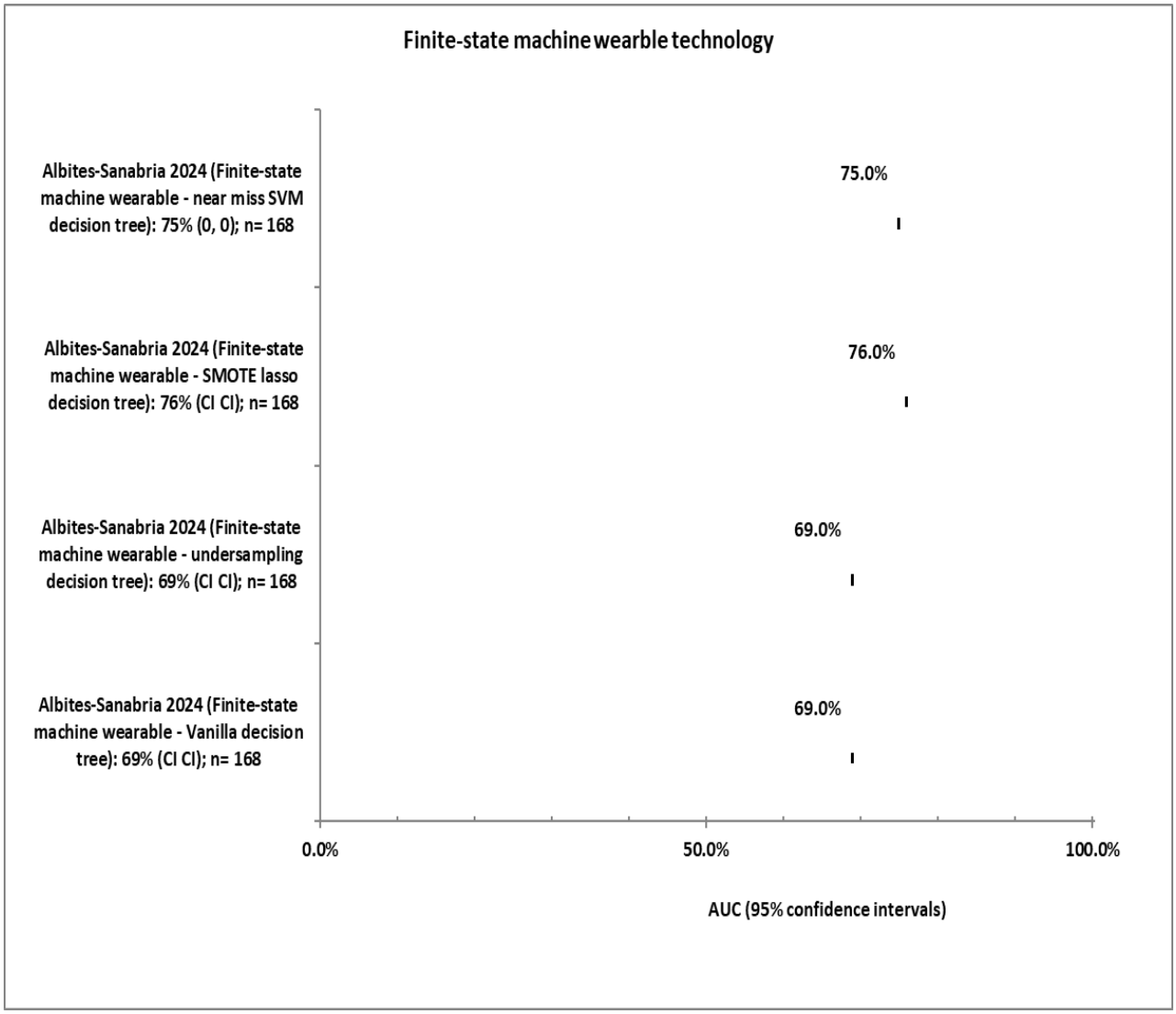
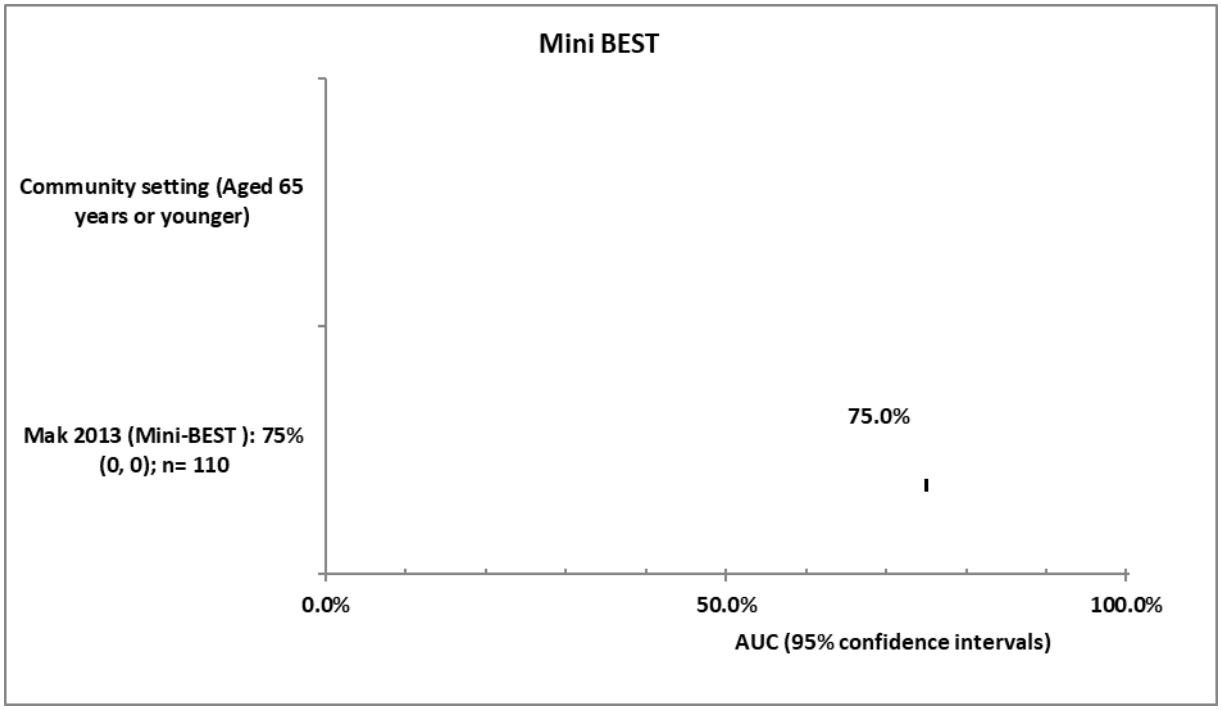


Figure 50: Mini-BEST – community setting (aged under 65 years)



F.2 Hospital setting

Figure 51: Simplified Tinetti Scale- hospital setting (aged 65 years or older)

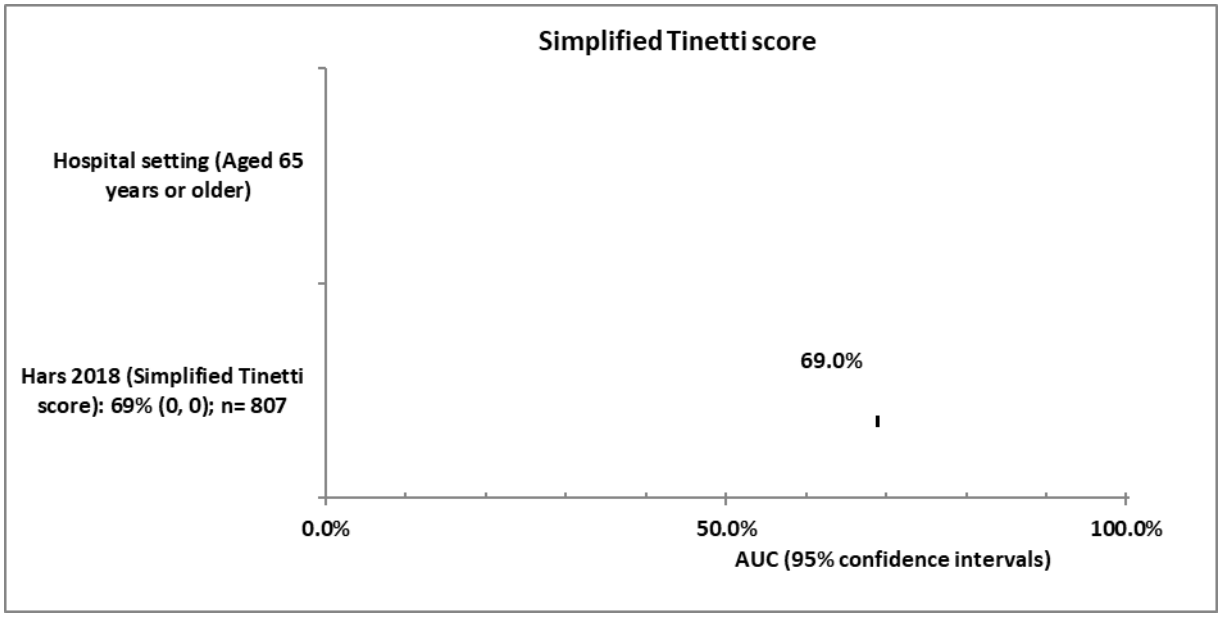


Figure 52: Predict FIRST tool - hospital setting (aged 65 years or older)

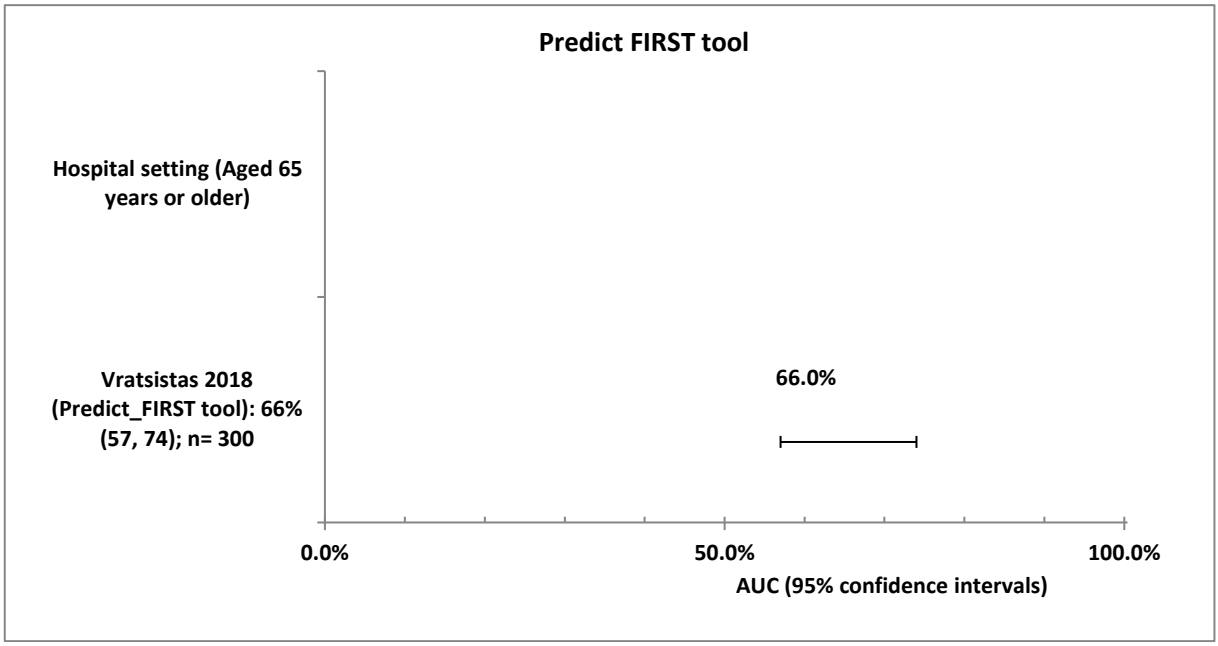


Figure 53: Patient history + Gait speed (m/s) - hospital setting (aged 65 years or older)

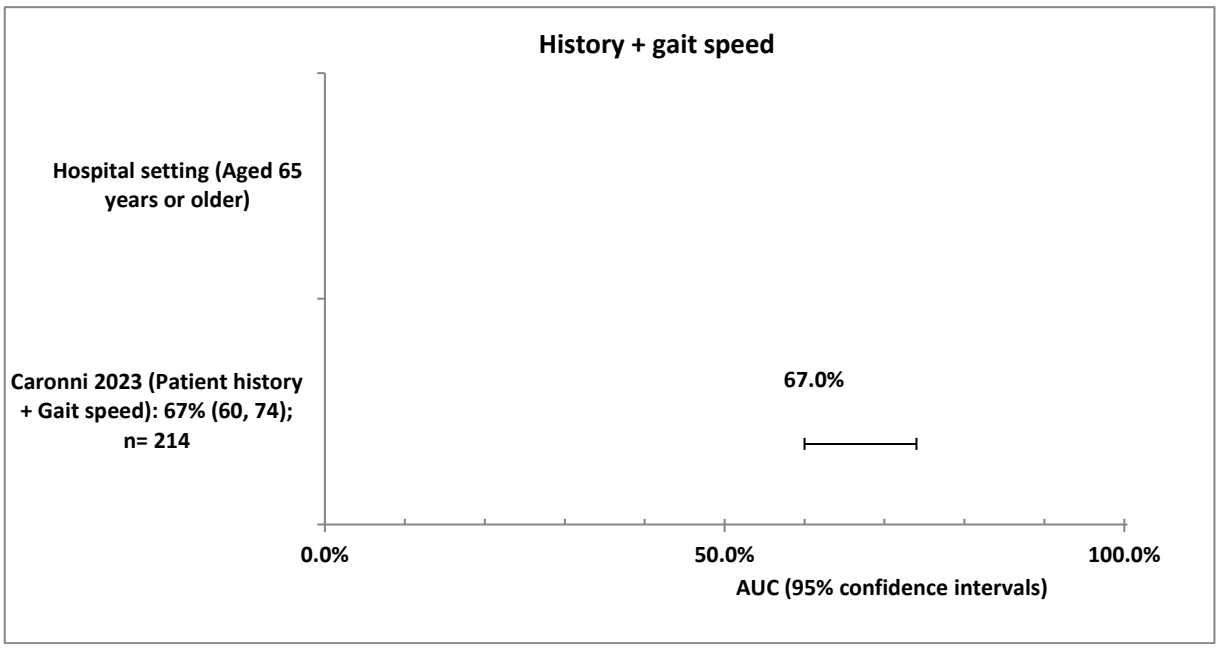


Figure 54: Patient history + Walk ratio - hospital setting (aged 65 years or older)

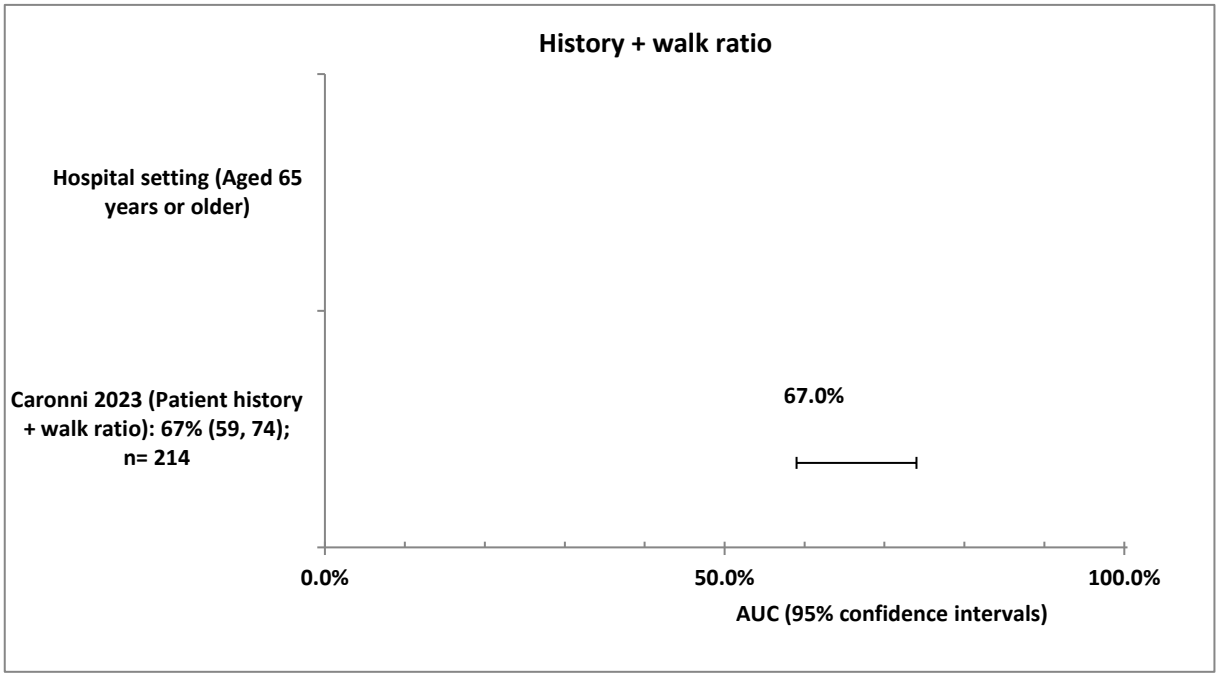


Figure 55: Patient history + Mini-BESTest - hospital setting (aged 65 years or older)

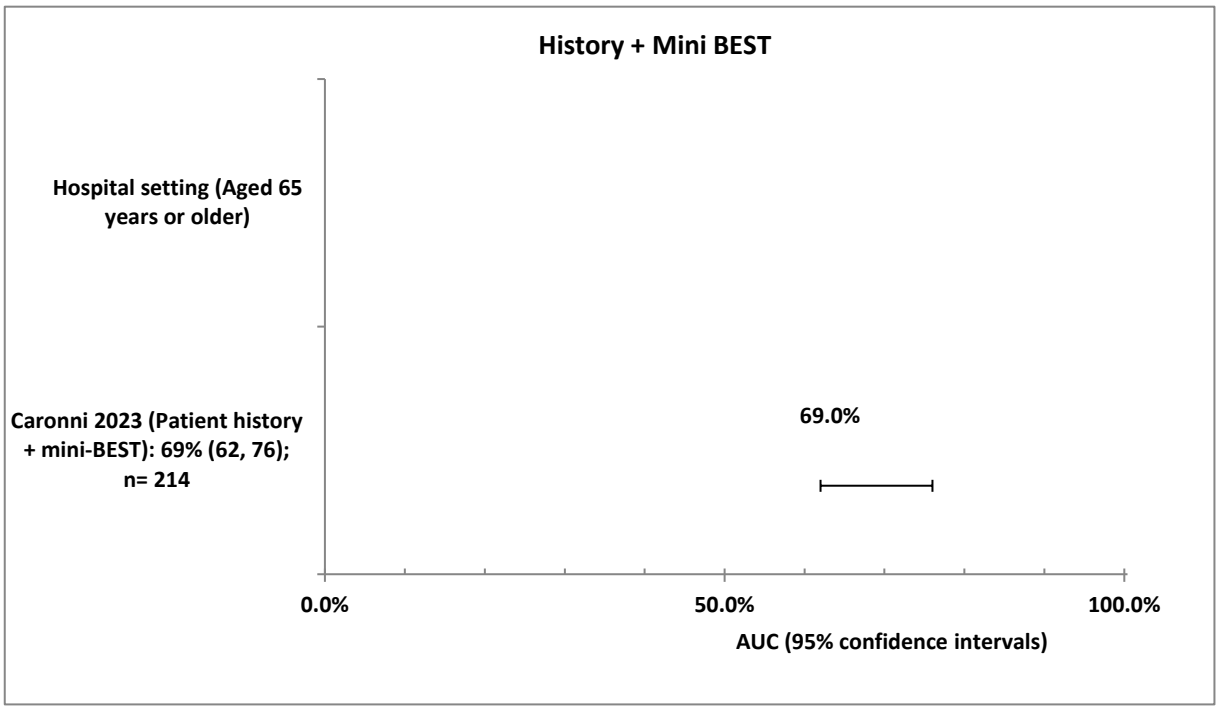


Figure 56: Patient history + TUG duration (s)- hospital setting (aged 65 years or older)

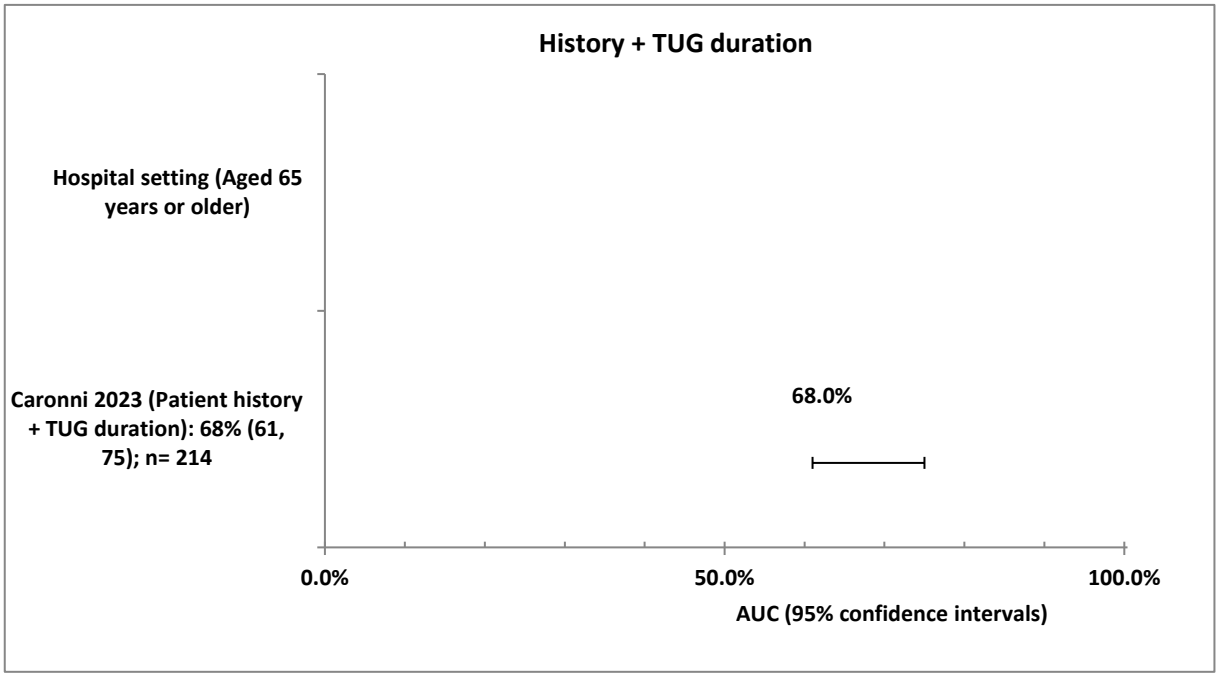


Figure 57: Patient history + sit-to-walk duration, s - hospital setting (aged 65 years or older)

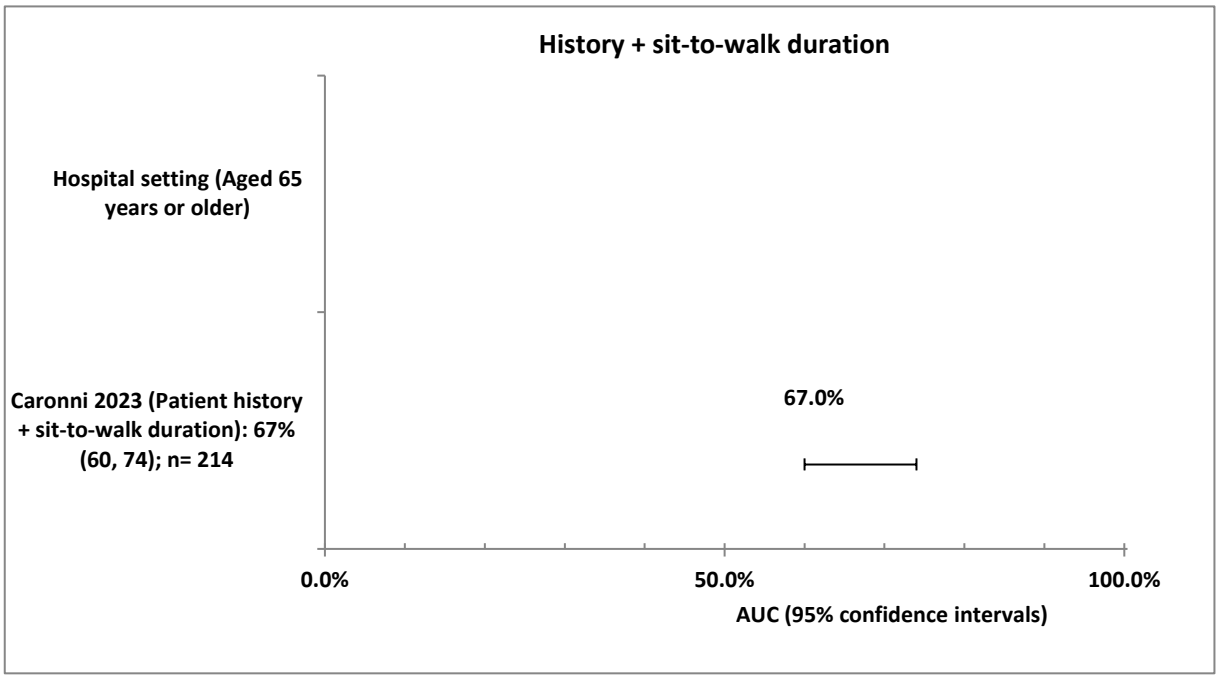


Figure 58: Patient history + Turn duration, (s) - hospital setting (aged 65 years or older)

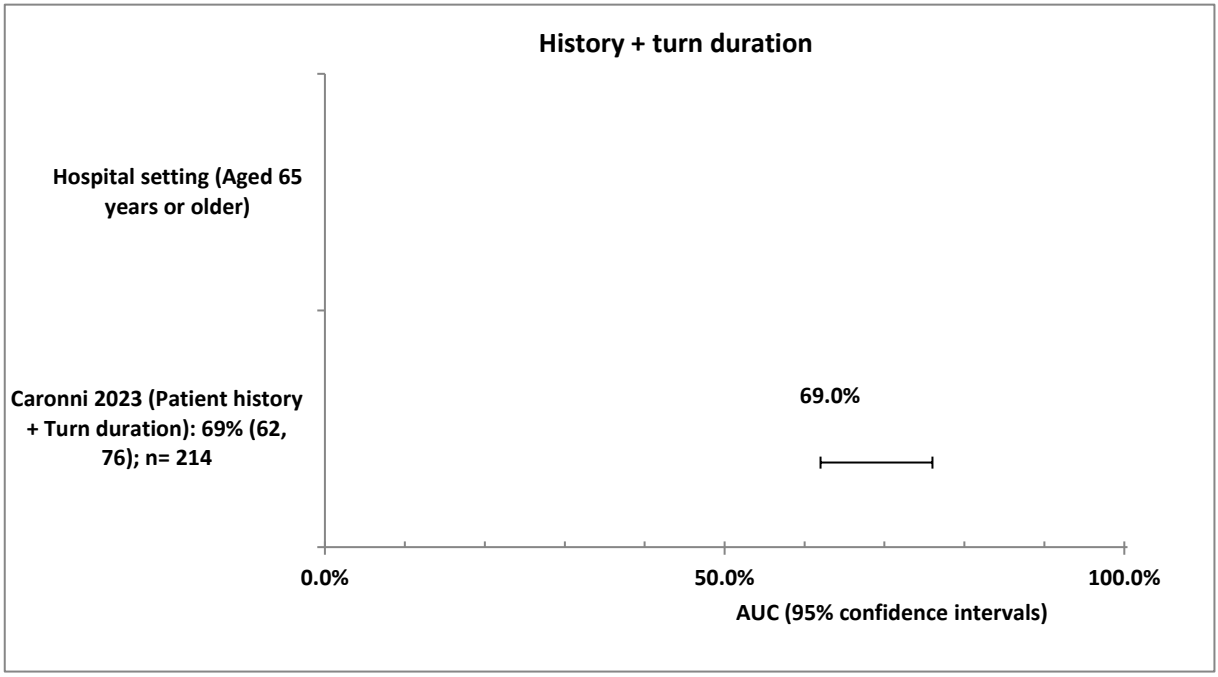


Figure 59: Patient history + Peak angular velocity, °/s - hospital setting (aged 65 years or older)

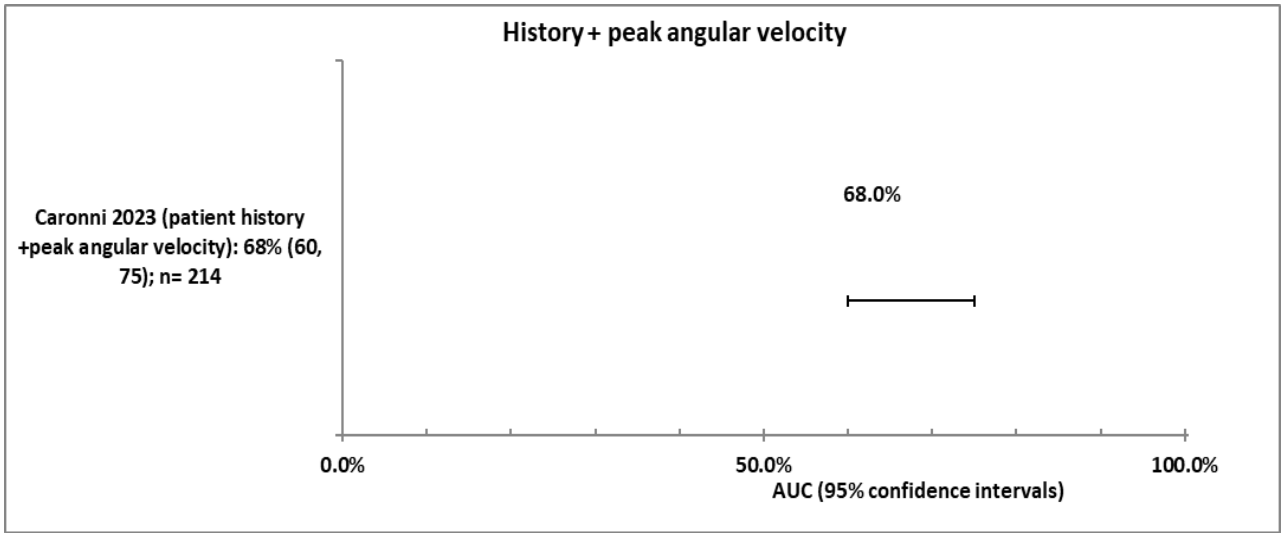
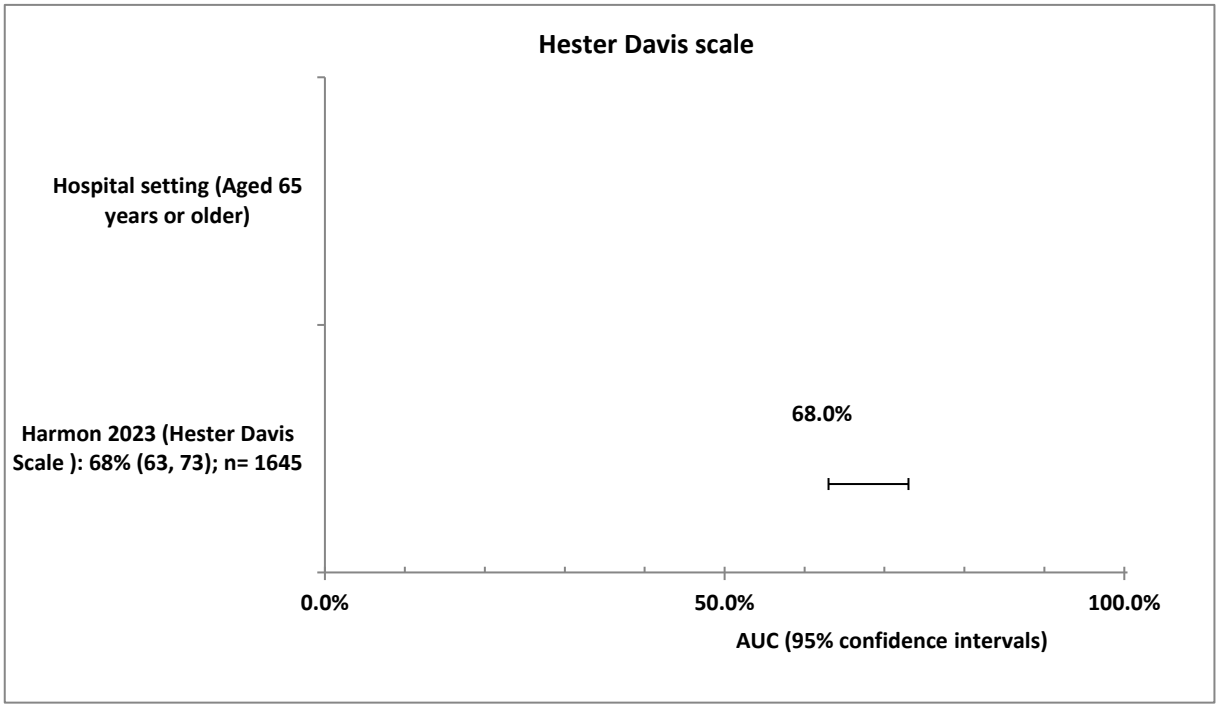


Figure 60: Hester Davis score - hospital setting (aged 65 years or older)



F.3 Residential care setting

Figure 61: Stride time (s) – residential care setting (aged 65 years or older)

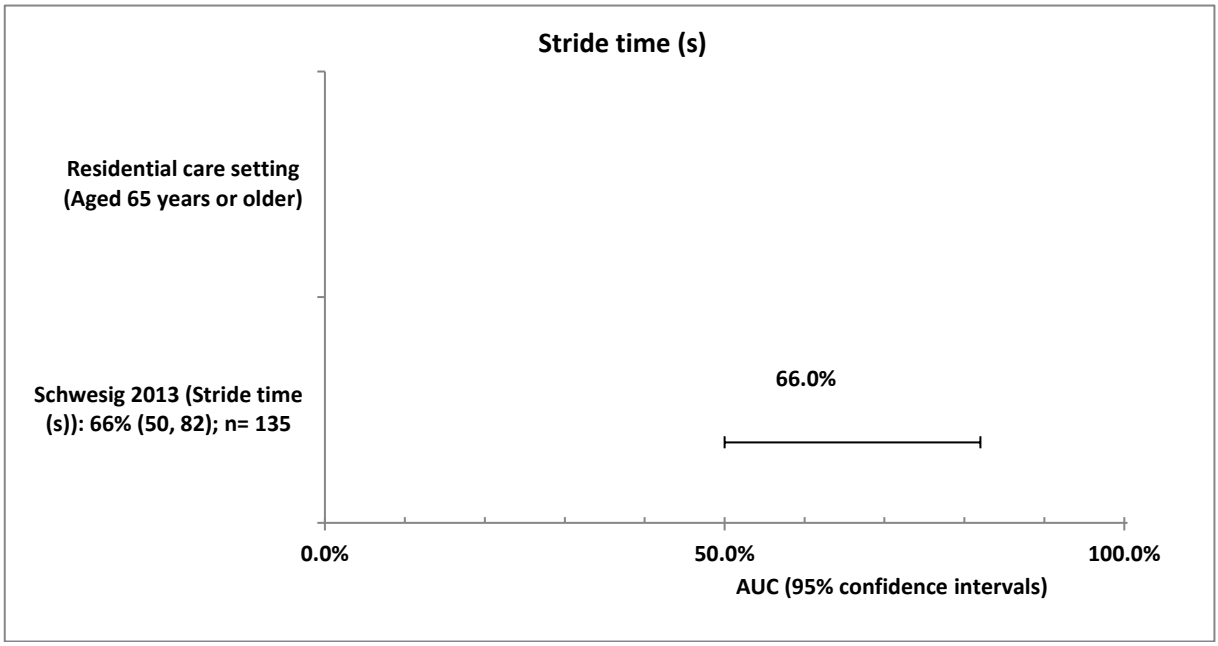


Figure 62: Standard deviation landing phase – residential care setting (aged 65 years or older)

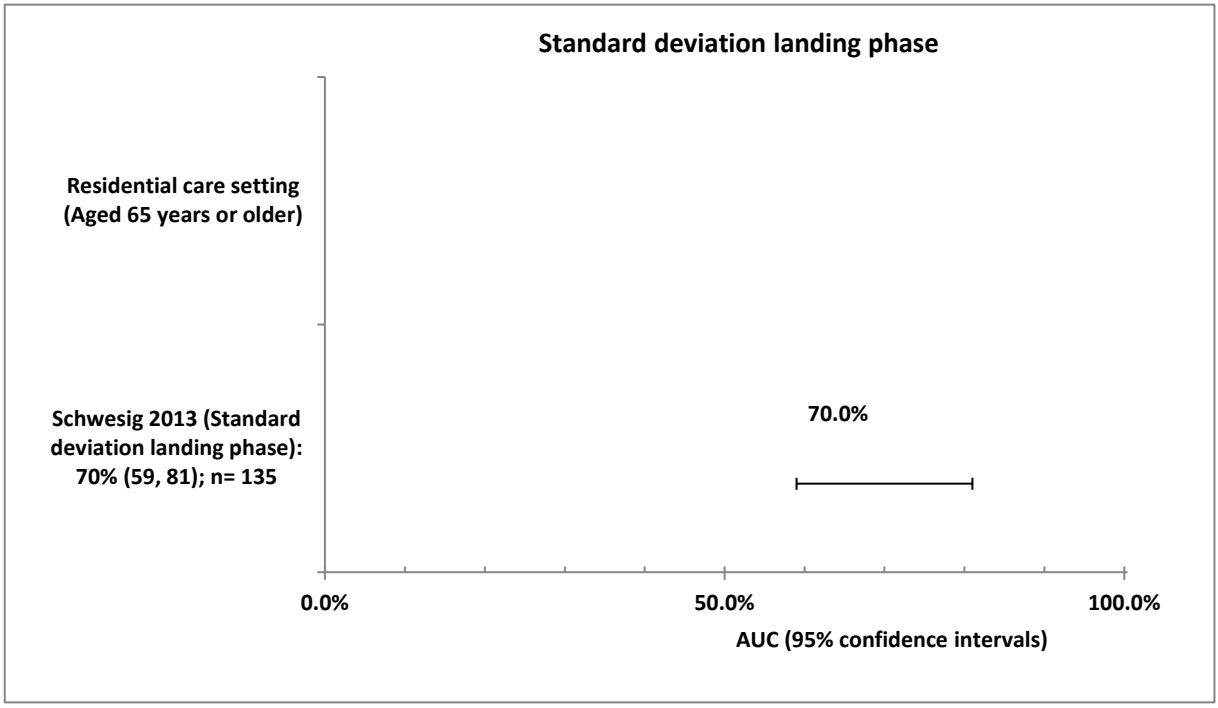


Figure 63: Posturographic frequency range – residential care setting (aged 65 years or older)

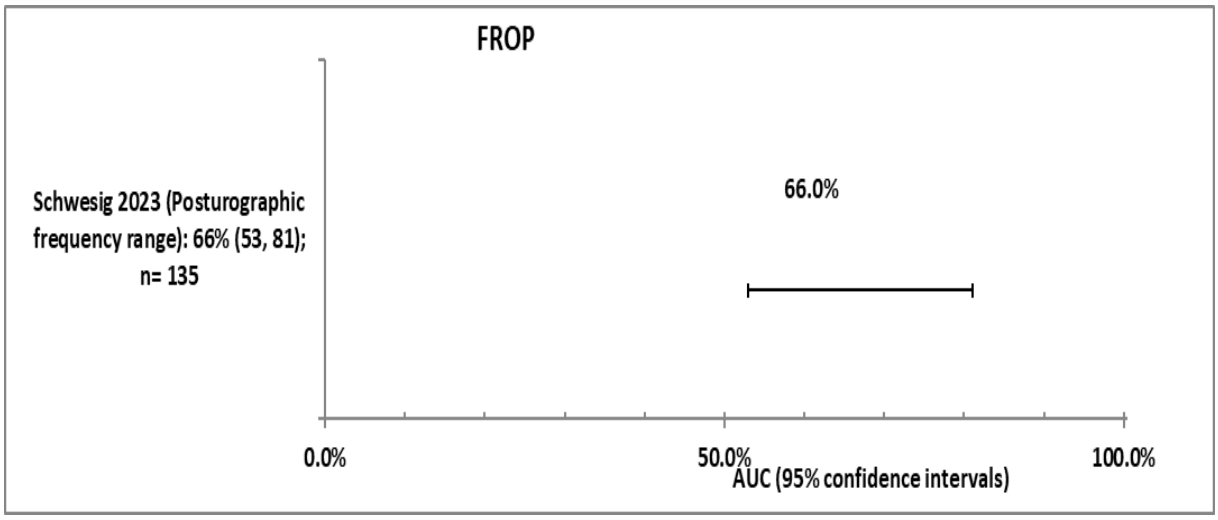
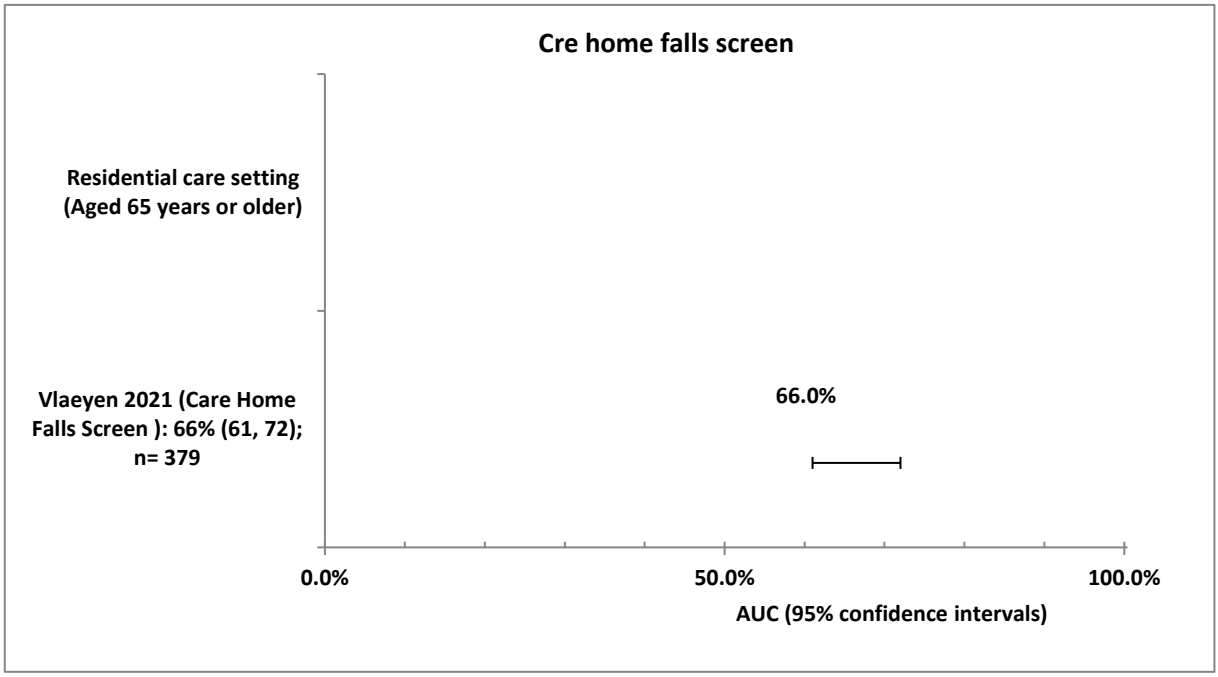
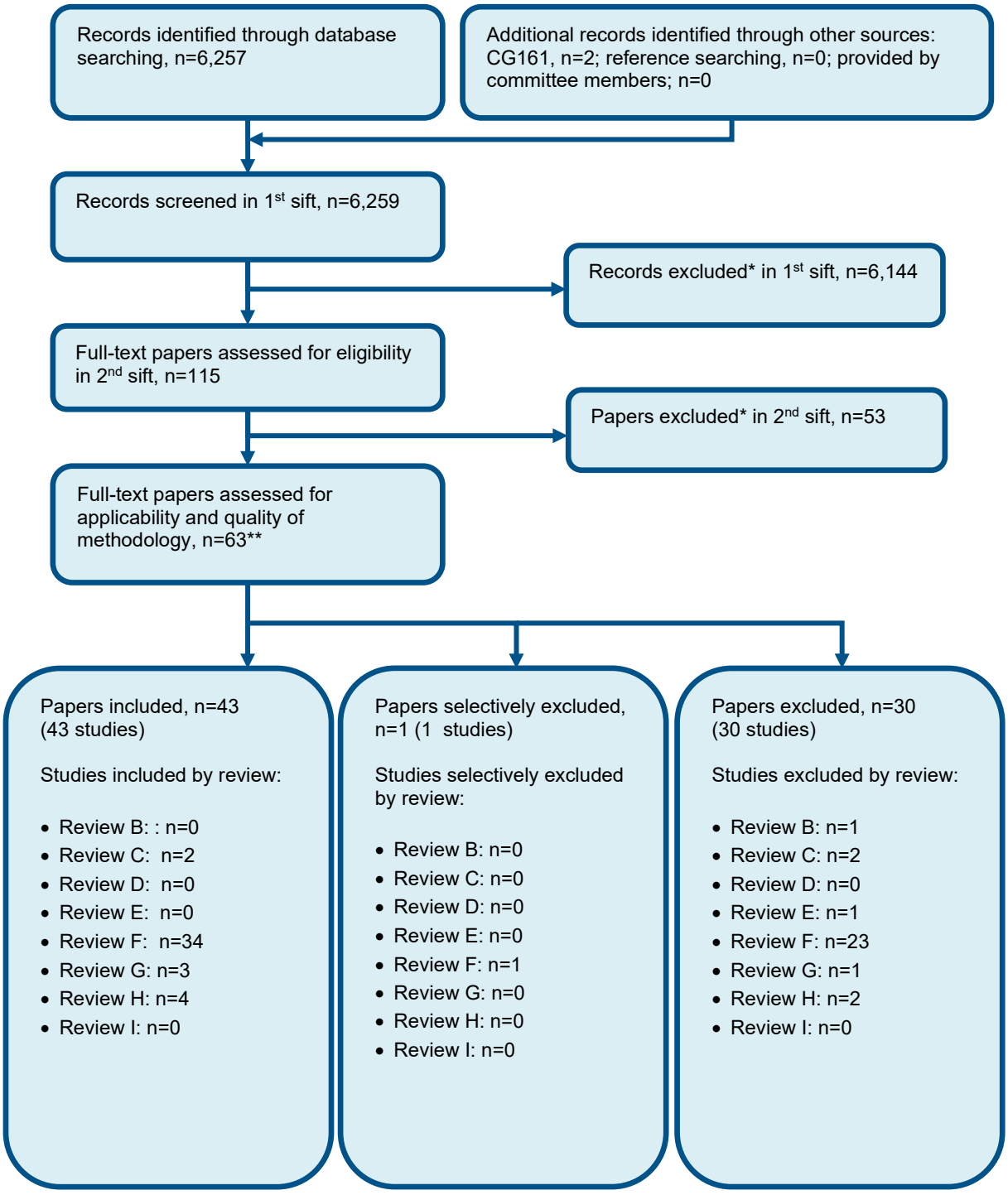


Figure 64: Care Home Falls Screen – residential care setting (aged 65 years or older)



Appendix G Economic evidence study selection



* Non-relevant population, intervention, comparison, design or setting; non-English language
**One paper included in two reviews

Appendix H Economic evidence tables

No Health economic studies were included .

Appendix I Health economic model

This review question was not prioritised for new health economic modelling.

Appendix J Excluded studies

J.1 Clinical studies

Table 8: Studies excluded from the clinical review

Study	Code [Reason]
Abou, Libak, Ilha, Jocemar, Romanini, Francielle et al. (2019) Do clinical balance measures have the ability to predict falls among ambulatory individuals with spinal cord injury? A systematic review and meta-analysis. Spinal cord 57(12): 1001-1013	- Systematic review used as source of primary studies
Abou, Libak, Peters, Joseph, Fritz, Nora E et al. (2022) Motor Cognitive Dual-Task Testing to Predict Future Falls in Multiple Sclerosis: A Systematic Review. Neurorehabilitation and neural repair 36(12): 757-769	- Population not relevant to this review protocol
Abou, Libak, Peters, Joseph, Wong, Ellyce et al. (2021) Gait and Balance Assessments using Smartphone Applications in Parkinson's Disease: A Systematic Review. Journal of medical systems 45(9): 87	- Systematic review used as source of primary studies
Abu Samah, Z., Mohd Nordin, N.A., Shahar, S. et al. (2016) Can gait speed test be used as a falls risk screening tool in community dwelling older adults? A review. Polish Annals of Medicine 23(1): 61-67	- Review article but not a systematic review
Agarwal, G, Angeles, R, Pirrie, M et al. (2017) Effectiveness of a community paramedic-led health assessment and education initiative in a seniors' residence building: the Community Health Assessment Program through Emergency Medical Services (CHAP-EMS). BMC emergency medicine 17(1): 8	- Study does not contain an intervention relevant to this review protocol
Al Abiad, Nahime, van Schooten, Kimberley S, Renaudin, Valerie et al. (2023) Association of Prospective Falls in Older People With Ubiquitous Step-Based Fall Risk Parameters Calculated From Ambulatory Inertial Signals: Secondary Data Analysis. JMIR aging 6: e49587	- Study design not relevant to this review protocol
Alkan, H., Yildiz, N., Sarsan, A. et al. (2014) The relationship between posturographic fall risk and clinical balance tests among community-dwelling older adults. Turk Geriatri Dergisi 17(3): 242-248	- Study does not contain an intervention relevant to this review protocol
Allum, John Hj and Carpenter, Mark G (2005) A speedy solution for balance and gait analysis: angular velocity measured at the centre of body mass. Current opinion in neurology 18(1): 15-21	- Study does not contain an intervention relevant to this review protocol
Almeida, Lorena R S, Valenca, Guilherme T, Negreiros, Nadja N et al. (2017) Predictors of Recurrent Falls in People with Parkinson's Disease and Proposal for a Predictive Tool. Journal of Parkinson's disease 7(2): 313-324	- Study does not contain an intervention relevant to this review protocol
Alsubheen, Sanaa A, Beauchamp, Marla K, Ellerton, Cindy et al. (2022) Validity of the Activities-specific Balance Confidence Scale in individuals with chronic obstructive pulmonary disease. Expert review of respiratory medicine 16(6): 689-696	- Study design not relevant to this review protocol
Alvarez, Marta Neira, Rodriguez-Sanchez, Cristina, Huertas-Hoyas, Elisabet et al. (2023) Predictors of fall risk in older adults using the G-STRIDE inertial	- Study design not relevant to this review protocol

Study	Code [Reason]
sensor: an observational multicenter case-control study. BMC geriatrics 23(1): 737	
Amundsen, T., Rossman, M., Ahmad, I. et al. (2022) Fall risk assessment and visualization through gait analysis. Smart Health 25: 100284	- Study does not contain an intervention relevant to this review protocol
An, SeungHeon; Lee, YunBok; Lee, GyuChang (2014) Validity of the performance-oriented mobility assessment in predicting fall of stroke survivors: a retrospective cohort study. The Tohoku journal of experimental medicine 233(2): 79-87	- Population not relevant to this review protocol
Aprahamian, Ivan, Suemoto, Claudia Kimie, Aliberti, Marlon Juliano Romero et al. (2018) Frailty and cognitive status evaluation can better predict mortality in older adults?. Archives of gerontology and geriatrics 77: 51-56	- Data not reported in an extractable format or a format that can be analysed
Arai, Tomoyuki, Fujita, Hiroaki, Maruya, Kohei et al. (2020) The one-leg portion of the Stand-Up Test predicts fall risk in aged individuals: A prospective cohort study. Journal of orthopaedic science : official journal of the Japanese Orthopaedic Association 25(4): 688-692	- Data not reported in an extractable format or a format that can be analysed
Aranda-Gallardo, Marta, Enriquez de Luna-Rodriguez, Margarita, Vazquez-Blanco, Maria J et al. (2017) Diagnostic validity of the STRATIFY and Downton instruments for evaluating the risk of falls by hospitalised acute-care patients: a multicentre longitudinal study. BMC health services research 17(1): 277	- Study does not contain an intervention relevant to this review protocol
Aranda-Gallardo, Marta, Morales-Asencio, Jose M, Canca-Sanchez, Jose C et al. (2013) Instruments for assessing the risk of falls in acute hospitalized patients: a systematic review and meta-analysis. BMC health services research 13: 122	- Study does not contain an intervention relevant to this review protocol
Arihisa, Katsuhiko, Yamamoto, Akihiko, Hayashi, Tatsuhiro et al. (2019) Development and Testing of a Visual Tool for Assessing Risk of Falls. Quality management in health care 28(3): 139-146	- Study not reported in English
Arndt, Holger, Burkard, Stefan, Talavera, Guillermo et al. (2017) Real-Time Constant Monitoring of Fall Risk Index by Means of Fully-Wireless Insoles. Studies in health technology and informatics 237: 193-197	- Population not relevant to this review protocol
Arslan, Ozge and Tosun, Zeynep (2022) Comparison of the psychometric properties of three commonly used fall risk assessment tools: a prospective observational study for stroke patients. Topics in stroke rehabilitation 29(6): 430-437	- Study does not contain an intervention relevant to this review protocol
Atrsaei, Arash, Paraschiv-Ionescu, Anisoara, Krief, Helene et al. (2022) Instrumented 5-Time Sit-To-Stand Test: Parameters Predicting Serious Falls beyond the Duration of the Test. Gerontology 68(5): 587-600	- Data not reported in an extractable format or a format that can be analysed
Ayers, Emmeline I, Tow, Amanda C, Holtzer, Roee et al. (2014) Walking while talking and falls in aging. Gerontology 60(2): 108-13	- Data not reported in an extractable format or a format that can be analysed

Study	Code [Reason]
Ayvat, Ender, Dogan, Mert, Ayvat, Fatma et al. (2024) Usefulness of the Berg Balance Scale for prediction of fall risk in multiple sclerosis. Neurological sciences : official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology	- Study design not relevant to this review protocol
Azad, Akram, Sabet, Azar, Taghizadeh, Ghorban et al. (2020) Clinical assessment of Persian translation of Fullerton Advanced Balance Scale in community-dwelling older adults. Disability and rehabilitation 42(4): 567-573	- Study does not contain an intervention relevant to this review protocol
Bailey, Patricia Hill, Rietze, Lori Lynn, Moroso, Sandra et al. (2011) A description of a process to calibrate the Morse fall scale in a long-term care home. Applied nursing research : ANR 24(4): 263-8	- Data not reported in an extractable format or a format that can be analysed
Baker, Nicky; Gough, Claire; Gordon, Susan J (2021) Inertial Sensor Reliability and Validity for Static and Dynamic Balance in Healthy Adults: A Systematic Review. Sensors (Basel, Switzerland) 21(15)	- Systematic review used as source of primary studies
Bargiotas, Ioannis, Audiffren, Julien, Vayatis, Nicolas et al. (2018) On the importance of local dynamics in statokinesigram: A multivariate approach for postural control evaluation in elderly. PloS one 13(2): e0192868	- Study does not contain an intervention relevant to this review protocol
Barker, Anna, Kamar, Jeannette, Graco, Marnie et al. (2011) Adding value to the STRATIFY falls risk assessment in acute hospitals. Journal of advanced nursing 67(2): 450-7	- Study design not relevant to this review protocol
Barry, Emma, Galvin, Rose, Keogh, Claire et al. (2014) 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 geriatrics 14: 14	- Study does not contain an intervention relevant to this review protocol
Bassett, Alaina M; Siu, Ka-Chun; Honaker, Julie A (2018) Functional Measures for Fall Risk in the Acute Care Setting: A Review. Western journal of nursing research 40(10): 1469-1488	- Data not reported in an extractale format or a format that can be analysed
Batko-Szwaczka, Agnieszka, Wilczynski, Krzysztof, Hornik, Beata et al. (2020) Predicting Adverse Outcomes in Healthy Aging Community-Dwelling Early-Old Adults with the Timed Up and Go Test. Clinical interventions in aging 15: 1263-1270	- Study does not contain an intervention relevant to this review protocol
Beauchamp, Marla K (2019) Balance assessment in people with COPD: An evidence-based guide. Chronic respiratory disease 16: 1479973118820311	- Review article but not a systematic review
Beauchamp, Marla K, Kuspinar, Ayse, Sohel, Nazmul et al. (2022) Mobility screening for fall prediction in the Canadian Longitudinal Study on Aging (CLSA): implications for fall prevention in the decade of healthy ageing. Age and ageing 51(5)	- Study does not contain an intervention relevant to this review protocol
Beauchet, O, Annweiler, C, Dubost, V et al. (2009) Stops walking when talking: a predictor of falls in older adults?. European journal of neurology 16(7): 786-95	- Study does not contain an intervention

Study	Code [Reason]
	relevant to this review protocol
Beauchet, O, Fantino, B, Allali, G et al. (2011) Timed Up and Go test and risk of falls in older adults: a systematic review. The journal of nutrition, health & aging 15(10): 933-8	- Study does not contain an intervention relevant to this review protocol
Beauchet, O, Noublanche, F, Simon, R et al. (2018) Falls Risk Prediction for Older Inpatients in Acute Care Medical Wards: Is There an Interest to Combine an Early Nurse Assessment and the Artificial Neural Network Analysis?. The journal of nutrition, health & aging 22(1): 131-137	- Study does not contain an intervention relevant to this review protocol
Beauchet, Olivier, Allali, Gilles, Annweiler, Cedric et al. (2008) Does change in gait while counting backward predict the occurrence of a first fall in older adults?. Gerontology 54(4): 217-23	- Data not reported in an extractale format or a format that can be analysed
Beauchet, Olivier, Matskiv, Jacqueline, Launay, Cyrille P et al. (2022) CARE frailty e-health scale: Association with incident adverse health outcomes and comparison with the Cardiovascular Health Study frailty scale in the NuAge cohort. Maturitas 162: 37-43	- Data not reported in an extractable format or a format that can be analysed
Beck Jepsen, D, Robinson, K, Ogliari, G et al. (2022) Predicting falls in older adults: an umbrella review of instruments assessing gait, balance, and functional mobility. BMC geriatrics 22(1): 615	- Review article but not a systematic review
Bentzen, Hege; Bergland, Astrid; Forsen, Lisa (2011) Diagnostic accuracy of three types of fall risk methods for predicting falls in nursing homes. Aging clinical and experimental research 23(3): 187-95	- Study does not contain an intervention relevant to this review protocol
Berg, K O, Wood-Dauphinee, S L, Williams, J I et al. (1992) Measuring balance in the elderly: validation of an instrument. Canadian journal of public health = Revue canadienne de sante publique 83suppl2: 7-11	- Data not reported in an extractable format or a format that can be analysed
Bet, Patricia; Castro, Paula C; Ponti, Moacir A (2019) Fall detection and fall risk assessment in older person using wearable sensors: A systematic review. International journal of medical informatics 130: 103946	- Systematic review used as source of primary studies
Betteridge, Callum M W, Natarajan, Pragadesh, Fonseka, R Dineth et al. (2021) Objective falls-risk prediction using wearable technologies amongst patients with and without neurogenic gait alterations: a narrative review of clinical feasibility. mHealth 7: 61	- Review article but not a systematic review
Bezold, Jelena, Krell-Roesch, Janina, Eckert, Tobias et al. (2021) Sensor-based fall risk assessment in older adults with or without cognitive impairment: a systematic review. European review of aging and physical activity : official journal of the European Group for Research into Elderly and Physical Activity 18(1): 15	- Systematic review used as source of primary studies
Blodgett, Joanna M, Ventre, Jodi P, Mills, Richard et al. (2022) A systematic review of one-legged balance performance and falls risk in community-dwelling adults. Ageing research reviews 73: 101501	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Bloem, Bastiaan R, Marinus, Johan, Almeida, Quincy et al. (2016) Measurement instruments to assess posture, gait, and balance in Parkinson's disease: Critique and recommendations. Movement disorders : official journal of the Movement Disorder Society 31(9): 1342-55	- Review article but not a systematic review
Blum, Lisa and Korner-Bitensky, Nicol (2008) Usefulness of the Berg Balance Scale in stroke rehabilitation: a systematic review. Physical therapy 88(5): 559-66	- Study does not contain an intervention relevant to this review protocol
Bongers, Kim T J, Schoon, Yvonne, Graauwmans, Maartje J et al. (2015) The predictive value of gait speed and maximum step length for falling in community-dwelling older persons. Age and ageing 44(2): 294-9	- Study does not contain an intervention relevant to this review protocol
Bongue, Bienvenu, Dupre, Caroline, Beauchet, Olivier et al. (2011) A screening tool with five risk factors was developed for fall-risk prediction in community-dwelling elderly. Journal of clinical epidemiology 64(10): 1152-60	- Study does not contain an intervention relevant to this review protocol
Boyce, Richard D, Kravchenko, Olga V, Perera, Subashan et al. (2022) Falls prediction using the nursing home minimum dataset. Journal of the American Medical Informatics Association : JAMIA 29(9): 1497-1507	- Study design not relevant to this review protocol *derivation and validation study using retrospective data*
Brauer, S G; Burns, Y R; Galley, P (2000) A prospective study of laboratory and clinical measures of postural stability to predict community-dwelling fallers. The journals of gerontology. Series A, Biological sciences and medical sciences 55(8): m469-76	- Study does not contain an intervention relevant to this review protocol
Breisinger, Terry P, Skidmore, Elizabeth R, Niyonkuru, Christian et al. (2014) The Stroke Assessment of Fall Risk (SAFR): predictive validity in inpatient stroke rehabilitation. Clinical rehabilitation 28(12): 1218-24	- Study does not contain an intervention relevant to this review protocol
Buckinx, F, Beaudart, C, Slomian, J et al. (2015) Added value of a triaxial accelerometer assessing gait parameters to predict falls and mortality among nursing home residents: A two-year prospective study. Technology and health care : official journal of the European Society for Engineering and Medicine 23(2): 195-203	- Data not reported in an extractale format or a format that can be analysed
Butler Forslund, Emelie, Jorgensen, Vivien, Skavberg Roaldsen, Kirsti et al. (2019) Predictors of falls in persons with spinal cord injury-a prospective study using the Downton fall risk index and a single question of previous falls. Spinal cord 57(2): 91-99	- Study does not contain an intervention relevant to this review protocol
Campanini, Isabella, Bargellini, Annalisa, Mastrangelo, Stefano et al. (2021) Performance of the Hendrich Fall Risk Model II in Patients Discharged from Rehabilitation Wards. A Preliminary Study of Predictive Ability. International journal of environmental research and public health 18(4)	- Study does not contain an intervention relevant to this review protocol
Campanini, Isabella, Mastrangelo, Stefano, Bargellini, Annalisa et al. (2018) Feasibility and predictive performance of the Hendrich Fall Risk Model II in a	- Study does not contain an

Study	Code [Reason]
rehabilitation department: a prospective study. BMC health services research 18(1): 18	intervention relevant to this review protocol
Campbell, Grace and Skubic, Marjorie A (2018) Balance and Gait Impairment: Sensor-Based Assessment for Patients With Peripheral Neuropathy. Clinical journal of oncology nursing 22(3): 316-325	- Review article but not a systematic review
Carazo, Matthew, Sadarangani, Tina, Natarajan, Sundar et al. (2017) Prognostic Utility of the Braden Scale and the Morse Fall Scale in Hospitalized Patients With Heart Failure. Western journal of nursing research 39(4): 507-523	- Data not reported in an extractable format or a format that can be analysed
Carpenter, Christopher R, Avidan, Michael S, Wildes, Tanya et al. (2014) Predicting geriatric falls following an episode of emergency department care: a systematic review. Academic emergency medicine : official journal of the Society for Academic Emergency Medicine 21(10): 1069-82	- Study does not contain an intervention relevant to this review protocol
Castaldo, Rossana, Melillo, Paolo, Izzo, R et al. (2017) Fall Prediction in Hypertensive Patients via Short-Term HRV Analysis. IEEE journal of biomedical and health informatics 21(2): 399-406	- Study does not contain an intervention relevant to this review protocol
Castellini, Greta, Gianola, Silvia, Stucovitz, Elena et al. (2019) Diagnostic test accuracy of an automated device as a screening tool for fall risk assessment in community-residing elderly: A STARD compliant study. Medicine 98(39): e17105	- Study design not relevant to this review protocol *Cross sectional*
Cattelani, Luca, Palumbo, Pierpaolo, Palmerini, Luca et al. (2015) FRAT-up, a Web-based fall-risk assessment tool for elderly people living in the community. Journal of medical Internet research 17(2): e41	- Study does not contain an intervention relevant to this review protocol
Cella, Alberto, De Luca, Alice, Squeri, Valentina et al. (2020) Development and validation of a robotic multifactorial fall-risk predictive model: A one-year prospective study in community-dwelling older adults. PloS one 15(6): e0234904	- Study population <100
Chantanachai, Thanwarat; Pichaiyongwongdee, Sopa; Jalayondeja, Chutima (2014) Fall prediction in thai elderly with timed up and go and tandem walk test: a cross-sectional study. Journal of the Medical Association of Thailand = Chotmaihet thangphaet 97suppl7: 21-5	- Study does not contain an intervention relevant to this review protocol
Chen, Manting, Wang, Hailiang, Yu, Lisha et al. (2022) A Systematic Review of Wearable Sensor-Based Technologies for Fall Risk Assessment in Older Adults. Sensors (Basel, Switzerland) 22(18)	- Systematic review used as source of primary studies
Chen, Shih-Hai, Lee, Chia-Hsuan, Jiang, Bernard C et al. (2021) Using a Stacked Autoencoder for Mobility and Fall Risk Assessment via Time-Frequency Representations of the Timed Up and Go Test. Frontiers in physiology 12: 668350	- Population not relevant to this review protocol
Chiang, Tsai-Lien, Hsu, Chan-Peng, Yuan, Yu-Jie et al. (2022) Can EMS providers and emergency department nurses work together to identify home risk factors for falls in older people?. Medicine 101(38): e30752	- Data not reported in an extractable format or a format that can be analysed

Study	Code [Reason]
Chinnadurai, Somasundaram Aadhimoolam, Gandhirajan, Divya, Srinivasan, Avathvadi Venkatesan et al. (2018) Predicting falls in multiple sclerosis: Do electrophysiological measures have a better predictive accuracy compared to clinical measures?. Multiple sclerosis and related disorders 20: 199-203	- Study does not contain an intervention relevant to this review protocol
Chow, Richard B, Lee, Andre, Kane, Bryan G et al. (2019) Effectiveness of the "Timed Up and Go" (TUG) and the Chair test as screening tools for geriatric fall risk assessment in the ED. The American journal of emergency medicine 37(3): 457-460	- Study does not contain an intervention relevant to this review protocol
Coker, Esther and Oliver, David (2003) Evaluation of the STRATIFY falls prediction tool on a geriatric unit. Outcomes management 7(1): 8-6	- Study does not contain an intervention relevant to this review protocol
Colagiorgio, P, Romano, F, Sardi, F et al. (2014) Affordable, automatic quantitative fall risk assessment based on clinical balance scales and Kinect data. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2014: 3500-3	- Data not reported in an extractable format or a format that can be analysed
Coll-Planas, Laura, Kron, Martina, Sander, Silvia et al. (2006) Accidental falls among community-dwelling older adults: improving the identification process of persons at risk by nursing staff. Zeitschrift fur Gerontologie und Geriatrie 39(4): 277-82	- Study does not contain an intervention relevant to this review protocol
Colon-Emeric, Cathleen S, McDermott, Cara L, Lee, Deborah S et al. (2024) Risk Assessment and Prevention of Falls in Older Community-Dwelling Adults: A Review. JAMA 331(16): 1397-1406	- Systematic review used as a source of primary studies
Criter, Robin E and Honaker, Julie A (2016) Identifying Balance Measures Most Likely to Identify Recent Falls. Journal of geriatric physical therapy (2001) 39(1): 30-7	- Population not relevant to this review protocol
Cuaya, German, Munoz-Melendez, Angelica, Nunez Carrera, Lidia et al. (2013) A dynamic Bayesian network for estimating the risk of falls from real gait data. Medical & biological engineering & computing 51(12): 29-37	- Population not relevant to this review protocol
Cwikel, J G, Fried, A V, Biderman, A et al. (1998) Validation of a fall-risk screening test, the Elderly Fall Screening Test (EFST), for community-dwelling elderly. Disability and rehabilitation 20(5): 161-7	- Study does not contain an intervention relevant to this review protocol
da Costa, Bruno Roza, Rutjes, Anne Wilhelmina Saskia, Mendy, Angelico et al. (2012) Can falls risk prediction tools correctly identify fall-prone elderly rehabilitation inpatients? A systematic review and meta-analysis. PloS one 7(7): e41061	- Study does not contain an intervention relevant to this review protocol
De Brauwer, Isabelle, Cornette, Pascale, Boland, Benoit et al. (2017) Can we predict functional decline in hospitalized older people admitted through the emergency department? Reanalysis of a predictive tool ten years after its conception. BMC geriatrics 17(1): 105	- Study does not contain an intervention relevant to this review protocol
De Brauwer, Isabelle, Lepage, Sylvain, Yombi, Jean-Cyr et al. (2012) Prediction of risk of in-hospital geriatric complications in older patients with hip fracture. Aging clinical and experimental research 24(1): 62-7	- Study does not contain an intervention

Study	Code [Reason]
	relevant to this review protocol
de Souza Moreira, Bruno, Mourao Barroso, Cristiano, Cavalcanti Furtado, Sheyla Rossana et al. (2015) Clinical functional tests help identify elderly women highly concerned about falls. Experimental aging research 41(1): 89-103	- Study does not contain an intervention relevant to this review protocol
Delbaere K, Van den Noortgate N, Bourgois J et al. (2006) The Physical Performance Test as a predictor of frequent fallers: a prospective community-based cohort study. Clinical rehabilitation 20(1): 83-90	- Study does not contain an intervention relevant to this review protocol
Demons, Jamehl L, Chenna, Swapna, Callahan, Kathryn E et al. (2014) Utilizing a Meals on Wheels program to teach falls risk assessment to medical students. Gerontology & geriatrics education 35(4): 409-20	- Data not reported in an extractable format or a format that can be analysed
Deng, You, Lin, Lin, Hou, Lijun et al. (2020) A self-reported Frailty Index predicts long-term mortality in hospitalized patients with cirrhosis. Annals of translational medicine 8(19): 1217	- Study does not contain an intervention relevant to this review protocol
Deng, Yi and Sato, Naomi (2024) Global frailty screening tools: Review and application of frailty screening tools from 2001 to 2023. Intractable & rare diseases research 13(1): 1-11	- Systematic review used as a source of primary studies
Di Rosa, Mirko, Hausdorff, Jeff M, Stara, Vera et al. (2017) Concurrent validation of an index to estimate fall risk in community dwelling seniors through a wireless sensor insole system: A pilot study. Gait & posture 55: 6-11	- Population not relevant to this review protocol
Doheny, Emer P, Fan, Chie Wei, Foran, Timothy et al. (2011) An instrumented sit-to-stand test used to examine differences between older fallers and non-fallers. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2011: 3063-6	- Study does not contain an intervention relevant to this review protocol
Doheny, Emer P, McGrath, Denise, Greene, Barry R et al. (2012) Displacement of centre of mass during quiet standing assessed using accelerometry in older fallers and non-fallers. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2012: 3300-3	- Conference abstract.
Doi, Takehiko, Hirata, Soichiro, Ono, Rei et al. (2013) The harmonic ratio of trunk acceleration predicts falling among older people: results of a 1-year prospective study. Journal of neuroengineering and rehabilitation 10: 7	- Population not relevant to this review protocol
Dolatabadi, Elham, Van Ooteghem, Karen, Taati, Babak et al. (2018) Quantitative Mobility Assessment for Fall Risk Prediction in Dementia: A Systematic Review. Dementia and geriatric cognitive disorders 45(56): 353-367	- Data not reported in an extractable format or a format that can be analysed
Donate-Martinez, Ascension; Alhambra-Borras, Tamara; Dura-Ferrandis, Estrella (2022) Frailty as a Predictor of Adverse Outcomes among Spanish Community-Dwelling Older Adults. International journal of environmental research and public health 19(19)	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Downey, Patricia A; Perry, Susan B; Anderson, Janice M (2013) Screening postmenopausal women for fall and fracture prevention. Journal of geriatric physical therapy (2001) 36(3): 138-45	- Study design not relevant to this review protocol
Dubois, Amandine; Bihl, Titus; Bresciani, Jean-Pierre (2017) Automating the Timed Up and Go Test Using a Depth Camera. Sensors (Basel, Switzerland) 18(1)	- Population not relevant to this review protocol
Duncan, Ryan P, Leddy, Abigail L, Cavanaugh, James T et al. (2012) Accuracy of fall prediction in Parkinson disease: six-month and 12-month prospective analyses. Parkinson's disease 2012: 237673	- Population not relevant to this review protocol
Eagle DJ, Salama S, Whitman D et al. (1999) Comparison of three instruments in predicting accidental falls in selected inpatients in a general teaching hospital. Journal of gerontological nursing 25(7): 40-45	- Study does not contain an intervention relevant to this review protocol
Eagles, Debra, Yadav, Krishan, Perry, Jeffrey J et al. (2018) Mobility assessments of geriatric emergency department patients: A systematic review. CJEM 20(3): 353-361	- Data not reported in an extractable format or a format that can be analysed
Eichler, Nadav, Raz, Shmuel, Toledano-Shubi, Adi et al. (2022) Automatic and Efficient Fall Risk Assessment Based on Machine Learning. Sensors (Basel, Switzerland) 22(4)	- Study does not contain an intervention relevant to this review protocol
Ejupi, Andreas; Lord, Stephen R; Delbaere, Kim (2014) New methods for fall risk prediction. Current opinion in clinical nutrition and metabolic care 17(5): 407-11	- Review article but not a systematic review
Elledge, Julie (2017) Concordance of Motion Sensor and Clinician-Rated Fall Risk Scores in Older Adults. Computers, informatics, nursing : CIN 35(12): 624-629	- Population not relevant to this review protocol
Eost-Telling, Charlotte, Yang, Yang, Norman, Gill et al. (2024) Digital technologies to prevent falls in people living with dementia or mild cognitive impairment: a rapid systematic overview of systematic reviews. Age and ageing 53(1)	- Systematic review used as a source of primary studies
Faber, Marjan J; Bosscher, Ruud J; van Wieringen, Piet C W (2006) Clinimetric properties of the performance-oriented mobility assessment. Physical therapy 86(7): 944-54	- Population not relevant to this review protocol
Fabre, Jennifer M, Ellis, Rebecca, Kosma, Maria et al. (2010) Falls risk factors and a compendium of falls risk screening instruments. Journal of geriatric physical therapy (2001) 33(4): 184-97	- Review article but not a systematic review
Fielding, Susan J; McKay, Michael; Hyrkas, Kristiina (2013) Testing the reliability of the Fall Risk Screening Tool in an elderly ambulatory population. Journal of nursing management 21(8): 1008-15	- Data not reported in an extractable format or a format that can be analysed
Fischer, Barbara L, Hoyt, William T, Maucieri, Lawrence et al. (2014) Performance-based assessment of falls risk in older veterans with executive dysfunction. Journal of rehabilitation research and development 51(2): 263-74	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Fischer, M.G.; Josef, K.L.; Russell, J.H. (2020) Functional outcomes graded with normative data can predict postdischarge falls and 30-day readmissions in hospitalized older adults. Journal of Acute Care Physical Therapy 11(4): 201-215	- Population not relevant to this review protocol
Flaherty, L M and Josephson, N C (2013) Screening for fall risk in patients with haemophilia. Haemophilia : the official journal of the World Federation of Hemophilia 19(3): e103-9	- Review article but not a systematic review
Flannery, Caragh, Dennehy, Rebecca, Riordan, Fiona et al. (2022) Enhancing referral processes within an integrated fall prevention pathway for older people: a mixed-methods study. BMJ open 12(8): e056182	- Study does not contain an intervention relevant to this review protocol
Flemming, Patricia J and Ramsay, Katherine (2012) Falls risk assessment begins with hello: lessons learned from the use of one home health agency's fall risk tool. Home healthcare nurse 30(9): 516-23	- Review article but not a systematic review
Forrester, D A; McCabe-Bender, J; Tiedeken, K (1999) Fall risk assessment of hospitalized adults and follow-up study. Journal for nurses in staff development : JNSD : official journal of the National Nursing Staff Development Organization 15(6): 251-9	- Data not reported in an extractale format or a format that can be analysed
French, Dustin D, Werner, Dennis C, Campbell, Robert R et al. (2007) A multivariate fall risk assessment model for VHA nursing homes using the minimum data set. Journal of the American Medical Directors Association 8(2): 115-22	- Study does not contain an intervention relevant to this review protocol
Frisendahl, Nathalie, Ek, Stina, Rosendahl, Erik et al. (2022) Can the 1-Leg Standing Test Be Replaced by Self-reported Balance in the First-Time Injurious Fall Screening Tool?. Journal of geriatric physical therapy (2001)	- Study does not contain an intervention relevant to this review protocol
Fu, C.-J., Chen, W.-C., Lu, M.-L. et al. (2021) Equipment-free fall-risk assessments for the functionally independent elderly: A systematic review and meta-analysis. International Journal of Gerontology 15(4): 301-308	- Study does not contain an intervention relevant to this review protocol
Gade, Gustav Valentin, Jorgensen, Martin Gronbech, Ryg, Jesper et al. (2021) Predicting falls in community-dwelling older adults: a systematic review of prognostic models. BMJ open 11(5): e044170	- Study does not contain an intervention relevant to this review protocol
Gafner, Simone Chantal, Allet, Lara, Hilfiker, Roger et al. (2021) Reliability and Diagnostic Accuracy of Commonly Used Performance Tests Relative to Fall History in Older Persons: A Systematic Review. Clinical interventions in aging 16: 1591-1616	- Systematic review used as source of primary studies
Gafner, Simone Chantal, Bastiaenen, Caroline Henrice Germaine, Ferrari, Serge et al. (2020) The Role of Hip Abductor Strength in Identifying Older Persons at Risk of Falls: A Diagnostic Accuracy Study. Clinical interventions in aging 15: 645-654	- Study does not contain an intervention relevant to this review protocol
Galindo-Ciocon, D J; Ciocon, J O; Galindo, D J (1995) Gait training and falls in the elderly. Journal of gerontological nursing 21(6): 10-7	- Population not relevant to this review protocol

Study	Code [Reason]
Ganz, David A, Bao, Yeran, Shekelle, Paul G et al. (2007) Will my patient fall?. JAMA 297(1): 77-86	- Study does not contain an intervention relevant to this review protocol
Gates, Simon, Smith, Lesley A, Fisher, Joanne D et al. (2008) Systematic review of accuracy of screening instruments for predicting fall risk among independently living older adults. Journal of rehabilitation research and development 45(8): 1105-16	- More recent systematic review included that covers the same topic
Gemmeke, Marle, Koster, Ellen S, Pajouheshnia, Romin et al. (2021) Using pharmacy dispensing data to predict falls in older individuals. British journal of clinical pharmacology 87(3): 1282-1290	- Study does not contain an intervention relevant to this review protocol
Giansanti, Daniele, Maccioni, Giovanni, Cesinaro, Stefano et al. (2008) Assessment of fall-risk by means of a neural network based on parameters assessed by a wearable device during posturography. Medical engineering & physics 30(3): 367-72	- Population not relevant to this review protocol
Gietzelt, Matthias, Nemitz, Gerhard, Wolf, Klaus-Hendrik et al. (2009) A clinical study to assess fall risk using a single waist accelerometer. Informatics for health & social care 34(4): 181-8	- Study does not contain an intervention relevant to this review protocol
Gillain, S, Boutaayamou, M, Beaudart, C et al. (2018) Assessing gait parameters with accelerometer-based methods to identify older adults at risk of falls: a systematic review. European geriatric medicine 9(4): 435-448	- Systematic review used as source of primary studies
Gobbens, Robbert Jj, Boersma, Petra, Uchmanowicz, Izabella et al. (2020) The Tilburg Frailty Indicator (TFI): New Evidence for Its Validity. Clinical interventions in aging 15: 265-274	- Study does not contain an intervention relevant to this review protocol
Godfrey, A (2017) Wearables for independent living in older adults: Gait and falls. Maturitas 100: 16-26	- Study does not contain an intervention relevant to this review protocol
Goldberg, Elizabeth M, Marks, Sarah J, Ilegbusi, Aderonke et al. (2020) GAPcare: The Geriatric Acute and Post-Acute Fall Prevention Intervention in the Emergency Department: Preliminary Data. Journal of the American Geriatrics Society 68(1): 198-206	- Study does not contain an intervention relevant to this review protocol
Gonzalez-Colaco Harmand, Magali, Meillon, Celine, Bergua, Valerie et al. (2017) Comparing the predictive value of three definitions of frailty: Results from the Three-City study. Archives of gerontology and geriatrics 72: 153-163	- Study does not contain an intervention relevant to this review protocol
Gor-Garcia-Fogeda, Maria Dolores, Cano de la Cuerda, Roberto, Carratala Tejada, Maria et al. (2016) Observational Gait Assessments in People With Neurological Disorders: A Systematic Review. Archives of physical medicine and rehabilitation 97(1): 131-40	- Systematic review used as source of primary studies

Study	Code [Reason]
Greenberg, Marna, Jacoby, Jeanne, Barraco, Robert D et al. (2021) Analysis of Falls Efficacy Scale and Vulnerable Elders Survey as Predictors of Falls. Cureus 13(4): e14471	- Study does not contain an intervention relevant to this review protocol
Greene, Barry R, Doheny, Emer P, Kenny, Rose A et al. (2014) Classification of frailty and falls history using a combination of sensor-based mobility assessments. Physiological measurement 35(10): 2053-66	- Data not reported in an extractable format or a format that can be analysed
Greene, Barry R, Premoli, Isabella, McManus, Killian et al. (2021) Predicting Fall Counts Using Wearable Sensors: A Novel Digital Biomarker for Parkinson's Disease. Sensors (Basel, Switzerland) 22(1)	- Study does not contain an intervention relevant to this review protocol
Greene, Barry R, Doheny, Emer P, McManus, Killian et al. (2022) Estimating balance, cognitive function, and falls risk using wearable sensors and the sit-to-stand test. Wearable technologies 3: e9	- Study design not relevant to this review protocol
Grosshauser, Franz J, Schoene, Daniel, Kiesswetter, Eva et al. (2022) Frailty in Nursing Homes-A Prospective Study Comparing the FRAIL-NH and the Clinical Frailty Scale. Journal of the American Medical Directors Association 23(10): 1717e1-1717e8	- Study does not contain an intervention relevant to this review protocol
Guerard, Emily J, Deal, Allison M, Williams, Grant R et al. (2015) Falls in Older Adults With Cancer: Evaluation by Oncology Providers. Journal of oncology practice 11(6): 470-4	- Study does not contain an intervention relevant to this review protocol
Gulley, Emma; Ayers, Emmeline; Verghese, Joe (2020) A comparison of turn and straight walking phases as predictors of incident falls. Gait & posture 79: 239-243	- Data not reported in an extractable format or a format that can be analysed
Gutierrez-Valencia, M.; Leache, L.; Saiz, L.C. (2022) Review of the validity of fall risk assessment scales in hospitalised patients. Revista Espanola de Geriatria y Gerontologia 57(3): 186-194	- Study not reported in English
Hachiya, Mizuki, Murata, Shin, Otao, Hiroshi et al. (2015) Usefulness of a 50-meter round walking test for fall prediction in the elderly requiring long-term care. Journal of physical therapy science 27(12): 3663-6	- Study does not contain an intervention relevant to this review protocol
Haines T, Kuys SS, Morrison G et al. (2009) Cost-effectiveness analysis of screening for risk of in-hospital falls using physiotherapist clinical judgement. Medical care 47(4): 448-456	- Study does not contain an intervention relevant to this review protocol
Haines, Terry P, Bennell, Kim L, Osborne, Richard H et al. (2006) A new instrument for targeting falls prevention interventions was accurate and clinically applicable in a hospital setting. Journal of clinical epidemiology 59(2): 168-75	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Haines, Terry P, Hill, Keith D, Bennell, Kim L et al. (2006) Recurrent events counted in evaluations of predictive accuracy. Journal of clinical epidemiology 59(11): 1155-61	- Study does not contain an intervention relevant to this review protocol
Haines, Terry, Kuys, Suzanne S, Morrison, Greg et al. (2008) Balance impairment not predictive of falls in geriatric rehabilitation wards. The journals of gerontology. Series A, Biological sciences and medical sciences 63(5): 523-8	- Study does not contain an intervention relevant to this review protocol
Halter, Mary, Vernon, Susan, Snooks, Helen et al. (2011) Complexity of the decision-making process of ambulance staff for assessment and referral of older people who have fallen: a qualitative study. Emergency medicine journal : EMJ 28(1): 44-50	- Study does not contain an intervention relevant to this review protocol
Hamacher, D, Singh, N B, Van Dieen, J H et al. (2011) Kinematic measures for assessing gait stability in elderly individuals: a systematic review. Journal of the Royal Society, Interface 8(65): 1682-98	- Systematic review used as source of primary studies
Han, J., Xu, L., Zhou, C. et al. (2017) Stratify, hendrich II fall risk model and morse fall scale used in predicting the risk of falling for elderly in-patients. Biomedical Research (India) 2017(specialissuehealthscienceandbioconvergencetechnologyeditionii): 439-s442	- Study does not contain an intervention relevant to this review protocol
Harper, Kristie J, Barton, Annette D, Arendts, Glenn et al. (2018) Failure of falls risk screening tools to predict outcome: a prospective cohort study. Emergency medicine journal : EMJ 35(1): 28-32	- Study does not contain an intervention relevant to this review protocol
Harper, Kristie J, Riley, Vera, Petta, Antonio et al. (2020) Occupational therapist use of the 'Timed Up and Go' test in a Memory Clinic to compare performance between cognitive diagnoses and screen for falls risk. Australian occupational therapy journal 67(1): 13-21	- Study does not contain an intervention relevant to this review protocol
Harrington, Linda, Luquire, Rosemary, Vish, Nancy et al. (2010) Meta-analysis of fall-risk tools in hospitalized adults. The Journal of nursing administration 40(11): 483-8	- Study does not contain an intervention relevant to this review protocol
Hawk, Cheryl, Hyland, John K, Rupert, Ronald et al. (2006) Assessment of balance and risk for falls in a sample of community-dwelling adults aged 65 and older. Chiropractic & osteopathy 14: 3	- Data not reported in an extractable format or a format that can be analysed
Healey, Frances and Haines, Terry P (2013) A pragmatic study of the predictive values of the Morse falls score. Age and ageing 42(4): 462-8	- Study does not contain an intervention relevant to this review protocol
Heim, Noor, van Fenema, Ester M, Weverling-Rijnsburger, Annelies W E et al. (2015) Optimal screening for increased risk for adverse outcomes in hospitalised older adults. Age and ageing 44(2): 239-44	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Hellmers, Sandra, Izadpanah, Babak, Dasenbrock, Lena et al. (2018) Towards an Automated Unsupervised Mobility Assessment for Older People Based on Inertial TUG Measurements. Sensors (Basel, Switzerland) 18(10)	- Data not reported in an extractable format or a format that can be analysed
Herman, Talia, Mirelman, Anat, Giladi, Nir et al. (2010) Executive control deficits as a prodrome to falls in healthy older adults: a prospective study linking thinking, walking, and falling. The journals of gerontology. Series A, Biological sciences and medical sciences 65(10): 1086-92	- Study does not contain an intervention relevant to this review protocol
Hermann, Olena, Schmidt, Simone B, Boltzmann, Melanie et al. (2018) Comparison of fall prediction by the Hessisch Oldendorf Fall Risk Scale and the Fall Risk Scale by Huhn in neurological rehabilitation: an observational study. Clinical rehabilitation 32(5): 671-678	- Study does not contain an intervention relevant to this review protocol
Hester, Amy L and Davis, Dees M (2013) Validation of the Hester Davis Scale for fall risk assessment in a neurosciences population. The Journal of neuroscience nursing : journal of the American Association of Neuroscience Nurses 45(5): 298-305	- Study does not contain an intervention relevant to this review protocol
Hirase, Tatsuya, Inokuchi, Shigeru, Matsusaka, Nobuou et al. (2014) A modified fall risk assessment tool that is specific to physical function predicts falls in community-dwelling elderly people. Journal of geriatric physical therapy (2001) 37(4): 159-65	- Study does not contain an intervention relevant to this review protocol
Hnizdo, Sandra, Archuleta, Raquel A, Taylor, Barbara et al. (2013) Validity and reliability of the modified John Hopkins Fall Risk Assessment Tool for elderly patients in home health care. Geriatric nursing (New York, N.Y.) 34(5): 423-7	- Study does not contain an intervention relevant to this review protocol
Hoffmann, V S, Neumann, L, Golgert, S et al. (2015) Pro-Active Fall-Risk Management is Mandatory to Sustain in Hospital-Fall Prevention in Older Patients--Validation of the LUCAS Fall-Risk Screening in 2,337 Patients. The journal of nutrition, health & aging 19(10): 1012-8	- Study does not contain an intervention relevant to this review protocol
Hofheinz, Martin and Mibs, Michael (2016) The Prognostic Validity of the Timed Up and Go Test With a Dual Task for Predicting the Risk of Falls in the Elderly. Gerontology & geriatric medicine 2: 2333721416637798	- Study does not contain an intervention relevant to this review protocol
Hohtari-Kivimaki, Ulla, Salminen, Marika, Vahlberg, Tero et al. (2016) Predicting Value of Nine-Item Berg Balance Scale Among the Aged: A 3-Year Prospective Follow-Up Study. Experimental aging research 42(2): 151-60	- Data not reported in an extractable format or a format that can be analysed
Homma, D., Minato, I., Imai, N. et al. (2023) Analysis of Phase Angle and Balance and Gait Functions in Pre-Frail Individuals: A Cross-Sectional Observational Study. Acta medica Okayama 77(1): 21-27	- Study design not relevant to this review protocol
Hohtari-Kivimaki, Ulla, Salminen, Marika, Vahlberg, Tero et al. (2013) Short Berg Balance Scale, BBS-9, as a predictor of fall risk among the aged: a prospective 12-month follow-up study. Aging clinical and experimental research 25(6): 645-50	- Data not reported in an extractable format or a format that can be analysed

Study	Code [Reason]
Hong, J., Min, J.-Y., Kim, S. et al. (2017) Success rate in tracking moving target with center of gravity in left-right direction predicts six-month fall in elderly. Journal of Clinical Gerontology and Geriatrics 8(4): 108-113	- Data not reported in an extractable format or a format that can be analysed
Horak, Fay B, Laird, Amy, Carlson-Kuhta, Patricia et al. (2023) The Instrumented Stand and Walk (ISAW) test to predict falls in older men. GeroScience 45(2): 823-836	- Study does not contain an intervention relevant to this review protocol
Hou, Wen-Hsuan, Kang, Chun-Mei, Ho, Mu-Hsing et al. (2017) Evaluation of an inpatient fall risk screening tool to identify the most critical fall risk factors in inpatients. Journal of clinical nursing 26(56): 698-706	- Study does not contain an intervention relevant to this review protocol
Howcroft, Jennifer; Kofman, Jonathan; Lemaire, Edward D (2013) Review of fall risk assessment in geriatric populations using inertial sensors. Journal of neuroengineering and rehabilitation 10(1): 91	- Study does not contain an intervention relevant to this review protocol
Hubbard, R E and Story, D A (2014) Patient frailty: the elephant in the operating room. Anaesthesia 69suppl1: 26-34	- Review article but not a systematic review
Hubbard, Ruth E, Peel, Nancye M, Samanta, Mayukh et al. (2017) Frailty status at admission to hospital predicts multiple adverse outcomes. Age and ageing 46(5): 801-806	- Study does not contain an intervention relevant to this review protocol
Huded, Jill M, Dresden, Scott M, Gravenor, Stephanie J et al. (2015) Screening for Fall Risks in the Emergency Department: A Novel Nursing-Driven Program. The western journal of emergency medicine 16(7): 1043-6	- Study does not contain an intervention relevant to this review protocol
Hunderfund, Andrea N Leep, Sweeney, Cynthia M, Mandrekar, Jayawant N et al. (2011) Effect of a multidisciplinary fall risk assessment on falls among neurology inpatients. Mayo Clinic proceedings 86(1): 19-24	- Data not reported in an extractable format or a format that can be analysed
Hur, Eun Young, Jin, Yinji, Jin, Taixian et al. (2017) Longitudinal Evaluation of Johns Hopkins Fall Risk Assessment Tool and Nurses' Experience. Journal of nursing care quality 32(3): 242-251	- Study does not contain an intervention relevant to this review protocol
Ibrahim, Azianah, Singh, Devinder Kaur Ajit, Shahar, Suzana et al. (2017) Timed up and go test combined with self-rated multifactorial questionnaire on falls risk and sociodemographic factors predicts falls among community-dwelling older adults better than the timed up and go test on its own. Journal of multidisciplinary healthcare 10: 409-416	- Study does not contain an intervention relevant to this review protocol
Irvin, D J (1999) Psychiatric unit fall event. Journal of psychosocial nursing and mental health services 37(12): 8-16	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Jacobsohn, Gwen Costa, Leaf, Margaret, Liao, Frank et al. (2022) Collaborative design and implementation of a clinical decision support system for automated fall-risk identification and referrals in emergency departments. Healthcare (Amsterdam, Netherlands) 10(1): 100598	- Data not reported in an extractable format or a format that can be analysed
Jahantabi-Nejad, Seifollah and Azad, Akram (2019) Predictive accuracy of performance oriented mobility assessment for falls in older adults: A systematic review. Medical journal of the Islamic Republic of Iran 33: 38	- Systematic review used as source of primary studies
Johnson, M; Cusick, A; Chang, S (2001) Home-screen: a short scale to measure fall risk in the home. Public health nursing (Boston, Mass.) 18(3): 169-77	- Data not reported in an extractable format or a format that can be analysed
Johnston, Kylie; Barras, Sarah; Grimmer-Somers, Karen (2010) Relationship between pre-discharge occupational therapy home assessment and prevalence of post-discharge falls. Journal of evaluation in clinical practice 16(6): 1333-9	- Study does not contain an intervention relevant to this review protocol
Jordre, B., Schweinle, W., Oetjen, S. et al. (2016) Fall History and Associated Physical Performance Measures in Competitive Senior Athletes. Topics in Geriatric Rehabilitation 32(1): 1-6	- Study does not contain an intervention relevant to this review protocol
Jung, Hee-Won, Baek, Ji Yeon, Kwon, Young Hye et al. (2022) At-Point Clinical Frailty Scale as a Universal Risk Tool for Older Inpatients in Acute Hospital: A Cohort Study. Frontiers in medicine 9: 929555	- Study does not contain an intervention relevant to this review protocol
Jung, Hyesil and Park, Hyeoun-Ae (2018) Testing the Predictive Validity of the Hendrich II Fall Risk Model. Western journal of nursing research 40(12): 1785-1799	- Study does not contain an intervention relevant to this review protocol
Kajzar, J, Janatova, M, Hill, M et al. (2022) Performance of Homebalance Test in an Assessment of Standing Balance in Elderly Adults. Physiological research 71(2): 305-315	- Data not reported in an extractable format or a format that can be analysed
Kamide, N.; Shiba, Y.; Takahashi, K. (2011) Determination of reference values for timed up and go test in healthy Japanese elderly people using methodology of meta-analysis. Physiotherapy (United Kingdom) 97(suppl1): es1526	- Conference abstract.
Kang, Li, Han, Peipei, Wang, Jiazhong et al. (2017) Timed Up and Go Test can predict recurrent falls: a longitudinal study of the community-dwelling elderly in China. Clinical interventions in aging 12: 2009-2016	- Study does not contain an intervention relevant to this review protocol
Kanne, Geraldine E, Sabol, Valerie K, Pierson, Dana et al. (2021) On the Move clinic: A fall prevention nurse practitioner-driven model of care. Geriatric nursing (New York, N.Y.) 42(4): 850-854	- Study design not relevant to this review protocol

Study	Code [Reason]
Karani, Mamta V; Haddad, Yara; Lee, Robin (2016) The Role of Pharmacists in Preventing Falls among America's Older Adults. Frontiers in public health 4: 250	- Study does not contain an intervention relevant to this review protocol
Karlsson, Lee, Doe, Kelsey, Gerry, Meghan et al. (2020) Outcomes of a Physical Therapist-Led, Statewide, Community-Based Fall Risk Screening. Journal of geriatric physical therapy (2001) 43(4): 185-193	- Data not reported in an extractable format or a format that can be analysed
Kegelmeyer, Deb A, Kloos, Anne D, Thomas, Karen M et al. (2007) Reliability and validity of the Tinetti Mobility Test for individuals with Parkinson disease. Physical therapy 87(10): 1369-78	- Conference abstract.
Kehinde, Julius Oluwole (2009) Instruments for measuring fall risk in older adults living in long-term care facilities: an integrative review. Journal of gerontological nursing 35(10): 46-55	- More recent systematic review included that covers the same topic
Keuseman, Rachel and Miller, Donna (2020) A hospitalist's role in preventing patient falls. Hospital practice (1995) 48(sup1): 63-67	- Review article but not a systematic review
Kim MJ, Seino S, Kim MK et al. (2009) Validation of lower extremity performance tests for determining the mobility limitation levels in community-dwelling older women. Aging clinical and experimental research 21(6): 437-444	- Study does not contain an intervention relevant to this review protocol
Kim, Emily Ang Neo, Mordiffi, Siti Zubaidah, Bee, Wong Hwee et al. (2007) Evaluation of three fall-risk assessment tools in an acute care setting. Journal of advanced nursing 60(4): 427-35	- Study does not contain an intervention relevant to this review protocol
Kim, Chaesu; Park, Haeun; You, Joshua Sung (2023) Ecological Fall Prediction Sensitivity, Specificity, and Accuracy in Patients with Mild Cognitive Impairment at a High Risk of Falls. Sensors (Basel, Switzerland) 23(15)	- Study population <100
Kinn, Sue and Clawson, Denise (2002) Health visitor risk assessment for preventing falls in elderly people. British journal of nursing (Mark Allen Publishing) 11(5): 316-21	- Study does not contain an intervention relevant to this review protocol
Kirk, Ben, French, Chloe, Gebauer, Maria et al. (2023) Diagnostic power of relative sit-to-stand muscle power, grip strength, and gait speed for identifying a history of recurrent falls and fractures in older adults. European geriatric medicine 14(3): 421-428	- Study design not relevant to this review protocol
Kline, Nancy E; Davis, Mary Elizabeth; Thom, Bridgette (2011) Fall risk assessment and prevention. Oncology (Williston Park, N.Y.) 25(2supplnurseed): 17-22	- Data not reported in an extractable format or a format that can be analysed
Klinkenberg, W Dean and Potter, Patricia (2017) Validity of the Johns Hopkins Fall Risk Assessment Tool for Predicting Falls on Inpatient Medicine Services. Journal of nursing care quality 32(2): 108-113	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Koh, Vanessa, Xuan, Lai Wei, Zhe, Tan Kai et al. (2024) Performance of digital technologies in assessing fall risks among older adults with cognitive impairment: a systematic review. GeroScience 46(3): 2951-2975	- Systematic review used as a source of primary studies
Kojima, Gotaro, Kendrick, Denise, Skelton, Dawn A et al. (2015) Frailty predicts short-term incidence of future falls among British community-dwelling older people: a prospective cohort study nested within a randomised controlled trial. BMC geriatrics 15: 155	- Study does not contain an intervention relevant to this review protocol
Kojima, Gotaro, Masud, Tahir, Kendrick, Denise et al. (2015) 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 geriatrics 15: 38	- Study does not contain an intervention relevant to this review protocol
Kopke, Sascha and Meyer, Gabriele (2006) The Tinetti test: Babylon in geriatric assessment. Zeitschrift fur Gerontologie und Geriatrie 39(4): 288-91	- Review article but not a systematic review
Kozinc, Ziga, Lofler, Stefan, Hofer, Christian et al. (2020) Diagnostic Balance Tests for Assessing Risk of Falls and Distinguishing Older Adult Fallers and Non-Fallers: A Systematic Review with Meta-Analysis. Diagnostics (Basel, Switzerland) 10(9)	- Study does not contain an intervention relevant to this review protocol
Kristoffersson, Annica; Du, Jiaying; Ehn, Maria (2021) Performance and Characteristics of Wearable Sensor Systems Discriminating and Classifying Older Adults According to Fall Risk: A Systematic Review. Sensors (Basel, Switzerland) 21(17)	- Systematic review used as source of primary studies
Kubicki, A, Laroche, D, Coquisart, L et al. (2021) The Frail'BESTest: an adaptation of the "balance evaluation system test" for frail older adults; Concurrent validity, responsiveness, validity for fall prediction and detection of slower walkers. European review of aging and physical activity : official journal of the European Group for Research into Elderly and Physical Activity 18(1): 22	- Data not reported in an extractable format or a format that can be analysed
Kulmala, Jenni, Viljanen, Anne, Sipila, Sarianna et al. (2009) Poor vision accompanied with other sensory impairments as a predictor of falls in older women. Age and ageing 38(2): 162-7	- Study does not contain an intervention relevant to this review protocol
Lajoie, Y and Gallagher, S P (2004) Predicting falls within the elderly community: comparison of postural sway, reaction time, the Berg balance scale and the Activities-specific Balance Confidence (ABC) scale for comparing fallers and non-fallers. Archives of gerontology and geriatrics 38(1): 11-26	- Study design not relevant to this review protocol *Derivation study*
Lam, Freddy M H; Leung, Jason C S; Kwok, Timothy C Y (2019) The Clinical Potential of Frailty Indicators on Identifying Recurrent Fallers in the Community: The Mr. Os and Ms. OS Cohort Study in Hong Kong. Journal of the American Medical Directors Association 20(12): 1605-1610	- Study does not contain an intervention relevant to this review protocol
Lamb, Sarah E, McCabe, Chris, Becker, Clemens et al. (2008) The optimal sequence and selection of screening test items to predict fall risk in older disabled women: the Women's Health and Aging Study. The journals of gerontology. Series A, Biological sciences and medical sciences 63(10): 1082-8	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Latorre, Jorge, Colomer, Carolina, Alcaniz, Mariano et al. (2019) Gait analysis with the Kinect v2: normative study with healthy individuals and comprehensive study of its sensitivity, validity, and reliability in individuals with stroke. Journal of neuroengineering and rehabilitation 16(1): 97	- Population not relevant to this review protocol
Latt, Mark D, Lord, Stephen R, Morris, John G L et al. (2009) Clinical and physiological assessments for elucidating falls risk in Parkinson's disease. Movement disorders : official journal of the Movement Disorder Society 24(9): 1280-9	- Data not reported in an extractable format or a format that can be analysed
Lee, Chia-Hsuan, Chen, Shih-Hai, Jiang, Bernard C et al. (2020) Estimating Postural Stability Using Improved Permutation Entropy via TUG Accelerometer Data for Community-Dwelling Elderly People. Entropy (Basel, Switzerland) 22(10)	- Population not relevant to this review protocol
Lee, Jacob; Geller, Andrew I; Strasser, Dale C (2013) Analytical review: focus on fall screening assessments. PM & R : the journal of injury, function, and rehabilitation 5(7): 609-21	- Systematic review used as source of primary studies
Lee, S.M., Loo, G., Long, W. et al. (2017) Risk assessment and falls prevention in the older adult: Asian experience with the Falls Risk for Older People in the Community tool. Geriatrics and Gerontology International 17(3): 518-519	- Not a peer-reviewed publication
Lektip, C, Chaovalit, S, Wattanapisit, A et al. (2023) Home hazard modification programs for reducing falls in older adults: a systematic review and meta-analysis. PeerJ 11: e15699	- Systematic review used as source of primary studies
Li, Guowei, Thabane, Lehana, Ioannidis, George et al. (2015) Comparison between frailty index of deficit accumulation and phenotypic model to predict risk of falls: data from the global longitudinal study of osteoporosis in women (GLOW) Hamilton cohort. PloS one 10(3): e0120144	- Study does not contain an intervention relevant to this review protocol
Li, J J, Jiang, S, Zhu, M L et al. (2021) Comparison of Three Frailty Scales for Prediction of Adverse Outcomes among Older Adults: A Prospective Cohort Study. The journal of nutrition, health & aging 25(4): 419-424	- Study does not contain an intervention relevant to this review protocol
Liang, Huey-Wen, Ameri, Rasoul, Band, Shahab et al. (2024) Fall risk classification with posturographic parameters in community-dwelling older adults: a machine learning and explainable artificial intelligence approach. Journal of neuroengineering and rehabilitation 21(1): 15	- Study design not relevant to this review protocol
Lima, C A, Ricci, N A, Nogueira, E C et al. (2018) The Berg Balance Scale as a clinical screening tool to predict fall risk in older adults: a systematic review. Physiotherapy 104(4): 383-394	- Systematic review used as source of primary studies
Lin, Mau-Roung, Hwang, Hei-Fen, Hu, Ming-Hsia et al. (2004) Psychometric comparisons of the timed up and go, one-leg stand, functional reach, and Tinetti balance measures in community-dwelling older people. Journal of the American Geriatrics Society 52(8): 1343-8	- Data not reported in an extractable format or a format that can be analysed
Lin, Sumika Mori, Aliberti, Marlon Juliano Romero, Fortes-Filho, Sileno de Queiroz et al. (2018) Comparison of 3 Frailty Instruments in a Geriatric Acute Care Setting in a Low-Middle Income Country. Journal of the American Medical Directors Association 19(4): 310-314e3	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Lindholm, Beata, Nilsson, Maria H, Hansson, Oskar et al. (2018) The clinical significance of 10-m walk test standardizations in Parkinson's disease. Journal of neurology 265(8): 1829-1835	- Study does not contain an intervention relevant to this review protocol
Liu, Jian; Zhang, Xiaoyue; Lockhart, Thurmon E (2012) Fall risk assessments based on postural and dynamic stability using inertial measurement unit. Safety and health at work 3(3): 192-8	- Population not relevant to this review protocol
Lockhart, Thurmon E, Soangra, Rahul, Yoon, Hyunsoo et al. (2021) Prediction of fall risk among community-dwelling older adults using a wearable system. Scientific reports 11(1): 20976	- Population not relevant to this review protocol
Loonlawong, Sriprapa, Limroongreungrat, Weerawat, Rattananupong, Thanapoom et al. (2022) Predictive validity of the Stopping Elderly Accidents, Deaths & Injuries (STEADI) program fall risk screening algorithms among community-dwelling Thai elderly. BMC medicine 20(1): 78	- Study does not contain an intervention relevant to this review protocol
Lord, S R and Dayhew, J (2001) Visual risk factors for falls in older people. Journal of the American Geriatrics Society 49(5): 508-15	- Review article but not a systematic review
Lovallo, Carmela, Rolandi, Stefano, Rossetti, Anna Maria et al. (2010) Accidental falls in hospital inpatients: evaluation of sensitivity and specificity of two risk assessment tools. Journal of advanced nursing 66(3): 690-6	- Study does not contain an intervention relevant to this review protocol
Lundin-Olsson, Lillemor, Jensen, Jane, Nyberg, Lars et al. (2003) Predicting falls in residential care by a risk assessment tool, staff judgement, and history of falls. Aging clinical and experimental research 15(1): 51-9	- Study does not contain an intervention relevant to this review protocol
Luo, Shuhong; Kalman, Melanie; Haines, Pamela (2020) Evaluating a Fall Risk Assessment Tool in an Emergency Department. Journal for healthcare quality : official publication of the National Association for Healthcare Quality 42(4): 205-214	- Study does not contain an intervention relevant to this review protocol
Lusardi, Michelle M, Fritz, Stacy, Middleton, Addie et al. (2017) Determining Risk of Falls in Community Dwelling Older Adults: A Systematic Review and Meta-analysis Using Posttest Probability. Journal of geriatric physical therapy (2001) 40(1): 1-36	- Study does not contain an intervention relevant to this review protocol
Ma, Colleen, Evans, Kelly, Bertmar, Carin et al. (2014) Predictive value of the Royal Melbourne Hospital Falls Risk Assessment Tool (RMH FRAT) for post-stroke patients. Journal of clinical neuroscience : official journal of the Neurosurgical Society of Australasia 21(4): 607-11	- Review article but not a systematic review
Ma, L (2019) Current situation of frailty screening tools for older adults. The journal of nutrition, health & aging 23(1): 111-118	- Study does not contain an intervention relevant to this review protocol
Maki, B E; Holliday, P J; Fernie, G R (1987) A posture control model and balance test for the prediction of relative postural stability. IEEE transactions on bio-medical engineering 34(10): 797-810	- Data not reported in an extractable format or a format that can be analysed

Study	Code [Reason]
Maki, B E; Holliday, P J; Topper, A K (1994) A prospective study of postural balance and risk of falling in an ambulatory and independent elderly population. Journal of gerontology 49(2): m72-84	- Study does not contain an intervention relevant to this review protocol
Marano, Massimo, Motolese, Francesco, Rossi, Mariagrazia et al. (2021) Remote smartphone gait monitoring and fall prediction in Parkinson's disease during the COVID-19 lockdown. Neurological sciences : official journal of the Italian Neurological Society and of the Italian Society of Clinical Neurophysiology 42(8): 3089-3092	- Population not relevant to this review protocol
Marchal, Noah; Skubic, Marjorie; Scott, Grant J (2023) Stepping Beyond Assessment: Fall Risk Prediction Models Among Older Adults from Cumulative Change in Gait Parameter Estimates. AMIA ... Annual Symposium proceedings. AMIA Symposium 2023: 1135-1144	- No useable outcome data
Marques, Nise Ribeiro, Spinoso, Deborah Hebling, Cardoso, Bruna Carvalho et al. (2018) Is it possible to predict falls in older adults using gait kinematics?. Clinical biomechanics (Bristol, Avon) 59: 15-18	- Population not relevant to this review protocol
Marschollek, M, Rehwald, A, Wolf, K H et al. (2011) Sensor-based fall risk assessment--an expert 'to go'. Methods of information in medicine 50(5): 420-6	- Population not relevant to this review protocol
Marschollek, Michael, Rehwald, Anja, Wolf, Klaus-Hendrik et al. (2011) Sensors vs. experts - a performance comparison of sensor-based fall risk assessment vs. conventional assessment in a sample of geriatric patients. BMC medical informatics and decision making 11: 48	- Population not relevant to this review protocol
Marschollek, Michael, Schulze, Mareike, Gietzelt, Matthias et al. (2013) Fall prediction with wearable sensors--an empirical study on expert opinions. Studies in health technology and informatics 190: 138-40	- Population not relevant to this review protocol
Marschollek, Michael, Wolf, Klaus-Hendrik, Gietzelt, Matthias et al. (2008) Assessing elderly persons' fall risk using spectral analysis on accelerometric data--a clinical evaluation study. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2008: 3682-5	- Conference abstract.
Martinez, Maria Carmen, Iwamoto, Viviane Ernesto, Latorre, Maria do Rosario Dias de Oliveira et al. (2019) Validity and reliability of the Brazilian version of the Johns Hopkins Fall Risk Assessment Tool to assess the risk of falls. Revista brasileira de epidemiologia = Brazilian journal of epidemiology 22: e190037	- Study does not contain an intervention relevant to this review protocol
Martinez, Matthew; De Leon, Phillip L; Keeley, David (2019) Bayesian classification of falls risk. Gait & posture 67: 99-103	- Study does not contain an intervention relevant to this review protocol
Matarese, Maria and Ivziku, Dhurata (2016) Falls risk assessment in older patients in hospital. Nursing standard (Royal College of Nursing (Great Britain) : 1987) 30(48): 53-63	- Study does not contain an intervention relevant to this review protocol
Matarese, Maria, Ivziku, Dhurata, Bartolozzi, Francesco et al. (2015) Systematic review of fall risk screening tools for older patients in acute hospitals. Journal of advanced nursing 71(6): 1198-209	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Matinolli, M, Korpelainen, J T, Korpelainen, R et al. (2009) Mobility and balance in Parkinson's disease: a population-based study. European journal of neurology 16(1): 105-11	- Study does not contain an intervention relevant to this review protocol
Matsumoto, Hiromi, Makabe, Tomoyuki, Morita, Tetsuji et al. (2015) Accelerometry-based gait analysis predicts falls among patients with a recent fracture who are ambulatory: a 1-year prospective study. International journal of rehabilitation research. Internationale Zeitschrift fur Rehabilitationsforschung. Revue internationale de recherches de readaptation 38(2): 131-6	- Population not relevant to this review protocol
Meekes, Wytske Ma, Korevaar, Joke C, Leemrijse, Chantal J et al. (2021) Practical and validated tool to assess falls risk in the primary care setting: a systematic review. BMJ open 11(9): e045431	- Systematic review used as source of primary studies
Melillo, Paolo, Castaldo, Rossana, Sannino, Giovanna et al. (2015) Wearable technology and ECG processing for fall risk assessment, prevention and detection. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2015: 7740-3	- Population not relevant to this review protocol
Menant, Jasmine C, Schoene, Daniel, Sarofim, Mina et al. (2014) Single and dual task tests of gait speed are equivalent in the prediction of falls in older people: a systematic review and meta-analysis. Ageing research reviews 16: 83-104	- Study does not contain an intervention relevant to this review protocol
Meyer, Gabriele, Kopke, Sascha, Bender, Ralf et al. (2005) Predicting the risk of falling--efficacy of a risk assessment tool compared to nurses' judgement: a cluster-randomised controlled trial [ISRCTN37794278]. BMC geriatrics 5: 14	- Data not reported in an extractable format or a format that can be analysed
Meyer, Brett M, Cohen, Jenna G, DePetrillo, Paolo et al. (2024) Assessing Free-Living Postural Sway in Persons With Multiple Sclerosis. IEEE transactions on neural systems and rehabilitation engineering : a publication of the IEEE Engineering in Medicine and Biology Society 32: 967-973	- Study population <100
Middleton, Addie, Fulk, George D, Herter, Troy M et al. (2016) Self-Selected and Maximal Walking Speeds Provide Greater Insight Into Fall Status Than Walking Speed Reserve Among Community-Dwelling Older Adults. American journal of physical medicine & rehabilitation 95(7): 475-82	- Study does not contain an intervention relevant to this review protocol
Mignardot, Jean-Baptiste, Deschamps, Thibault, Barrey, Eric et al. (2014) Gait disturbances as specific predictive markers of the first fall onset in elderly people: a two-year prospective observational study. Frontiers in aging neuroscience 6: 22	- Study design not relevant to this review protocol *Derivation study*
Milisen, K, Dejaeger, E, Braes, T et al. (2006) Process evaluation of a nurse-led multifactorial intervention protocol for risk screening and assessment of fall problems among community-dwelling older persons: a pilot-study. The journal of nutrition, health & aging 10(5): 446-52	- Study does not contain an intervention relevant to this review protocol
Milisen, Koen, Coussement, Joke, Flamaing, Johan et al. (2012) Fall prediction according to nurses' clinical judgment: differences between medical, surgical, and geriatric wards. Journal of the American Geriatrics Society 60(6): 1115-21	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Mir, F.; Zafar, F.; Rodin, M.B. (2014) Falls in Older Adults with Cancer. Current Geriatrics Reports 3(3): 175-181	- Data not reported in an extractable format or a format that can be analysed
Miranda-Cantellops, Natalia and Tiu, Timothy K. (2021) Berg Balance Testing.	- Not a peer-reviewed publication
Mizumoto, A., Ihira, H., Makino, K. et al. (2015) Hip walking performance predicts the fall one year later in community dwelling old-old women. Physiotherapy (United Kingdom) 101(suppl1): es939-es940	- Conference abstract.
Mohler, M Jane, Wendel, Christopher S, Taylor-Piliae, Ruth E et al. (2016) Motor Performance and Physical Activity as Predictors of Prospective Falls in Community-Dwelling Older Adults by Frailty Level: Application of Wearable Technology. Gerontology 62(6): 654-664	- Data not reported in an extractable format or a format that can be analysed
Moiz, Jamal Ali, Bansal, Vishal, Noohu, Majumi M et al. (2017) Activities-specific balance confidence scale for predicting future falls in Indian older adults. Clinical interventions in aging 12: 645-651	- Study does not contain an intervention relevant to this review protocol
Mojtaba, Mahnaz; Alinaghizadeh, Hassan; Rydwik, Elisabeth (2018) Downton Fall Risk Index during hospitalisation is associated with fall-related injuries after discharge: a longitudinal observational study. Journal of physiotherapy 64(3): 172-177	- Study does not contain an intervention relevant to this review protocol
Montesinos, Luis; Castaldo, Rossana; Pecchia, Leandro (2018) Wearable Inertial Sensors for Fall Risk Assessment and Prediction in Older Adults: A Systematic Review and Meta-Analysis. IEEE transactions on neural systems and rehabilitation engineering : a publication of the IEEE Engineering in Medicine and Biology Society 26(3): 573-582	- Systematic review used as source of primary studies
Moore, T; Martin, J; Stonehouse, J (1996) Predicting falls: risk assessment tool versus clinical judgement. Perspectives (Gerontological Nursing Association (Canada)) 20(1): 8-11	- Study does not contain an intervention relevant to this review protocol
Morris, Meg E, Haines, Terry, Hill, Anne Marie et al. (2021) Divesting from a Scored Hospital Fall Risk Assessment Tool (FRAT): A Cluster Randomized Non-Inferiority Trial. Journal of the American Geriatrics Society 69(9): 2598-2604	- Study does not contain an intervention relevant to this review protocol
Morris, Rob (2007) Predicting falls in older women. Menopause international 13(4): 170-7	- Study does not contain an intervention relevant to this review protocol
Morris, Rob, Harwood, Rowan H, Baker, Ros et al. (2007) A comparison of different balance tests in the prediction of falls in older women with vertebral fractures: a cohort study. Age and ageing 36(1): 78-83	- Study does not contain an intervention relevant to this review protocol
Morse, J M, Black, C, Oberle, K et al. (1989) A prospective study to identify the fall-prone patient. Social science & medicine (1982) 28(1): 81-6	- Study does not contain an

Study	Code [Reason]
	intervention relevant to this review protocol
Mousavipour, S.-S., Ebadi, A., Saremi, M. et al. (2022) Reliability, sensitivity, and specificity of the morse fall scale: A hospitalized population in Iran. Archives of Trauma Research 11(2): 65-70	- Study does not contain an intervention relevant to this review protocol
Muir, Susan W, Berg, Katherine, Chesworth, Bert et al. (2010) Balance impairment as a risk factor for falls in community-dwelling older adults who are high functioning: a prospective study. Physical therapy 90(3): 338-47	- Study does not contain an intervention relevant to this review protocol
Muir, Susan W, Berg, Katherine, Chesworth, Bert et al. (2010) Application of a fall screening algorithm stratified fall risk but missed preventive opportunities in community-dwelling older adults: a prospective study. Journal of geriatric physical therapy (2001) 33(4): 165-72	- Study does not contain an intervention relevant to this review protocol
Muir-Hunter, S W and Wittwer, J E (2016) Dual-task testing to predict falls in community-dwelling older adults: a systematic review. Physiotherapy 102(1): 29-40	- Study does not contain an intervention relevant to this review protocol
Mulasso, Anna, Roppolo, Mattia, Gobbens, Robbert J et al. (2017) Mobility, balance and frailty in community-dwelling older adults: What is the best 1-year predictor of falls?. Geriatrics & gerontology international 17(10): 1463-1469	- Study does not contain an intervention relevant to this review protocol
Myers, Helen and Nikoletti, Sue (2003) Fall risk assessment: a prospective investigation of nurses' clinical judgement and risk assessment tools in predicting patient falls. International journal of nursing practice 9(3): 158-65	- Study does not contain an intervention relevant to this review protocol
Nagamatsu, Lindsay S, Voss, Michelle, Neider, Mark B et al. (2011) Increased cognitive load leads to impaired mobility decisions in seniors at risk for falls. Psychology and aging 26(2): 253-9	- Population not relevant to this review protocol
Nandy, S., Parsons, S., Cryer, C. et al. (2005) Erratum: Development and preliminary examination of the predictive validity of the Falls Risk Assessment Tool (FRAT) for use in primary care (Journal of Public Health (2004) 26, 2 (138-143)). Journal of Public Health 27(1): 129-130	- Not a peer-reviewed publication
Narayanan, V, Dickinson, A, Victor, C et al. (2016) Falls screening and assessment tools used in acute mental health settings: a review of policies in England and Wales. Physiotherapy 102(2): 178-83	- Study does not contain an intervention relevant to this review protocol
Neuls, Patrick D, Clark, Tammie L, Van Heuklon, Nicole C et al. (2011) Usefulness of the Berg Balance Scale to predict falls in the elderly. Journal of geriatric physical therapy (2001) 34(1): 3-10	- Systematic review used as source of primary studies
Newland, Pamela, Wagner, Joanne M, Salter, Amber et al. (2016) Exploring the feasibility and acceptability of sensor monitoring of gait and falls in the homes of persons with multiple sclerosis. Gait & posture 49: 277-282	- Population not relevant to this review protocol

Study	Code [Reason]
Ni Scanaill, Cliodhna, Garattini, Chiara, Greene, Barry R et al. (2011) Technology Innovation Enabling Falls Risk Assessment in a Community Setting. Ageing international 36(2): 217-231	- Study does not contain an intervention relevant to this review protocol
Nishimura, Hirosuke, Endo, Kenji, Suzuki, Hidekazu et al. (2015) Gait Analysis in Cervical Spondylotic Myelopathy. Asian spine journal 9(3): 321-6	- Population not relevant to this review protocol
Noohu, M.M.; Dey, A.B.; Hussain, M.E. (2014) Relevance of balance measurement tools and balance training for fall prevention in older adults. Journal of Clinical Gerontology and Geriatrics 5(2): 31-35	- Review article but not a systematic review
Nordin, E, Moe-Nilssen, R, Ramnemark, A et al. (2010) Changes in step-width during dual-task walking predicts falls. Gait & posture 32(1): 92-7	- Study does not contain an intervention relevant to this review protocol
Nordin, Ellinor, Lindelof, Nina, Rosendahl, Erik et al. (2008) Prognostic validity of the Timed Up-and-Go test, a modified Get-Up-and-Go test, staff's global judgement and fall history in evaluating fall risk in residential care facilities. Age and ageing 37(4): 442-8	- Study does not contain an intervention relevant to this review protocol
Nouredanesh, Mina, Godfrey, Alan, Howcroft, Jennifer et al. (2021) Fall risk assessment in the wild: A critical examination of wearable sensor use in free-living conditions. Gait & posture 85: 178-190	- Systematic review used as source of primary studies
Nunan, Susan, Brown Wilson, Christine, Henwood, Timothy et al. (2018) Fall risk assessment tools for use among older adults in long-term care settings: A systematic review of the literature. Australasian journal on ageing 37(1): 23-33	- Study does not contain an intervention relevant to this review protocol
Nyberg, L and Gustafson, Y (1996) Using the Downton index to predict those prone to falls in stroke rehabilitation. Stroke 27(10): 1821-4	- Data not reported in an extractable format or a format that can be analysed
Oddsson, L.I.E., Bisson, T., Cohen, H.S. et al. (2020) The Effects of a Wearable Sensory Prosthesis on Gait and Balance Function After 10 Weeks of Use in Persons With Peripheral Neuropathy and High Fall Risk - The walk2Wellness Trial. Frontiers in Aging Neuroscience 12: 592751	- Population not relevant to this review protocol
Oh, Koei, Furuya, Takefumi, Inoue, Eisuke et al. (2021) A simple screening test to assess risk of falls in Japanese patients with rheumatoid arthritis: Results from the IORRA cohort study. Modern rheumatology 31(2): 506-509	- Data not reported in an extractable format or a format that can be analysed
Oliver, David, Daly, Fergus, Martin, Finbarr C et al. (2004) Risk factors and risk assessment tools for falls in hospital in-patients: a systematic review. Age and ageing 33(2): 122-30	- Study does not contain an intervention relevant to this review protocol
Oliver, David and Healy, Frances (2009) Falls risk prediction tools for hospital inpatients: do they work?. Nursing times 105(7): 18-21	- Data not reported in an extractable format or a format

Study	Code [Reason]
	that can be analysed
Olsson Moller, U. and Jakobsson, U. (2012) Predictive validity and cut-off scores in four diagnostic tests for falls-a study in frail older people at home. European Geriatric Medicine 3(suppl1): 49	- Study does not contain an intervention relevant to this review protocol
Omana, Humberto, Bezaire, Kari, Brady, Kyla et al. (2021) Functional Reach Test, Single-Leg Stance Test, and Tinetti Performance-Oriented Mobility Assessment for the Prediction of Falls in Older Adults: A Systematic Review. Physical therapy 101(10)	- Systematic review used as source of primary studies
Ong, Mei Fong, Soh, Kim Lam, Saimon, Rosalia et al. (2022) Falls risk screening tools intended to reduce fall risk among independent community-dwelling older adults: A systematic review. International journal of nursing practice: e13083	- Study does not contain an intervention relevant to this review protocol
Otoguro, M., Ohnuma, T., Hirao, K. et al. (2012) Can a newly -established test for assessing standing and balance function be an alternative to the timed up-and-go test? -Functional assessment of gait and balance in elderly patients for a comprehensive geriatric assessment initiative named 'Dr. SUPERMAN'. Japanese Journal of Geriatrics 49(5): 589-596	- Study not reported in English
Overcash, Janine (2007) Prediction of falls in older adults with cancer: a preliminary study. Oncology nursing forum 34(2): 341-6	- Study does not contain an intervention relevant to this review protocol
Pajala, Satu, Era, Pertti, Koskenvuo, Markku et al. (2008) Force platform balance measures as predictors of indoor and outdoor falls in community-dwelling women aged 63-76 years. The journals of gerontology. Series A, Biological sciences and medical sciences 63(2): 171-8	- Study does not contain an intervention relevant to this review protocol
Pajewski, Nicholas M, Lenoir, Kristin, Wells, Brian J et al. (2019) Frailty Screening Using the Electronic Health Record Within a Medicare Accountable Care Organization. The journals of gerontology. Series A, Biological sciences and medical sciences 74(11): 1771-1777	- Study does not contain an intervention relevant to this review protocol
Palumbo, Pierpaolo, Klenk, Jochen, Cattelani, Luca et al. (2016) Predictive Performance of a Fall Risk Assessment Tool for Community-Dwelling Older People (FRAT-up) in 4 European Cohorts. Journal of the American Medical Directors Association 17(12): 1106-1113	- Study does not contain an intervention relevant to this review protocol
Palumbo, Pierpaolo, Palmerini, Luca, Bandinelli, Stefania et al. (2015) Fall Risk Assessment Tools for Elderly Living in the Community: Can We Do Better?. PloS one 10(12): e0146247	- Study does not contain an intervention relevant to this review protocol
Park, Seong-Hi (2018) Tools for assessing fall risk in the elderly: a systematic review and meta-analysis. Aging clinical and experimental research 30(1): 1-16	- Study does not contain an intervention relevant to this review protocol
Park, Seong-Hi and Lee, Young-Shin (2017) The Diagnostic Accuracy of the Berg Balance Scale in Predicting Falls. Western journal of nursing research 39(11): 1502-1525	- Systematic review used as

Study	Code [Reason]
	source of primary studies
Pasa, Thiana Sebben, Magnago, Tania Solange Bosi De Souza, Urbanetto, Janete De Souza et al. (2017) Risk assessment and incidence of falls in adult hospitalized patients. Revista latino-americana de enfermagem 25: e2862	- Study does not contain an intervention relevant to this review protocol
Paul, Serene S, Canning, Colleen G, Sherrington, Catherine et al. (2013) Three simple clinical tests to accurately predict falls in people with Parkinson's disease. Movement disorders : official journal of the Movement Disorder Society 28(5): 655-62	- Study design not relevant to this review protocol
Paulson, Daniel and Lichtenberg, Peter A (2015) The Paulson-Lichtenberg Frailty Index: evidence for a self-report measure of frailty. Aging & mental health 19(10): 892-901	- Study does not contain an intervention relevant to this review protocol
Peeters, G.M.E.E., Pluijm, S.M.F., Van Schoor, N.M. et al. (2010) Validation of the LASA fall risk profile for recurrent falling in older recent fallers. Journal of Clinical Epidemiology 63(11): 1242-1248	- Study does not contain an intervention relevant to this review protocol
Pelicioni, Paulo H S, Waters, Debra L, Still, Amanda et al. (2022) A pilot investigation of reliability and validity of balance and gait assessments using telehealth with healthy older adults. Experimental gerontology 162: 111747	- Data not reported in an extractable format or a format that can be analysed
Pellicciari, Leonardo, Piscitelli, Daniele, Caselli, Serena et al. (2019) A Rasch analysis of the Conley Scale in patients admitted to a general hospital. Disability and rehabilitation 41(23): 2807-2816	- Study does not contain an intervention relevant to this review protocol
Perell, K L, Nelson, A, Goldman, R L et al. (2001) Fall risk assessment measures: an analytic review. The journals of gerontology. Series A, Biological sciences and medical sciences 56(12): m761-6	- Systematic review used as source of primary studies
Perez-Zepeda, Mario Ulises; Cesari, Matteo; Garcia-Pena, Carmen (2016) Predictive Value of Frailty Indices for Adverse Outcomes in Older Adults. Revista de investigacion clinica; organo del Hospital de Enfermedades de la Nutricion 68(2): 92-8	- Study does not contain an intervention relevant to this review protocol
Persad, C C; Cook, S; Giordani, B (2010) Assessing falls in the elderly: should we use simple screening tests or a comprehensive fall risk evaluation?. European journal of physical and rehabilitation medicine 46(2): 249-59	- Review article but not a systematic review
Perttila, N M, Pitkala, K H, Kautiainen, H et al. (2017) Various Diagnostic Measures of Frailty as Predictors for Falls, Weight Change, Quality of Life, and Mortality among Older Finnish Men. The Journal of frailty & aging 6(4): 188-194	- Study does not contain an intervention relevant to this review protocol
Pettersson, Beatrice, Nordin, Ellinor, Ramnemark, Anna et al. (2020) Neither Timed Up and Go test nor Short Physical Performance Battery predict future falls among independent adults aged >=75 years living in the community. Journal of frailty, sarcopenia and falls 5(2): 24-30	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Poe, Stephanie S, Dawson, Patricia B, Cvach, Maria et al. (2018) The Johns Hopkins Fall Risk Assessment Tool: A Study of Reliability and Validity. Journal of nursing care quality 33(1): 10-19	- Study does not contain an intervention relevant to this review protocol
Pozaic, T., Lindemann, U., Grebe, A.-K. et al. (2016) Sit-to-Stand Transition Reveals Acute Fall Risk in Activities of Daily Living. IEEE Journal of Translational Engineering in Health and Medicine 4: 7763750	- Study does not contain an intervention relevant to this review protocol
Pua, Yong-Hao and Matchar, David B (2019) Physical Performance Predictor Measures in Older Adults With Falls-Related Emergency Department Visits. Journal of the American Medical Directors Association 20(6): 780-784	- Study does not contain an intervention relevant to this review protocol
Quijoux, F., Nicolai, A., Aflalo, J. et al. (2021) Contribution of posturography to balance assessment in elderly people. Pratique Neurologique - FMC 12(4): 290-302	- Study not reported in English
Quinn, Gillian, Comber, Laura, Galvin, Rose et al. (2018) The ability of clinical balance measures to identify falls risk in multiple sclerosis: a systematic review and meta-analysis. Clinical rehabilitation 32(5): 571-582	- Systematic review used as source of primary studies
Quinn, Gillian, Comber, Laura, McGuigan, Chris et al. (2019) Discriminative ability and clinical utility of the Timed Up and Go (TUG) in identifying falls risk in people with multiple sclerosis: a prospective cohort study. Clinical rehabilitation 33(2): 317-326	- Study does not contain an intervention relevant to this review protocol
Rantz, Marilyn J, Skubic, Marjorie, Abbott, Carmen et al. (2013) In-home fall risk assessment and detection sensor system. Journal of gerontological nursing 39(7): 18-22	- Population not relevant to this review protocol
Rehman, Rana Zia Ur, Zhou, Yuhan, Del Din, Silvia et al. (2020) Gait Analysis with Wearables Can Accurately Classify Fallers from Non-Fallers: A Step toward Better Management of Neurological Disorders. Sensors (Basel, Switzerland) 20(23)	- Study does not contain an intervention relevant to this review protocol
Ricci, G., Barrionuevo, M.L., Bodini, S. et al. (2012) Balance, gait and falls in an elderly institutionalized population: One year monitoring by Performance Oriented Mobility Assessment (POMA). Giornale di Gerontologia 60(2): 88-98	- Study not reported in English
Riddle, D L and Stratford, P W (1999) Interpreting validity indexes for diagnostic tests: an illustration using the Berg balance test. Physical therapy 79(10): 939-48	- Study design not relevant to this review protocol
Ritchie, Christine, Wieland, Darryl, Tully, Chris et al. (2002) Coordination and advocacy for rural elders (CARE): a model of rural case management with veterans. The Gerontologist 42(3): 399-405	- Data not reported in an extractable format or a format that can be analysed
Rivolta, Massimo W and Sassi, Roberto (2017) Linear-Sigmoidal modelling of accelerometer features and Tinetti score for automatic fall risk assessment. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2017: 3810-3813	- Population not relevant to this review protocol

Study	Code [Reason]
Rodriguez-Molinero, Alejandro, Galvez-Barron, Cesar, Narvaiza, Leire et al. (2017) A two-question tool to assess the risk of repeated falls in the elderly. PloS one 12(5): e0176703	- Study does not contain an intervention relevant to this review protocol
Roeing, Kathleen L; Hsieh, Katherine L; Sosnoff, Jacob J (2017) A systematic review of balance and fall risk assessments with mobile phone technology. Archives of gerontology and geriatrics 73: 222-226	- Study does not contain an intervention relevant to this review protocol
Rosa, Marlene Cristina, Marques, Alda, Demain, Sara et al. (2015) Fast gait speed and self-perceived balance as valid predictors and discriminators of independent community walking at 6 months post-stroke--a preliminary study. Disability and rehabilitation 37(2): 129-34	- Study does not contain an intervention relevant to this review protocol
Rosa, Matheus Vieira; Perracini, Monica Rodrigues; Ricci, Natalia Aquaroni (2019) Usefulness, assessment and normative data of the Functional Reach Test in older adults: A systematic review and meta-analysis. Archives of gerontology and geriatrics 81: 149-170	- Study does not contain an intervention relevant to this review protocol
Rose, Debra J.; Jones, C. Jessie; Lucchese, Nicole (2002) Predicting the Probability of Falls in Community-Residing Older Adults Using the 8-Foot Up-and-Go: A New Measure of Functional Mobility. Journal of Aging and Physical Activity 10(4): 466-475	- Study does not contain an intervention relevant to this review protocol
Russell, Melissa A, Hill, Keith D, Blackberry, Irene et al. (2008) The reliability and predictive accuracy of the falls risk for older people in the community assessment (FROP-Com) tool. Age and ageing 37(6): 634-9	- Study does not contain an intervention relevant to this review protocol
Safieddine, Doha, Chkeir, Aly, Herlem, Cyrille et al. (2017) Identification of the period of stability in a balance test after stepping up using a simplified cumulative sum. Medical engineering & physics 49: 14-21	- Study does not contain an intervention relevant to this review protocol
Saho, Kenshi, Fujimoto, Masahiro, Kobayashi, Yoshiyuki et al. (2022) Experimental Verification of Micro-Doppler Radar Measurements of Fall-Risk-Related Gait Differences for Community-Dwelling Elderly Adults. Sensors (Basel, Switzerland) 22(3)	- Study does not contain an intervention relevant to this review protocol
Sakthivadivel, Varatharajan, Geetha, Jeganathan, Gaur, Archana et al. (2022) Performance-Oriented Mobility Assessment test and Timed Up and Go test as predictors of falls in the elderly - A cross-sectional study. Journal of family medicine and primary care 11(11): 7294-7298	- Study design not relevant to this review protocol
Salzman, Brooke (2010) Gait and balance disorders in older adults. American family physician 82(1): 61-8	- Review article but not a systematic review
Salis, Francesco and Mandas, Antonella (2023) Physical Performance and Falling Risk Are Associated with Five-Year Mortality in Older Adults: An Observational Cohort Study. Medicina (Kaunas, Lithuania) 59(5)	- No useable outcome data
Sanders, Joost B, Bremmer, Marijke A, Comijs, Hannie C et al. (2017) Gait Speed and Processing Speed as Clinical Markers for Geriatric Health	- Study does not contain an intervention

Study	Code [Reason]
Outcomes. The American journal of geriatric psychiatry : official journal of the American Association for Geriatric Psychiatry 25(4): 374-385	relevant to this review protocol
Santos, Gilmar M, Souza, Ana C S, Virtuoso, Janeisa F et al. (2011) Predictive values at risk of falling in physically active and no active elderly with Berg Balance Scale. Revista brasileira de fisioterapia (Sao Carlos (Sao Paulo, Brazil)) 15(2): 95-101	- Population not relevant to this review protocol
Sato M, Yamashita T, Okazaki D, Asada H, Yamashita K. Valid Indicators for Predicting Falls in Community-Dwelling Older Adults Under Ongoing Exercise Intervention to Prevent Care Requirement. Gerontology and Geriatric Medicine. 2024;10	- Study population < 100
Sattar, Schroder, Kenis, Cindy, Haase, Kristen et al. (2020) Falls in older patients with cancer: Nursing and Allied Health Group of International Society of Geriatric Oncology review paper. Journal of geriatric oncology 11(1): 1-7	- Study does not contain an intervention relevant to this review protocol
Schniepp, Roman, Huppert, Anna, Decker, Julian et al. (2021) Fall prediction in neurological gait disorders: differential contributions from clinical assessment, gait analysis, and daily-life mobility monitoring. Journal of neurology 268(9): 3421-3434	- Study design not relevant to this review protocol
Schoene, Daniel, Wu, Sandy M-S, Mikolaizak, A Stefanie et al. (2013) Discriminative ability and predictive validity of the timed up and go test in identifying older people who fall: systematic review and meta-analysis. Journal of the American Geriatrics Society 61(2): 202-8	- Study does not contain an intervention relevant to this review protocol
Schoenenberger, Andreas W, Bieri, Christoph, Ozguler, Onur et al. (2014) A novel multidimensional geriatric screening tool in the ED: evaluation of feasibility and clinical relevance. The American journal of emergency medicine 32(6): 623-8	- Study does not contain an intervention relevant to this review protocol
Schonwetter, Ronald S, Kim, Sehwan, Kirby, Jackie et al. (2010) Etiology of falls among cognitively intact hospice patients. Journal of palliative medicine 13(11): 1353-63	- Study does not contain an intervention relevant to this review protocol
Schoufour, Josje D, Echteld, Michael A, Bastiaanse, Luc P et al. (2015) The use of a frailty index to predict adverse health outcomes (falls, fractures, hospitalization, medication use, comorbid conditions) in people with intellectual disabilities. Research in developmental disabilities 38: 39-47	- Study does not contain an intervention relevant to this review protocol
Schwendimann, R; De Geest, S; Milisen, K (2006) Evaluation of the Morse Fall Scale in hospitalised patients. Age and ageing 35(3): 311-3	- Not a peer-reviewed publication
Scott, Robin A, Oman, Kathleen S, Flarity, Kathleen et al. (2018) Above, Beyond, and Over the Side rails: Evaluating the New Memorial Emergency Department Fall-Risk-Assessment Tool. Journal of emergency nursing 44(5): 483-490	- Not a peer-reviewed publication
Scott, Vicky, Votova, Kristine, Scanlan, Andria et al. (2007) Multifactorial and functional mobility assessment tools for fall risk among older adults in community, home-support, long-term and acute care settings. Age and ageing 36(2): 130-9	- Systematic review used as source of primary studies
Scura, Daniel and Munakomi, Sunil (2022) Tinetti Gait and Balance Test.	- Study does not contain an intervention

Study	Code [Reason]
	relevant to this review protocol
Seiger Cronfalk, Berit, Fjell, Astrid, Carstens, Nina et al. (2017) Health team for the elderly: a feasibility study for preventive home visits. Primary health care research & development 18(3): 242-252	- Study does not contain an intervention relevant to this review protocol
Shah, M.N., Caprio, T.V., Swanson, P. et al. (2010) A novel emergency medical services-based program to identify and assist older adults in a rural community. Journal of the American Geriatrics Society 58(11): 2205-2211	- Study does not contain an intervention relevant to this review protocol
Sharma, Anjali, Hoover, Donald R, Shi, Qiuhu et al. (2019) Frailty as a predictor of falls in HIV-infected and uninfected women. Antiviral therapy 24(1): 51-61	- Population not relevant to this review protocol
Shea, Cristina A, Ward, Rachel E, Welch, Sarah A et al. (2018) Inability to Perform the Repeated Chair Stand Task Predicts Fall-Related Injury in Older Primary Care Patients. American journal of physical medicine & rehabilitation 97(6): 426-432	- Study does not contain an intervention relevant to this review protocol
Shimada, Hiroyuki, Suzukawa, Megumi, Tiedemann, Anne et al. (2009) Which neuromuscular or cognitive test is the optimal screening tool to predict falls in frail community-dwelling older people?. Gerontology 55(5): 532-8	- Study does not contain an intervention relevant to this review protocol
Si, Huaxin, Jin, Yaru, Qiao, Xiaoxia et al. (2021) Predictive performance of 7 frailty instruments for short-term disability, falls and hospitalization among Chinese community-dwelling older adults: A prospective cohort study. International journal of nursing studies 117: 103875	- Study does not contain an intervention relevant to this review protocol
Silva, Joana; Sousa, Ines; Cardoso, Jaime S (2020) Fusion of Clinical, Self-Reported, and Multisensor Data for Predicting Falls. IEEE journal of biomedical and health informatics 24(1): 50-56	- Study design not relevant to this review protocol *derivation study*
Silva, Sabrina de Oliveira, Barbosa, Jessica Bandeira, Lemos, Thiago et al. (2023) Agreement and predictive performance of fall risk assessment methods and factors associated with falls in hospitalized older adults: A longitudinal study. Geriatric nursing (New York, N.Y.) 49: 109-114	- Study does not contain an intervention relevant to this review protocol
Smith, Jane; Forster, Anne; Young, John (2006) Use of the 'STRATIFY' falls risk assessment in patients recovering from acute stroke. Age and ageing 35(2): 138-43	- Study does not contain an intervention relevant to this review protocol
Smulders, Katrijn, Esselink, Rianne A J, Weiss, Aner et al. (2012) Assessment of dual tasking has no clinical value for fall prediction in Parkinson's disease. Journal of neurology 259(9): 1840-7	- Population not relevant to this review protocol
Sorensen, G.V., Jorgensen, M.G., Ryg, J. et al. (2019) Development, feasibility, acceptability, and adjustment of a portable, multifactorial falls risk test battery for community-dwelling older adults. Cogent Medicine 6(1): 1674099	- Population not relevant to this review protocol

Study	Code [Reason]
Soto, D. and Fogel, J.F. (2012) Do physicians in-training assess for falls among the elderly population in the outpatient setting?. Journal of the American Geriatrics Society 60(suppl4): 158	- Data not reported in an extractable format or a format that can be analysed
Southerland, Lauren T, Slattery, Lauren, Rosenthal, Joseph A et al. (2017) Are triage questions sufficient to assign fall risk precautions in the ED?. The American journal of emergency medicine 35(2): 329-332	- Data not reported in an extractable format or a format that can be analysed
Sri-On, Jiraporn, Tirrell, Gregory Philip, Kamsom, Anucha et al. (2018) A High-yield Fall Risk and Adverse Events Screening Questions From the Stopping Elderly Accidents, Death, and Injuries (STEADI) Guideline for Older Emergency Department Fall Patients. Academic emergency medicine : official journal of the Society for Academic Emergency Medicine 25(8): 927-938	- Study does not contain an intervention relevant to this review protocol
Sternberg, Shelley A, Bentur, Netta, Abrams, Chad et al. (2012) Identifying frail older people using predictive modeling. The American journal of managed care 18(10): e392-7	- Study does not contain an intervention relevant to this review protocol
Strini, Veronica; Schiavolin, Roberta; Prendin, Angela (2021) Fall Risk Assessment Scales: A Systematic Literature Review. Nursing reports (Pavia, Italy) 11(2): 430-443	- Data not reported in an extractable format or a format that can be analysed
Strupeit, Steve; Buss, Arne; Wolf-Ostermann, Karin (2016) Assessing Risk of Falling in Older Adults-A Comparison of Three Methods. Worldviews on evidence-based nursing 13(5): 349-355	- Study does not contain an intervention relevant to this review protocol
Suh, Minhee and Cho, Insook (2021) Effectiveness of nursing care provided for fall prevention: Survival analysis of nursing records in a tertiary hospital. Japan journal of nursing science : JJNS 18(2): e12403	- Study does not contain an intervention relevant to this review protocol
Swanenburg, Jaap, de Bruin, Eling D, Uebelhart, Daniel et al. (2010) Falls prediction in elderly people: a 1-year prospective study. Gait & posture 31(3): 317-21	- Study does not contain an intervention relevant to this review protocol
Tan, L F, Chan, Y H, Tay, A et al. (2021) Practicality and Reliability of Self Vs Administered Rapid Geriatric Assessment Mobile App. The journal of nutrition, health & aging 25(9): 1064-1069	- Study does not contain an intervention relevant to this review protocol
Tapper, Elliot B, Finkelstein, Daniel, Mittleman, Murray A et al. (2015) Standard assessments of frailty are validated predictors of mortality in hospitalized patients with cirrhosis. Hepatology (Baltimore, Md.) 62(2): 584-90	- Study does not contain an intervention relevant to this review protocol
Tanaka, Shinya, Imaizumi, Takahiro, Morohashi, Akemi et al. (2023) In-Hospital Fall Risk Prediction by Objective Measurement of Lower Extremity Function in a High-Risk Population. Journal of the American Medical Directors Association 24(12): 1861-1867e2	- Study design not relevant to this review protocol

Study	Code [Reason]
Tatum Iii, Paul E; Talebreza, Shaida; Ross, Jeanette S (2018) Geriatric Assessment: An Office-Based Approach. American family physician 97(12): 776-784	- Data not reported in an extractable format or a format that can be analysed
Terry, Kevin; Stanley, Christopher; Damiano, Diane (2014) A new perspective on the walking margin of stability. Journal of applied biomechanics 30(6): 737-41	- Study does not contain an intervention relevant to this review protocol
Thapa, P B, Gideon, P, Brockman, K G et al. (1996) Clinical and biomechanical measures of balance as fall predictors in ambulatory nursing home residents. The journals of gerontology. Series A, Biological sciences and medical sciences 51(5): m239-46	- Data not reported in an extractable format or a format that can be analysed
Thomas, J and O'Neal, S (2019) Relationship of Functional Reach Test scores and falls in Special Olympics athletes. Journal of intellectual disability research : JIDR 63(6): 587-592	- Population not relevant to this review protocol
Tideiksaar, R (1993) Falls in older persons. The Mount Sinai journal of medicine, New York 60(6): 515-21	- Data not reported in an extractable format or a format that can be analysed
Tiedemann A, Shimada H, Sherrington C et al. (2008) The comparative ability of eight functional mobility tests for predicting falls in community-dwelling older people. Age and ageing 37(4): 430-435	- Study does not contain an intervention relevant to this review protocol
Tijsma, Mylou, Vister, Eva, Hoang, Phu et al. (2017) A simple test of choice stepping reaction time for assessing fall risk in people with multiple sclerosis. Disability and rehabilitation 39(6): 601-607	- Study does not contain an intervention relevant to this review protocol
Tilson, Julie K, Wu, Samuel S, Cen, Steven Y et al. (2012) Characterizing and identifying risk for falls in the LEAPS study: a randomized clinical trial of interventions to improve walking poststroke. Stroke 43(2): 446-52	- Study does not contain an intervention relevant to this review protocol
Tipping, Claire J, Hodgson, Carol L, Harrold, Meg et al. (2019) Frailty in Patients With Trauma Who Are Critically Ill: A Prospective Observational Study to Determine Feasibility, Concordance, and Construct and Predictive Validity of 2 Frailty Measures. Physical therapy 99(8): 1089-1097	- Data not reported in an extractable format or a format that can be analysed
Trinh, Vincent Quoc-Nam, Zhang, Steven, Kovoor, Joshua et al. (2023) The use of natural language processing in detecting and predicting falls within the healthcare setting: a systematic review. International journal for quality in health care : journal of the International Society for Quality in Health Care 35(4)	- Systematic review used as a source of primary papers
Tripathy, Soumya Ranjan; Chakravarty, Kingshuk; Sinha, Aniruddha (2018) Eigen Posture Based Fall Risk Assessment System Using Kinect. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2018: 1-4	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Trueblood, Peggy R., Hodson-Chennault, Nichole, McCubbin, Annette et al. (2001) Performance and Impairment-Based Assessments Among Community Dwelling Elderly: Sensitivity and Specificity. Journal of Geriatric Physical Therapy 24(1)	- Study does not contain an intervention relevant to this review protocol
Tsai, Chang-Lin, Lai, Yun-Ru, Lien, Chia-Yi et al. (2022) Feasibility of Combining Disease-Specific and Balance-Related Measures as Risk Predictors of Future Falls in Patients with Parkinson's Disease. Journal of clinical medicine 12(1)	- Population not relevant to this review protocol
Tueth, Lauren Elizabeth; Earhart, Gammon M; Rawson, Kerri Sharp (2021) Association between falls in Alzheimer disease and scores on the Balance Evaluation Systems Test (BESTest) and MiniBESTest. Somatosensory & motor research 38(3): 248-252	- Population not relevant to this review protocol
Ullrich, Martin, Roth, Nils, Kuderle, Arne et al. (2022) Fall Risk Prediction in Parkinson's Disease Using Real-World Inertial Sensor Gait Data. IEEE journal of biomedical and health informatics pp	- Population not relevant to this review protocol
Urbanek, Jacek K, Roth, David L, Karas, Marta et al. (2022) Free-living gait cadence measured by wearable accelerometer: a promising alternative to traditional measures of mobility for assessing fall risk. The journals of gerontology. Series A, Biological sciences and medical sciences	- Study does not contain an intervention relevant to this review protocol
van Rie, Kayla J; Kanji, Amisha; Naude, Alida (2022) Professional Guidelines and Reported Practice of Audiologists Performing Fall Risk Assessment With Older Adults: A Systematic Review. American journal of audiology 31(1): 243-260	- Study does not contain an intervention relevant to this review protocol
Vassallo, Michael, Poynter, Lynn, Sharma, Jagdish C et al. (2008) Fall risk-assessment tools compared with clinical judgment: an evaluation in a rehabilitation ward. Age and ageing 37(3): 277-81	- Study does not contain an intervention relevant to this review protocol
Vassallo, Michael, Stockdale, Rachel, Sharma, Jagdish C et al. (2005) A comparative study of the use of four fall risk assessment tools on acute medical wards. Journal of the American Geriatrics Society 53(6): 1034-8	- Duplicate reference
Vellas, B J, Wayne, S J, Romero, L et al. (1997) One-leg balance is an important predictor of injurious falls in older persons. Journal of the American Geriatrics Society 45(6): 735-8	- Study does not contain an intervention relevant to this review protocol
Verghese, Joe, Ambrose, Anne F, Lipton, Richard B et al. (2010) Neurological gait abnormalities and risk of falls in older adults. Journal of neurology 257(3): 392-8	- Data not reported in an extractale format or a format that can be analysed
Viccaro, Laura J; Perera, Subashan; Studenski, Stephanie A (2011) Is timed up and go better than gait speed in predicting health, function, and falls in older adults?. Journal of the American Geriatrics Society 59(5): 887-92	- Study does not contain an intervention relevant to this review protocol
Vilpunaho, Tommi, Karinkanta, Saija, Sievanen, Harri et al. (2023) Predictive ability of a self-rated fall risk assessment tool in community-dwelling older women. Aging clinical and experimental research 35(6): 1205-1212	- No usable outcome data

Study	Code [Reason]
Volrathongchai, Kanittha; Brennan, Patricia F; Ferris, Michael C (2005) Predicting the likelihood of falls among the elderly using likelihood basis pursuit technique. AMIA ... Annual Symposium proceedings. AMIA Symposium: 764-8	- Study does not contain an intervention relevant to this review protocol
Vuong, Kenny, Canning, Colleen G, Menant, Jasmine C et al. (2018) Gait, balance, and falls in Huntington disease. Handbook of clinical neurology 159: 251-260	- Review article but not a systematic review
Wald, Patricia, Chocano-Bedoya, Patricia O, Meyer, Ursina et al. (2020) Comparative Effectiveness of Functional Tests in Fall Prediction After Hip Fracture. Journal of the American Medical Directors Association 21(9): 1327-1330	- Study does not contain an intervention relevant to this review protocol
Wang, Lu, Song, Peiyu, Cheng, Cheng et al. (2021) The Added Value of Combined Timed Up and Go Test, Walking Speed, and Grip Strength on Predicting Recurrent Falls in Chinese Community-dwelling Elderly. Clinical interventions in aging 16: 1801-1812	- Study does not contain an intervention relevant to this review protocol
Webster, J., Courtney, M., Marsh, N. et al. (2010) The STRATIFY tool and clinical judgment were poor predictors of falling in an acute hospital setting. Journal of Clinical Epidemiology 63(1): 109-113	- Study does not contain an intervention relevant to this review protocol
Welch, Sarah A, Ward, Rachel E, Beauchamp, Marla K et al. (2021) The Short Physical Performance Battery (SPPB): A Quick and Useful Tool for Fall Risk Stratification Among Older Primary Care Patients. Journal of the American Medical Directors Association 22(8): 1646-1651	- Study does not contain an intervention relevant to this review protocol
Wettasinghe, Asha H, Dissanayake, Dilshani W N, Allet, Lara et al. (2020) Falls in older people with diabetes: Identification of simple screening measures and explanatory risk factors. Primary care diabetes 14(6): 723-728	- Population not relevant to this review protocol
Whitney, Julie C; Lord, Stephen R; Close, Jacqueline C T (2005) Streamlining assessment and intervention in a falls clinic using the Timed Up and Go Test and Physiological Profile Assessments. Age and ageing 34(6): 567-71	- Study does not contain an intervention relevant to this review protocol
Whitney, Julie, Close, Jacqueline C T, Lord, Stephen R et al. (2012) Identification of high risk fallers among older people living in residential care facilities: a simple screen based on easily collectable measures. Archives of gerontology and geriatrics 55(3): 690-5	- Study does not contain an intervention relevant to this review protocol
Wilbur, Jason, Jogerst, Gerald, Butler, Nicholas et al. (2022) How accurate are geriatricians' fall predictions?. BMC geriatrics 22(1): 436	- Study does not contain an intervention relevant to this review protocol
Winser, Stanley J, Kannan, Priya, Bello, Umar Muhhamad et al. (2019) Measures of balance and falls risk prediction in people with Parkinson's disease: a systematic review of psychometric properties. Clinical rehabilitation 33(12): 1949-1962	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Wolfson, L I, Whipple, R, Amerman, P et al. (1986) Stressing the postural response. A quantitative method for testing balance. Journal of the American Geriatrics Society 34(12): 845-50	- Study does not contain an intervention relevant to this review protocol
Wong Shee, Annkarin; Phillips, Bev; Hill, Keith (2012) Comparison of two fall risk assessment tools (FRATs) targeting falls prevention in sub-acute care. Archives of gerontology and geriatrics 55(3): 653-9	- Study does not contain an intervention relevant to this review protocol
Wood, Tyler A; Wajda, Douglas A; Sosnoff, Jacob J (2019) Use of a Short Version of the Activities-specific Balance Confidence Scale in Multiple Sclerosis. International journal of MS care 21(1): 15-21	- Study does not contain an intervention relevant to this review protocol
Wright, Jonathan R, Koch-Hanes, Trisha, Cortney, Ciera et al. (2022) Planning for Safe Hospital Discharge by Identifying Patients Likely to Fall After Discharge. Physical therapy 102(2)	- Population not relevant to this review protocol
Xia, Lixia, Zheng, Yining, Lin, Zheng et al. (2022) Gap between risk factors and prevention strategies? A nationwide survey of fall prevention among medical and surgical patients. Journal of advanced nursing 78(8): 2472-2481	- Study does not contain an intervention relevant to this review protocol
Yamada, Minoru and Ichihashi, Noriaki (2010) Predicting the probability of falls in community-dwelling elderly individuals using the trail-walking test. Environmental health and preventive medicine 15(6): 386-91	- Study does not contain an intervention relevant to this review protocol
Yang, Christine, Ghaedi, Bahareh, Campbell, T Mark et al. (2021) Predicting Falls Using the Stroke Assessment of Fall Risk Tool. PM & R : the journal of injury, function, and rehabilitation 13(3): 274-281	- Study does not contain an intervention relevant to this review protocol
Yang, Yaqin, Wang, Yongjun, Zhou, Yanan et al. (2014) Validity of the Functional Gait Assessment in patients with Parkinson disease: construct, concurrent, and predictive validity. Physical therapy 94(3): 392-400	- Study does not contain an intervention relevant to this review protocol
Yelnik, A and Bonan, I (2008) Clinical tools for assessing balance disorders. Neurophysiologie clinique = Clinical neurophysiology 38(6): 439-45	- Data not reported in an extractale format or a format that can be analysed
Yoo, Sung-Hee; Kim, Sung Reul; Shin, Yong Soon (2015) A prediction model of falls for patients with neurological disorder in acute care hospital. Journal of the neurological sciences 356(12): 113-7	- Study does not contain an intervention relevant to this review protocol
Zasadzka, Ewa, Borowicz, Adrianna Maria, Roszak, Magdalena et al. (2015) Assessment of the risk of falling with the use of timed up and go test in the elderly with lower extremity osteoarthritis. Clinical interventions in aging 10: 1289-98	- Study does not contain an intervention relevant to this review protocol

Study	Code [Reason]
Zaslavsky, Oleg, Zelber-Sagi, Shira, LaCroix, Andrea Z et al. (2017) Comparison of the Simplified sWHI and the Standard CHS Frailty Phenotypes for Prediction of Mortality, Incident Falls, and Hip Fractures in Older Women. The journals of gerontology. Series A, Biological sciences and medical sciences 72(10): 1394-1400	- Study does not contain an intervention relevant to this review protocol
Zhou, Rong; Li, Jiayu; Chen, Meiling (2022) The Value of Cognitive and Physical Function Tests in Predicting Falls in Older Adults: A Prospective Study. Frontiers in medicine 9: 900488	- Study does not contain an intervention relevant to this review protocol
Zhou, Yuhan, Zia Ur Rehman, Rana, Hansen, Clint et al. (2020) Classification of Neurological Patients to Identify Fallers Based on Spatial-Temporal Gait Characteristics Measured by a Wearable Device. Sensors (Basel, Switzerland) 20(15)	- Population not relevant to this review protocol
Zhu, Kun, Devine, Amanda, Lewis, Joshua R et al. (2011) "'Timed up and go' test and bone mineral density measurement for fracture prediction. Archives of internal medicine 171(18): 1655-61	- Study does not contain an intervention relevant to this review protocol
Ziegl, Andreas, Hayn, Dieter, Kastner, Peter et al. (2020) Machine Learning Based Walking Aid Detection in Timed Up-and-Go Test Recordings of Elderly Patients. Annual International Conference of the IEEE Engineering in Medicine and Biology Society. IEEE Engineering in Medicine and Biology Society. Annual International Conference 2020: 808-811	- Study does not contain an intervention relevant to this review protocol
Zijlstra, A, Ufkes, T, Skelton, D A et al. (2008) Do dual tasks have an added value over single tasks for balance assessment in fall prevention programs? A mini-review. Gerontology 54(1): 40-9	- Review article but not a systematic review
Zur, Oz, Berner, Yitshal, Ohel, Yair et al. (2018) Two-Year Follow-Up of Fall Prediction Among Older Adults in an Independent-Living Community. Advances in experimental medicine and biology 1040: 63-71	- Data not reported in an extractable format or a format that can be analysed

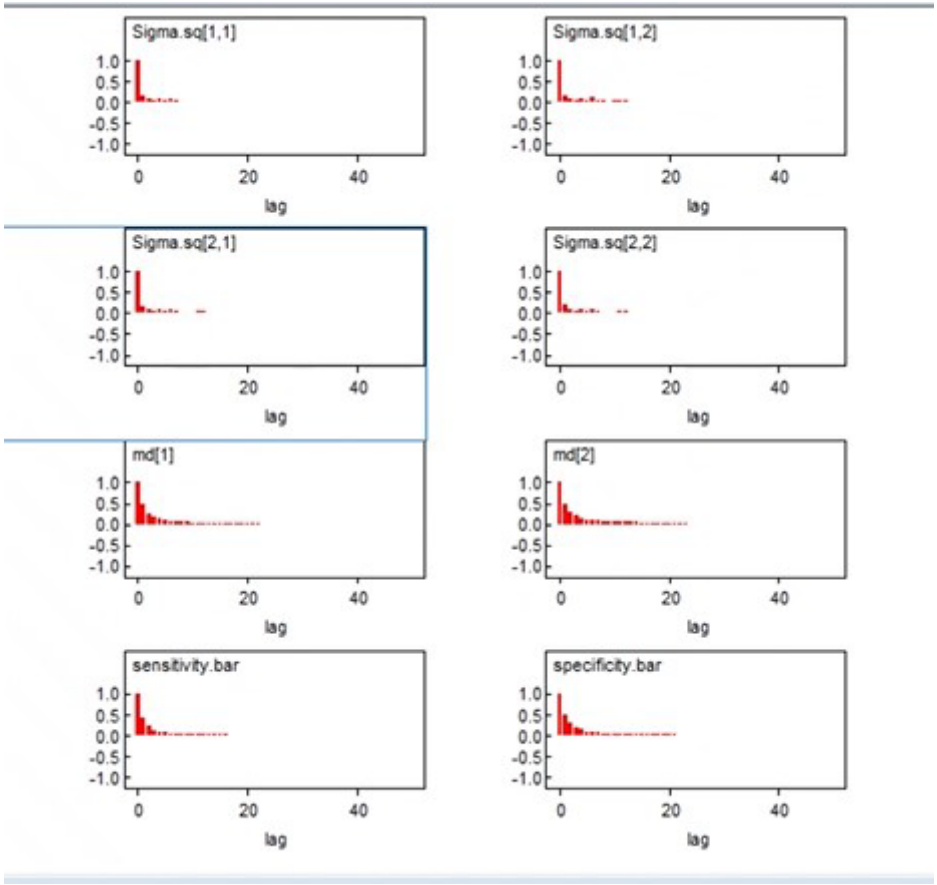
J.2 Health Economic studies

Table 9: Studies excluded from the health economic review

Reference	Reason for exclusion
Peeters, G. M., Heymans, M. W., de Vries, O. J. et al. (2011) Multifactorial evaluation and treatment of persons with a high risk of recurrent falling was not cost-effective. Osteoporosis International 22(7): 2187-2196	- Wrong intervention/comparator [RCT not included in clinical study due to intervention (includes blood tests)]

Appendix K OpenBUGS output

Figure 65: OpenBUGS output - Berg balance scale <45 cut off – community setting



node	mean	sd	MC error	2.5%	median	97.5%	start	sample
Sigma.sq[1,1]	1.428	7.623	0.04658	0.1509	0.6362	6.745	60001	60000
Sigma.sq[1,2]	-0.2928	6.423	0.04107	-2.919	-0.08875	1.504	60001	60000
Sigma.sq[2,1]	-0.2928	6.423	0.04107	-2.919	-0.08875	1.504	60001	60000
Sigma.sq[2,2]	1.253	7.212	0.04945	0.134	0.5459	5.963	60001	60000
md[1]	-0.5103	0.6772	0.005702	-1.861	-0.5062	0.8022	60001	60000
md[2]	1.562	0.6339	0.006044	0.3264	1.567	2.784	60001	60000
sensitivity.bar	0.3846	0.1331	9.783E-4	0.1346	0.3761	0.6905	60001	60000
specificity.bar	0.8118	0.09401	8.482E-4	0.5809	0.8273	0.9418	60001	60000

Appendix L Research Recommendations

L.1 How accurate are wearable technologies in identifying risk of falls?

L.1.1 Why this is important

Wearable technologies have potential for people at risk of falls in a number of ways. Firstly, it is important to be able to identify people who are at higher risk of falls and therefore most likely to benefit from interventions. The options for doing this include asking about previous falls, use of fall risk assessment tools or conventional gait and balance assessments. This review found no single falls risk assessment or gait and balance tool could be recommended based on review finding insufficient accuracy in low quality studies. Wearable technologies have the potential to enhance identification of falls risk as well as determine specific gait or balance deficits that would be amenable to interventions. Such technologies could also be used to monitor and improve adherence to exercise interventions. Finally, emerging technology could also support older people avoid a long lie by detecting fall events. Technology that can accuracy detect falls also has immense potential for future research studies where falls are measured as the primary outcome.

L.1.2 Rationale for the recommendation for research

Importance to 'patients' or the population	There is insufficient evidence to support the use of wearable technologies. Implemented in the appropriate way, they could provide patients with a simple and rapid method of self-assessment for falls risk and could reduce the personnel resources required to undertake gait and balance assessments. More accurate fall risk detection could also improve the efficiency of falls services in ensuring patients access interventions to reduce their risk of falls at the right time and right place.
Relevance to NICE guidance	Wearable technologies could address an evidence gap for accurate tools to identify older people at high risk of falls and those with gait and balance impairments that would benefit from exercise interventions.
Relevance to the NHS	Wearable technologies could improve the efficiency of services and support providing fall risk assessment at scale where personnel resources are limited. Such technologies would need to be supported within NHS IT infrastructure.
National priorities	The use of wearable technologies to identify fall risk and streamline access to the more appropriate intervention aligns with the NHS Long Term Plan which is looking to improve local systems by using digital technologies to -Work in more efficient ways -Improve diagnosis and treatment

	-improve services
Current evidence base	The reviews undertaken for these guidelines did not identify sufficient high-quality evidence to support any recommendations for the use of wearables to detect fall risk, to analyse gait and balance impairments or to support adherence to exercise interventions. There have been numerous studies that have attempted, mostly using internal validation techniques, to establish the predictive accuracy of wearable technologies to establish fall risk. Studies have used a range of wearable technologies which use inertial measurement units (IMUs), gyroscopes and/or accelerometers to establish characteristics associated with gait and/or balance predictive of fall risk. There is significant heterogeneity in the way in which they have been evaluated. Wearables can be applied to a range of different positions on the body, fixed using different methods. Sensors may be a stand-alone piece of equipment or can use the technology available in a smartphone. Most technologies look at the assessment of gait and this can be done by analysing performance while undertaking standard tests (i.e. walking 4 metres) or from collecting 'free living' data over several days of 'usual activity. Additionally, there are a range of gait feature extraction models using different characteristics and modelling approaches. Many of these tools/models have been validated against other 'gold standard' gait and/or balance measures and other fall risk assessment tools. Fewer studies have evaluated the prognostic accuracy using prospective follow up measuring falls[a].
Equality considerations	Use of wearables may be less accessible to those who are digitally excluded. Evidence suggests older people and those living with frailty are more likely to experience digital exclusion. Work would be required to ensure barriers to digital inclusion are addressed alongside the development an implementation of such technologies.

L.1.3 Modified PICO table

Population	Older people (aged >65) or those between 50 and 64 at increased risk of falls. Further

[a] Subramaniam S, Faisal AI, Deen MJ. Wearable Sensor Systems for Fall Risk Assessment: A Review. Front Digit Health. 2022 Jul 14;4:921506.

	research on the value of wearables would be particularly beneficial in a community setting but also recommended for all settings covered by these guidelines: community, hospital and residential care.
Intervention	Wearable technologies including: -Standalone sensors or smartphones to measure gait or balance characteristics during standardised conditions or free-living situations, and the related data extraction models
Comparator	Usual care, Placebo
Outcome	Falls, fall related injury, fall related fracture Prospective data collection
Study design	Prognostic accuracy studies using a cohort design with prospective follow up for falls
Timeframe	Medium
Additional information	It would be helpful to have evidence to support the most cost-effective ways to use wearable technologies for identifying fall risk and understand the potential for these technologies to increase health inequalities.

Appendix M Additional analyses (comprehensive falls assessment)

Studies from the following two forest plots (figure 66 and 67), from evidence review F1, which showed efficacy (the point estimate did not cross 0.80 or 1.25) were further investigated for the assessment tool components and/or risk factors assessed within the study. These details are presented in table 9. The risk factors were then discussed by the committee and a list compiled of the most pertinent.

Figure 66: Multifactorial interventions versus control – rate of falls

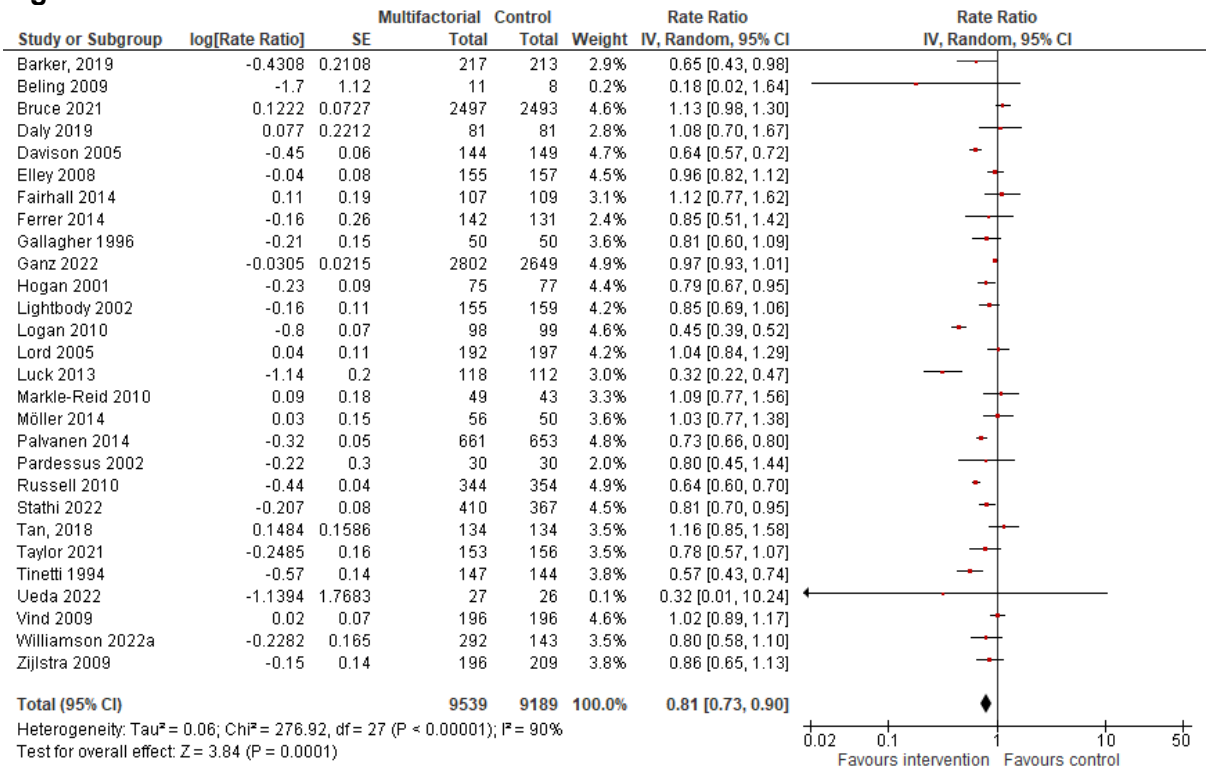
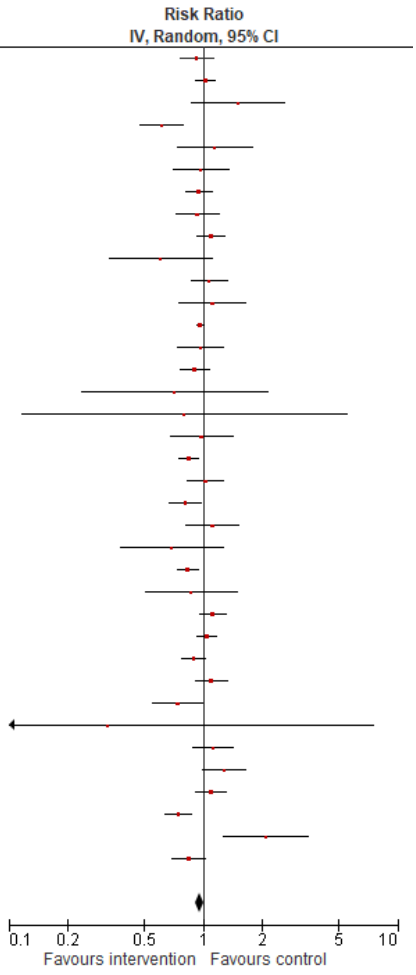


Figure 67: Multifactorial interventions versus control – number of fallers

Study or Subgroup	log[Risk Ratio]	SE	Multifactorial Total	Control Total	Weight	Risk Ratio IV, Random, 95% CI
Barker, 2019	-0.0769	0.1007	217	213	3.3%	0.93 [0.76, 1.13]
Bruce 2021	0.0308	0.0594	2497	2493	5.0%	1.03 [0.92, 1.16]
Ciaschini 2009	0.41	0.28	101	100	0.7%	1.51 [0.87, 2.61]
Close 1999	-0.49	0.13	184	213	2.5%	0.61 [0.47, 0.79]
Coleman 1999	0.14	0.23	79	63	1.0%	1.15 [0.73, 1.81]
Daly 2019	-0.0256	0.1689	77	71	1.7%	0.97 [0.70, 1.36]
Davison 2005	-0.05	0.08	144	149	4.1%	0.95 [0.81, 1.11]
De Vries 2010	-0.07	0.13	106	111	2.5%	0.93 [0.72, 1.20]
Elley 2008	0.09	0.08	155	157	4.1%	1.09 [0.94, 1.28]
Fabacher 1994	-0.5	0.31	100	95	0.6%	0.61 [0.33, 1.11]
Fairhall 2014	0.07	0.11	119	119	3.0%	1.07 [0.86, 1.33]
Ferrer 2014	0.11	0.2	142	131	1.3%	1.12 [0.75, 1.65]
Ganz 2022	-0.0369	0.0192	2802	2649	6.6%	0.96 [0.93, 1.00]
Hendriks 2008	-0.03	0.14	124	134	2.2%	0.97 [0.74, 1.28]
Hogan 2001	-0.1	0.09	75	77	3.7%	0.90 [0.76, 1.08]
Huang 2005	-0.34	0.56	63	63	0.2%	0.71 [0.24, 2.13]
Kingston 2001	-0.22	0.98	51	41	0.1%	0.80 [0.12, 5.48]
Lightbody 2002	-0.02	0.19	155	159	1.4%	0.98 [0.68, 1.42]
Logan 2010	-0.17	0.06	102	102	5.0%	0.84 [0.75, 0.95]
Lord 2005	0.03	0.11	202	201	3.0%	1.03 [0.83, 1.28]
Marrocco 2023	-0.2126	0.0955	875	882	3.5%	0.81 [0.67, 0.97]
Möller 2014	0.11	0.16	80	73	1.9%	1.12 [0.82, 1.53]
Newbury 2001	-0.37	0.31	45	44	0.6%	0.69 [0.38, 1.27]
Palvanen 2014	-0.18	0.06	661	653	5.0%	0.84 [0.74, 0.94]
Pardessus 2002	-0.14	0.28	30	30	0.7%	0.87 [0.50, 1.50]
Russell 2010	0.11	0.08	320	330	4.1%	1.12 [0.95, 1.31]
Spice 2009	0.04	0.06	106	80	5.0%	1.04 [0.93, 1.17]
Spice 2009	-0.11	0.07	164	80	4.5%	0.90 [0.78, 1.03]
Taylor 2021	0.0968	0.0958	153	156	3.5%	1.10 [0.91, 1.33]
Tinetti 1994	-0.3	0.15	147	144	2.0%	0.74 [0.55, 0.99]
Ueda 2022	-1.135	1.6106	27	26	0.0%	0.32 [0.01, 7.55]
Van Haastregt 2000	0.12	0.12	120	115	2.7%	1.13 [0.89, 1.43]
Vetter 1992	0.25	0.13	240	210	2.5%	1.28 [1.00, 1.66]
Vind 2009	0.09	0.09	196	196	3.7%	1.09 [0.92, 1.31]
Wagner 1994 (1)	-0.29	0.08	635	607	4.1%	0.75 [0.64, 0.88]
Whitehead 2003	0.74	0.26	58	65	0.8%	2.10 [1.26, 3.49]
Zijlstra 2009	-0.17	0.1	188	203	3.3%	0.84 [0.69, 1.03]
Total (95% CI)			**11540**	**11235**	**100.0%**	**0.96 [0.91, 1.01]**

Heterogeneity: Tau² = 0.01; Chi² = 80.98, df = 36 (P < 0.0001); I² = 56%
Test for overall effect: Z = 1.64 (P = 0.10)



Footnotes
(1) Multifactorial arm vs control

Table 10: Multifactorial studies' assessment and risk factors

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Barker 2019	RESPOND Clinician (registered healthcare professional) home visit	Falls Risk for Older people in the community (FROP-Com) tool. Risk factors in the FROP-Com tool: • No. of falls in the past 12 months • walks safely in the house • Observation of balance • Incontinence • Number of medical conditions • Vision deficit • Assistance required to perform personal ADLs • Number of falls risk medications • Assistance required to perform domestic ADLs • Somatosensory deficit • Cognitive status • Level of physical activity • Foot problems • Number of medications • Food intake • Weight loss • Nocturia • Alcohol intake • Inappropriate footwear • Injury in past 12 months	• No. of falls in the past 12 months • walks safely in the house • Observation of balance • Incontinence • Number of medical conditions • Vision deficit • Assistance required to perform personal ADLs • Number of falls risk medications • Assistance required to perform domestic ADLs • Somatosensory deficit • Cognitive status • Level of physical activity • Foot problems • Number of medications • Food intake • Weight loss • Nocturia • Alcohol intake • Inappropriate footwear • Injury in past 12 months
		Functional health literacy questionnaire	
		EuroQol-5D-5L	
		Falls Efficacy Scale-International (short version)	
		Berg Balance Scale	
		Screening conducted if reported visual problems using a Snellen eye chart for visual acuity.	

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Beling 2009	Initial telephone	Cognition	Mini Mental State Exam with a score of > or equal to 24/30 points

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
	interview then a follow-up-in person enrolment interview by passing the Mini Mental State exam; TUG and whether had 2 or more falls in the past year, and /or one fall with an injury in past year.	Functional/balance status	3-metre TUG test with a score of > or equal to 13.5 seconds
		Health status	Health status questionnaire
		Medication review	Those taking more than 4 prescription medications and/or drugs that may increase the risk of falling were referred for a medication review
		Muscle testing and Range of motion	Lower extremity manual muscle testing (MMT) and range of motion
		Gait analysis	GAITRite system
		Balance parameters	Dynamic posturography with the Smart EquiTest and included the Sensory Organisation test, the Motor Control Test and the Adaptation Test.
		Functional Balance	Berg Balance Scale
		Visual screening	Screening conducted if reported visual problems using a Snellen eye chart for visual acuity.

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Davison 2005	Accident and emergency department. Included if they had at least one additional fall in the preceding year and excluded if cognitively impaired (mini-mental state examination).	Clinical assessment	Medical and fall history and full clinical examination, including assessment of medications and vision. A comprehensive cardiovascular assessment was performed to assess for orthostatic hypotension, carotid sinus hypersensitivity and vasovagal hypersensitivity.
		Risk factor assessment	Full multidisciplinary assessment: Commonest abnormalities: Balance Gait Culprit medication Home environmental hazards Visual impairment Neurological abnormalities (including peripheral neuropathy and depression).
		Tests	Laboratory blood test and ECG
		Gait and balance assessment	Modified performance orientated mobility score (POMA) Feet, footwear and assistive device

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Hogan 2001	In-home assessment by a specialist in geriatric medicine, 2 nurses, 2 occupational therapists and a physiotherapist	Assessment of risk factors	Environmental hazards
			Balance and mobility abnormality
			Neurologic and sensory impairment
			Lower-extremity disability
			Drug and alcohol use
			Postural hypotension
			Behaviour

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Luck 2013	Standardised interviews were conducted in the participants home by trained study personnel (psychologist, sociologist, or nurse scientist).	Assessed falls in all participants in intervention and control groups.	Questions: Did you fall in the last 12 months (yes/no)? How often did you fall in the last 12 months? Were they categorised into a higher level of care, according to the German long-term care insurance policy?
		Performance in basic activities of daily living (eg personal hygiene, mobility) of intervention and control groups	Barthel Index
		Performance in more complex activities of daily living (e.g. using the telephone, handling routine finances) assessed in intervention and control groups	Instrumental Activities of Daily Living scale
		Multidimensional geriatric assessment of self-care deficits and risk factors for insitutionalisation including those that are also associated with falling	e.g. impairment in vision, age-inappropriateness of housing conditions, malnutrition.
		Performance in basic activities of daily living (eg personal hygiene, mobility) of intervention and control groups	Barthel Index
		Performance in more complex activities of daily living (e.g. using the telephone, handling routine finances) assessed in intervention and control groups	Instrumental Activities of Daily Living scale

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Taylor 2021A (i-FOCIS RCT)	Experienced occupational therapists undertook assessments	Functional cognition	LACLS-5 (Large Allen's Cognitive Level Screen), validated using the placemat or ribbon card tasks and interpreted using the Allen's Cognitive Disability Model (ACDM).
		Mobility and balance	Short Physical Performance Battery (static balance, sit-to-stand, and gait speed).
		Sensorimotor function	5-item Physiological Profile Assessment (PPA), assesses: • vision • simple hand reaction time • proprioception • knee extension strength postural sway on foam
		Balance further assessed	Coordinated stability and maximal balance range tests.

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Tinetti 1994	Assessments were conducted in the subjects' homes by the study nurse practitioner and physical therapist. The nurse practitioner obtained demographic data, history of falls, information on depressive symptoms, the presence of chronic diseases and the level of	Risk factor assessment: Targeted risk factors were selected on the basis of evidence of their association with the risk of falling and the availability of assessment measures considered feasible in usual clinical practice.	Assessed by nurse: • postural hypotension: drop in systolic BP equal or over 20mmHg or to <90mmHg on standing • Use of any benzodiazepine or other sedative-hypnotic agent • Use of 4 or mor prescription medications • Inability to transfer safely to bath-tub or toilet • Environmental hazards for falls or tripping
			Assessed by a physical therapist: • Any impairment in gait • Any impairment in transfer skills or balance

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
	independence in activities of daily living and administered the Falls Efficacy Scale (a measure of the subject's degree of confidence in performing 10 common activities (such as walking and stair climbing) without falling, and the ambulation and mobility subscales of the Sickness Impact Profile. Also assessing near vision and hearing. The number of hazards for falling was determined by a room-by-room examination of walking paths, furniture and stairs.		• Impairment in leg or arm muscle strength or range of motion (hip, ankle, knee, shoulder, hand, elbow)

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Ueda 2022	Physical therapist conducted the program using home floor plans drawn by patients prior to hospital discharge. Additional data regarding patients characteristics		
		Assessment of home hazards	Checked paths used during daily living in homes and confirmed home fall hazards in individual face-to-face interviews. • Any stairs? • Whether floors in living room and bedroom were clear

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
	including medication status, fall injury causing hospitalisation, number of falls in the past year, living environment, house environment certification for long-term care before admission, sedentary time before hospitalisation, walking ability before and after hospitalisation and length of hospital stay were collected from their medical records.		• Whether floor mats were held in place (so they would not slide) • Whether they wore footwear that fit poorly or had high heels Whether there was poor lighting placement.
		Activities of daily living	Barthel Index
		Physical function	Timed up and go test
		Mental and psychological function	Geriatric Depression scale 5 Modified Fall Efficacy scale

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Williamson 2022a (BOOST trial)	Individual physiotherapy assessment including presenting Neurogenic Claudication symptoms, general health status, current activity levels, including walking ability and screening for serious pathology. Screening for cognitive impairment.	Physical testing	6 minute walk test (6MWT)
			Short Physical Performance Battery (SPPB)

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Logan 2010	Researcher visited at home and administered a questionnaire including number of falls in 3 months before recruitment	Daily living	Barthel activities of daily living index, to measure personal ability with activities of daily living
		Daily living	Nottingham extended activities of daily living scale to measure ability with instrumental activities of daily living
		Fear of falling	Falls efficacy scale

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Pardessus 2002	Occupational therapist and ergotherapist assessed patients' homes for environmental hazards. A general physical examination was given to patients and balance was tested by the get-up-and-go test. Cognitive status was estimated by the Mini Mental test. From the baseline information, medical assessment, causes and risk factors for falling were determined.	Functional status	The activities of daily living (ADL scale) which estimates bathing, dressing, use of toilet, walking inside and outside, urinary and faecal continence and preparing meals.
		Functional status	The instrumental activities of daily living (IADL) scale assesses using the telephone, taking medication, using public transportation, and managing a budget.
		Functional status	The functional autonomy measurement system (SMAF) scale is a global evaluative instrument and estimates mobility, communication, mental function, and instrumental activities of daily living.

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Palvanen 2014	At clinic a one hour meeting with a nurse regarding background details (type of residence, activities of daily living, functional ability, exercise, fear of falling, medical conditions, medications, living arrangements, previous falls and injuries and nutrition. Cognitive status was assessed by the Mini-Mental State Examination and depressive symptoms by the Geriatric Depression Scale (GDS-15). Additional one hour assessment by a physiotherapist, including tests for balance, walking speed, muscle activity and strength and reaction time.	Mobility, balance, walking speed and ability to rise from a chair.	Short Physical PerformanceBattery (SPPB) Timed up and go test (TUG)
		Reaction time	Computer-based eye-hand reaction test
		Muscle strength	Isometric quadriceps strength was measured in sitting position with a custom-made dynamometer; Grip strength was measured from both handsy by Jamar hand dynamometer.
		Medical examination by Chaos Clinic physician	Cardiovascular assessment; blood pressure measurement and orthostatic test and respiratory system examined by auscultation.
		Assessment of musculoskeletal system	Measurement of active and passive range of motion of the joints, spine flexibility and participants' ability to walk by heels and toes.
		Short neurological examination	Assessed cerebral nerves, reflexes, sensation, and coordination.
		Visual acuity	Snellen eye chart and low contrast visual acuity test char. Red reflection and field of vision.

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Close 1999 (PROFET)	General medical examination given, additionally focusing on a more detailed assessment of visual acuity, balance, cognition, affect and prescribing practice. Mini mental state examination to assess cognition and modified geriatric depression scale to assess affect. Carotid sinus studies were undertaken if the cause of the fall was unclear or clinical suspicion was high. After assessment and in conjunction with baseline data a primary cause for the index fall was assigned, and identified risk factors modified. Hom visit by Occupational therapist after medical assessment.	Function	Barthel Index and supplemented (for descriptive purposes only) by a modified version of the functional independence and functional assessment measures. The most common environmental hazards at the time of the fall were uneven outdoor surfaces, change in surface level, ramps or steps, inappropriate floor covering, and unsuitable footwear.
		Environmental hazards	Health and Safety Executive (UK) Checklist.
		Psychological	Falls handicap inventory as an indirect marker of psychological consequences of the fall (18 questions on health, function, and emotion)

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Fabacher 1994	Before randomisation	Daily living	Activities of daily living (Katz 1970)

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
	telephone interview for 15 minutes for information on demographics, health and functional status and recent use of medical services. The (HAPSA) group received an initial in-home assessment within 2 weeks by a physician's assistant or research nurse trained in geriatrics. Initial assessment included a thorough medical history and medication review, brief focused physical examination, hearing and vision screen, blood pressure, health behaviour inventory and a battery of validated geriatric assessment screening instruments: mental status examination, the geriatric depression scale and activities of daily living and instrumental ADLs and a gait and	Instrumental activities of daily living	Instrumental activities of daily living (IADL) (Lawton1969)
		Gait and balance assessment	Reference given is Tinetti 1986

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
	balance assessment.		

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Huang 2005	Within 24-48 hours of patients' admission start to assess their health care needs; visit regularly (every 48 hours at least) during hospitalisation to assess, counsel, education, coordinate and evaluate the health care needs of patients and caregivers.	Level of independent functioning	Barthel Index
		Health status	SF-36

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Newbury 2001	Control participants completed an SF-36 QoL questionnaire only; Intervention participants completed an SF-36 and had a 75+HA performed.	Components of the assessment instrument	Hearing
			Vision
			Physical condition
			Medication
			Compliance
			Miscellaneous (vaccination, alcohol and tobacco use)
			Cognition (Folstein mini-mental state)
			Mood (Geriatric depression scale GDS-15)
			Activities of daily living (Barthel ADL)

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
			Mobility
			Nutrition (Australian Nutrition Screening Initiative)
			Social
			Housing

Study (year)	Person undertaking assessment and location	Assessment	Risk factors included
Kingston 2001	Both groups were assessed face to face by an independent researcher at baseline and within 4 days of the fall with a standard battery of question including biographical details, questions about Activities of Daily Living (ADL) before the index fall and medical history over previous 12 months.	Daily living	Activities of daily living before the index fall.
		Physical function	Short Form 36 (SF3) acute version.

Summary of risk factors assessed within multifactorial studies

- No. of falls in the past 12 months/Injury in past 12 months
- Home environmental hazards
- Walks safely in the house/walking speed
- Balance/Gait/muscle testing/range of motion
- Cognitive status
- Level of physical activity
- Foot problems/inappropriate footwear
- Incontinence/Nocturia
- Number of medical conditions

- Medications/number of falls risk medications/vaccinations
- Vision/Hearing
- Activities of daily living/Assistance required to perform personal ADLs/Assistance required to perform domestic ADLs
- Number of falls risk medications
- Somatosensory deficit
- Food intake/weight loss/alcohol intake
- Mood/depression
- Social/housing
- Falls self-efficacy
- Blood pressure
- Cardiovascular