

**A novel home-based telerehabilitation program targeting fall prevention in Parkinson disease: a preliminary trial**

Afshari M, Hernandez AV, Joyce JM, Hauptschein AW, Trenkle KL, Stebbins GT, Goetz CG. *Neurol. Clin. Pract.* 2024; 14(1): e200246.

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**Abstract**

**BACKGROUND AND OBJECTIVES:** Falls in a person with Parkinson disease (PwP) are frequent, consequential, and only partially prevented by current therapeutic options. Notably, most falls in PwPs occur in the home or its immediate surroundings; however, our current strategies for fall prevention are clinic-centered. The primary objective of this nonrandomized pilot trial was to investigate the feasibility and preliminary efficacy of the novel implementation of home-based PD telerehabilitation (tele-physical/occupational therapy) focusing on fall risk reduction and home-safety modification.

**METHODS:** Persons with mild-to-moderate PD who were identified as being at risk of falls by their movement disorders neurologist were recruited from a tertiary movement disorders clinic. After an initial in-person evaluation by the study physical and occupational therapists, 15 patients with PD (Hoehn and Yahr Stage 2 (n = 8) and Stage 3 (n = 7)) participated in 4 biweekly PT/OT televisits with care partner supervision over the course of 10 weeks. The Goal Attainment Scale (GAS) was implemented to assess progress toward individualized PT/OT goals established at baseline. Outcomes were assessed at the end of the intervention at 10 weeks and at a six-month follow-up.

**RESULTS:** Participants completed all 120 protocol-defined televisits without dropouts and adverse events. At 10 weeks, mean composite PT and OT-GAS scores showed significant improvement from baseline (PT:  $p < 0.001$ , OT:  $p < 0.008$ ), which continued at 6 months (PT:  $p < 0.0005$ , OT:  $p < 0.0005$ ). Home-modification recommendations made through novel virtual home-safety tours were cumulatively met by participants at 87% at 10 weeks and 91% at 6 months.

**DISCUSSION:** Home-based telerehabilitation is a promising new strategy toward fall prevention in PD. The GAS has the potential to serve as an effective and patient-driven primary outcome variable for rehabilitation interventions for heterogeneous PwPs to assess progress toward personalized goals.

**TRIAL REGISTRATION INFORMATION:** ClinicalTrial.gov identifier: NCT04600011.

**Language:** en

## Usefulness of the Berg Balance Scale for prediction of fall risk in multiple sclerosis

Ayvat E, Doğan M, Ayvat F, Kılınç O, Sutcu G, Kılınç M, Yıldırım SA. Neurol. Sci. 2024; ePub(ePub): ePub.

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### Abstract

**INTRODUCTION:** The Berg Balance Scale, possibly the most widely used balance-related measure, has gained popularity in clinical trials. It provides information about patients' balance-related abilities and can be used to assess improvement or worsening after rehabilitation. The aim of this study is to determine the cut-off value of the Berg Balance Scale for the fall risk in patients with multiple sclerosis (MS).

**METHODS:** This study was designed as a prospective descriptive trial, and 186 patients with MS were included. Fall history was recorded by interview; balance was assessed using the Berg Balance Scale (BBS).

**RESULTS:** The mean ages of 96 patients with a fall history within the previous month and 90 patients without a fall history were  $35.98 \pm 8.58$  and  $35.71 \pm 9.33$  years, respectively. The mean value of the BBS score of the faller group was  $49.44 \pm 5.43$  while  $52.36 \pm 3.53$  in non-faller group. The cut-off value of the BBS for fall risk in patients with MS was determined as 50.50 points.

**CONCLUSIONS:** For patient safety and the success of rehabilitation, it is crucial to evaluate the risk of falling in patients with MS, one of the neurological patient groups where complaints about falling are most prevalent. The results showed that BBS is a sensitive and specific measure for identifying in patients with MS at risk of falling.

**Language:** en

**Keywords:** Rehabilitation; Balance; Multiple sclerosis; Berg Balance Scale; Fall

# **Risk factors for osteoporotic hip fracture among community-dwelling older adults: a real-world evidence study**

Azevedo DC, Hoff LS, Kowalski SC, de Andrade CAF, Trevisani VFM, de Melo AKG. *Adv. Rheumatol.* 2024; 64(1): e8.

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**PMID:** 38233892

## **Abstract**

**BACKGROUND:** Hip fractures in the older adults lead to increased morbidity and mortality. Although a low bone mineral density is considered the leading risk factor, it is essential to recognize other factors that could affect the risk of hip fractures. This study aims to evaluate the contribution of clinical characteristics, patient-reported outcomes, and muscle and aerobic capacity for hip fractures in community-dwelling older adults.

**METHODS:** This is a retrospective cohort study with real world-data from subjects  $\geq 60$  years old attending an outpatient clinic in Minas Gerais, Brazil, from May 1, 2019, to August 22, 2022. Data about clinical characteristics (multimorbidity, medications of long-term use, sedative and or tricyclic medications, number of falls), patient-reported outcomes (self-perception of health, self-report of difficulty walking, self-report of vision problems, and self-report of falls) and muscle and aerobic capacity (calf circumference, body mass index, and gait speed) were retrieved from an electronic health record. The association of each potential risk factor and hip fracture was investigated by a multivariable logistic regression analysis adjusted for age and sex.

**RESULTS:** A total of 7,836 older adults were included with a median age of 80 years (IQR 72-86) and 5,702 (72.7%) were female. Hip fractures occurred in 121 (1.54%) patients. Multimorbidity was associated with an increased risk of hip fracture (OR = 1.12, 95%CI 1.06-1.18) and each episode of fall increased the chance of hip fracture by 1.7-fold (OR = 1.69, 95%CI 1.52-1.80). Patient-reported outcomes associated with increased fracture risk were regular or poor self-perception of health (OR = 1.59, 95%CI 1.06-2.37), self-report of walking difficulty (OR = 3.06, 95%CI 1.93-4.84), and self-report of falls (OR = 2.23, 95%CI 1.47-3.40). Body mass index and calf circumference were inversely associated with hip fractures (OR = 0.91, 95%CI 0.87-0.96 and OR = 0.93, 95%CI 0.88-0.97, respectively), while slow gait speed increased the chance of hip fractures by almost two-fold (OR = 1.80, 95%CI 1.22-2.66).

**CONCLUSION:** Our study reinforces the importance of identified risk factors for hip fracture in community-dwelling older adults beyond bone mineral density and available fracture risk assessment tools. Data obtained in primary care can help physicians, other health professionals, and public health policies to identify patients at increased risk of hip fractures.

**Language:** en

**Keywords:** Patient-reported outcomes; Community-dwelling older adults; Hip fractures

# **A comparison of the effects of mediolateral surface and foot placement perturbations on balance control and response strategies during walking**

Brough LG, Neptune RR. Gait Posture 2024; 108: 313-319.

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## **Abstract**

**BACKGROUND:** Balance perturbation studies during walking have improved our understanding of balance control in various destabilizing conditions. However, it is unknown to what extent balance recovery strategies can be generalized across different types of mediolateral balance perturbations.

**RESEARCH QUESTION:** Do similar mediolateral perturbations (foot placement versus surface translation) have similar effects on balance control and corresponding balance response strategies?

**METHODS:** Kinetic and kinematic data were previously collected during two separate studies, each with 15 young, healthy participants walking on an instrumented treadmill. In both studies, medial and lateral balance perturbations were applied at 80% of the gait cycle either by a treadmill surface translation or a pneumatic force applied to the swing foot. Differences in balance control (frontal plane whole body angular momentum) and balance response strategies (hip abduction moment, ankle inversion moment, center of pressure excursion and frontal plane trunk moment) between perturbed and unperturbed gait cycles were evaluated using statistical parametric mapping.

**RESULTS:** Balance disruptions after foot placement perturbations were larger and sustained longer compared to surface translations. Changes in joint moment responses were also larger for the foot placement perturbations compared to the surface translation perturbations. Lateral hip, ankle, and trunk strategies were used to maintain balance after medial foot placement perturbations, while a trunk strategy was primarily used after surface translations.

**SIGNIFICANCE:** Surface and foot placement perturbations influence balance control and corresponding response strategies differently. These results can help inform the development of perturbation-based balance training interventions aimed at reducing fall risk in clinical populations.

**Language:** en

**Keywords:** Walking; Balance control; Biomechanics; Gait; Perturbations; Response strategies

# Impact of frailty and sex-related differences on postural control and gait in older adults with Parkinson's Disease

Dallaire M, Houde-Thibeault A, Bouchard-Tremblay J, Wotto EA, Côté S, Oliveira CS, Ngomo S, da Silva RA. Exp. Gerontol. 2024; ePub(ePub): ePub.

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## Abstract

**BACKGROUND:** Parkinson's Disease (PD), a neurodegenerative condition, affects normal aging and leads to reduced motor abilities. In addition, frailty syndrome can increase vulnerability and risks of undesirable effects such as disease progression, falls, disability, and premature death among individuals with PD. **AIMS:** To assess the impact of frailty on balance and gait parameters in older with PD and to determine if sex mediates these measures.

**METHODS:** Twenty-seven (27) participants (n = 18 men; n = 10 frail) performed 4 balance tasks on a force platform (eyes opened/closed in bipodal/semi-tandem position) while linear center of pressure (COP) parameters were calculated. Participants also performed two different speed walks on a gait analysis system to assess gait parameters.

**RESULTS:** Significant differences between the frail and non-frail group were observed on postural control (mainly for area of COP  $p = 0.013/d = 0.47/70\%$ ; sway velocity  $p = 0.048/d = 0.41/23\%$ ) where frail reported poor balance. No significant sex differences were reported for postural control. Gait analysis was comparable between frail and non-frail, while significant differences between men and women were observed for step length ( $p = 0.002, d = 0.71$ ), step width ( $p = 0.001, d = 0.75$ ) and base of support ( $p = 0.012, d = 0.64$ ) variables.

**CONCLUSION:** Frail Parkinson's individuals present poorer postural control than non-frail individuals, but comparable gait parameters. Men and women are comparable on postural control but show different gait parameters. These results may have implications in clinical decision-making in rehabilitation for frailty in older adults, men and women with Parkinson's disease when balance and gait are of concern.

**Language:** en

**Keywords:** Aging; Balance; Gait; Frailty; Parkinson's Disease; Sex

## **Monitoring falls in residential aged care facilities: agreement between falls incident reports and progress notes**

Dawson R, Feng A, Oliveira JS, Hassett L, Sherrington C, Pinheiro MB. *Australas. J. Ageing* 2024; ePub(ePub): ePub.

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### **Abstract**

**OBJECTIVES:** Accurate fall reporting is essential for assessing the effectiveness of fall prevention strategies. This study aimed to investigate the level of agreement between incident reports and resident progress notes as data sources for falls monitoring in residential aged care facilities.

**METHODS:** A retrospective observational study was conducted involving 46 older people from six residential aged care facilities who had consented to join the broader TOP UP trial. Fall events documented in the incident report system and resident progress notes over 12 months before randomisation were extracted by two independent reviewers using a standardised Excel form. Agreement between the two data collection methods was calculated using Cohen's kappa coefficient.

**RESULTS:** A total of 75 falls were recorded from 27 (59%) of the 46 participants who were 65% female, with an average age of 83 [SD 9] years. The incident reports captured 68 (90.7%) falls, while the progress notes captured 73 (97.3%) falls. Overall, there was a 75% agreement between falls recorded in progress notes and incident reports. Perfect agreement was identified for five facilities ( $n = 35$ ), while one facility had a lower agreement rate of 29% ( $n = 11$ ), which appeared to be attributable to staff shortages linked to the COVID-19 pandemic.

**CONCLUSIONS:** There was substantial agreement between incident reports and progress records. These findings support the use of incident reports for identifying falls in research or to investigate the effectiveness of fall prevention strategies in residential aged care facilities.

**Language:** en

**Keywords:** accidents; geriatrics; long-term care; medical records

# **Digital technologies to prevent falls in people living with dementia or mild cognitive impairment: a rapid systematic overview of systematic reviews**

Eost-Telling C, Yang Y, Norman G, Hall A, Hanratty B, Knapp M, Robinson L, Todd C. Age Ageing 2024; 53(1).

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PMC10788098

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## **Abstract**

**OBJECTIVE:** Falls are a common cause of potentially preventable death, disability and loss of independence with an annual estimated cost of £4.4bn. People living with dementia (PlwD) or mild cognitive impairment (MCI) have an increased fall risk. This overview evaluates evidence for technologies aiming to reduce falls and fall risk for PlwD or MCI.

**METHODS:** In October 2022, we searched five databases for evidence syntheses. We used standard methods to rapidly screen, extract data, assess risk of bias and overlap, and synthesise the evidence for each technology type.

**RESULTS:** We included seven systematic reviews, incorporating 22 relevant primary studies with 1,412 unique participants. All reviews had critical flaws on AMSTAR-2: constituent primary studies were small, heterogeneous, mostly non-randomised and assessed as low or moderate quality. Technologies assessed were: wearable sensors, environmental sensor-based systems, exergaming, virtual reality systems. We found no evidence relating to apps. Review evidence for the direct impact on falls was available only from environmental sensors, and this was inconclusive. For wearables and virtual reality technologies there was evidence that technologies may differentiate PlwD who fell from those who did not; and for exergaming that balance may be improved.

**CONCLUSIONS:** The evidence for technology to reduce falls and falls risk for PlwD and MCI is methodologically weak, based on small numbers of participants and often indirect. There is a need for higher-quality RCTs to provide robust evidence for effectiveness of fall prevention technologies. Such technologies should be designed with input from users and consideration of the wider implementation context.

**Language:** en

**Keywords:** dementia; aged; technology; falls; older people; rapid review



# Using the analytic hierarchy process to measure nurses' decision-making regarding fall risks and care strategies for fall prevention

Hiyama A. J. Nurs. Meas. 2024; ePub(ePub): ePub.

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## Abstract

**Background and Purpose:** Visualizing the thought processes of nurses is useful in forming evidence to prevent falls. This study aimed to quantify nursing judgment by comparing the choices made by nurses with different experiences regarding fall prevention.

**METHODS:** Questionnaires were administered to participants with  $<9$  and  $\geq 10$  years of nursing experience to examine their importance ratings regarding fall prevention using an analytic hierarchy process (AHP).

**RESULTS:** Compared with the group with  $<9$  years of experience, the group with  $\geq 10$  years of experience viewed habitual behavior in unstable activity as the most important fall risk. They also viewed early detection and alleviation of symptoms that lead to fall risk due to side effects of drugs and diseases as an important nursing practice.

**CONCLUSION:** Since differences in nursing judgment between experienced and inexperienced nurses were revealed, it is possible that nursing judgment can be measured using AHP.

**Language:** en

**Keywords:** analytic hierarchy process; fall prevention; nursing assessment; patient safety; quality of care

# **The association of skeletal muscle energetics with recurrent falls in older adults within the Study of Muscle, Mobility and Aging (SOMMA)**

Kramer PA, Zamora E, Barnes HN, Strotmeyer ES, Glynn NW, Lane NE, Coen PM, Cawthon PM, Goodpaster BH, Newman AB, Kritchevsky SB, Cummings SR. J. Gerontol. A Biol. Sci. Med. Sci. 2024; ePub(ePub): ePub.

(Copyright © 2024, Gerontological Society of America)

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## **Abstract**

**BACKGROUND:** Falls in the older population are a major public health concern. While many physiological and environmental factors have been associated with fall risk, muscle mitochondrial energetics has not yet been investigated.

**METHODS:** In this analysis, 835 Study of Muscle, Mobility and Aging (SOMMA) participants aged 70-94 were surveyed for number of falls (total), recurrent falls (2+), and fall-related injuries over the past 12 months at baseline and again after one year. Skeletal muscle energetics were assessed at baseline in vivo using 31P Magnetic Resonance Spectroscopy (MRS) after an acute bout of exercise (ATPmax) and ex vivo by High Resolution Respirometry (HRR) of permeabilized muscle fibers from the vastus lateralis (MaxOXPHOS).

**RESULTS:** At least one fall was reported in 28.7% of SOMMA participants in the first year of the study, with 12% of older adults reporting recurrent falls (2+). Individuals who experienced recurrent falls had a slower 400m walk gait speed ( $1.0 \pm 0.2$  vs.  $1.1 \pm 0.2$ ,  $p < .001$ ), reported fewer alcoholic drinks per week in the past year ( $2.4 \pm 4.3$  vs.  $2.8 \pm 4.4$ ,  $p = 0.054$ ), and took a significantly greater number of medication in the 30 days before their baseline visit ( $5.6 \pm 4.4$  vs.  $4.2 \pm 3.4$ ,  $p < 0.05$ ). A history of falls was reported in 63% of individuals who experienced recurrent falls in the first year of the study compared to 22.8% who experienced one or fewer falls. MaxOXPHOS was significantly lower in those who reported recurrent falls ( $p = 0.008$ ) compared to those with one or fewer falls, but there was no significant difference in ATPmax ( $p = 0.369$ ). Neither muscle energetics measure was significantly associated with total number of falls or injurious falls, but recurrent falls were significantly higher with lower MaxOXPHOS (RR=1.33, 95% CI= 1.02-1.73,  $p = 0.033$ ). However, covariates accounted for the increased risk.

**CONCLUSIONS:** Mitochondrial energetics were largely unrelated to fall risk in older adults when accounting for variables, suggesting that the complex etiology of falls may not be related to a single "hallmark of aging" biological pathway.

**Language:** en

**Keywords:** Mobility; Frailty; Mitochondria

## **Influence of verbal instruction on gait training in Parkinson's disease: a randomized controlled trial**

Li MH, Tai CH, Luh JJ, Chen YJ, Hsu WL, Lee YY. Am. J. Phys. Med. Rehabil. 2024; ePub(ePub): ePub.

(Copyright © 2024, Lippincott Williams and Wilkins)

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### **Abstract**

**OBJECTIVE:** Verbal instruction is one of the most commonly used methods that therapists use to correct walking pattern for people with Parkinson's disease (PD). This study aimed to compare the long-term training effects of two different verbal instructions that either asked the participants to 'take big steps' or 'strike the ground with the heel' on walking ability in individuals with PD.

**DESIGN:** Forty-five participants with PD were randomized into the big-step (BIG) or heel strike (HS) group. The participants underwent 12 sessions of treadmill and overground gait training. Throughout the interventions, the BIG group received an instruction to 'take big steps,' while the HS group received an instruction to 'strike the ground with your heel.' The primary outcome was gait performance, including velocity, stride length, cadence, and heel strike angle. The participants were assessed before, immediately after, and 1-month after training.

**RESULTS:** Both groups showed significant improvements in gait performance after training. The HS group showed continuous improvements in velocity and stride length during the follow-up period; however, the BIG group showed slightly decreased performance.

**CONCLUSION:** A verbal instruction emphasizing heel strike can facilitate long-term retention of walking performance in people with PD.

**Language:** en

# **Risk assessment of falls among older adults based on probe reaction time during water-carrying walking**

Liu F, Yu H, Xu Q, Gong J, Huo M, Huang F. Clin. Interv. Aging 2024; 19: 21-29.

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**PMCID:** PMC10777860

## **Abstract**

**PURPOSE:** Falls are a significant factor affecting the health of older adults and are closely related to cognitive function. Adopting an effective method to evaluate the risk of falls in older adults is essential for improving their healthcare. This study combined cognitive and motor functions to determine a reliable probe reaction time during water-carrying walking.

**PATIENTS AND METHODS:** We divided 100 community-dwelling older adults (aged 65 years and over) into two groups according to their fall history: the fall group and no-fall group. All subjects were tested on fall tasks using the timed up-and-go (TUG) test, 10-m walk timing test, trail marking test part-A (TMT-A), and water-carrying walking probe reaction time (P-RT).

**RESULTS:** The fall group showed slower walking speeds and longer TUG, TMT-A, and P-RT times than the no-fall group. In the logistic regression analysis with falls as the dependent variable, water-carrying walking P-RT was identified as a useful factor, and the cut-off value of the water-carrying walking P-RT was 454 ms, which was evaluated using the receiver operating characteristic curve.

**CONCLUSION:** The P-RT of the water-carrying walking test was found to be credible and useful for evaluating the fall risk in older adults. Therefore, it is recommended that the P-RT-based dual-task be used as a predictive indicator of future falls in the older population.

**Language:** en

**Keywords:** Aged; Humans; Risk Assessment; Water; older adults; falls; \*Accidental Falls/prevention & control; \*Walking; dual task; probe reaction time; Reaction Time

## **Stepping beyond assessment: fall risk prediction models among older adults from cumulative change in gait parameter estimates**

Marchal N, Skubic M, Scott GJ. AMIA Annu. Symp. Proc. 2023; 2023: 1135-1144.

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**PMCID:** PMC10785833

### **Abstract**

Falls significantly affect the health of older adults. Injuries sustained through falls have long-term consequences on the ability to live independently and age in place, and are the leading cause of injury death in the United States for seniors. Early fall risk detection provides an important opportunity for prospective intervention by healthcare providers and home caregivers. In-home depth sensor technologies have been developed for real-time fall detection and gait parameter estimation including walking speed, the sixth vital sign, which has been shown to correlate with the risk of falling. This study evaluates the use of supervised classification for estimating fall risk from cumulative changes in gait parameter estimates as captured by 3D depth sensors placed within the homes of older adult participants. Using recall as the primary metric for model success rate due to the severity of fall injuries sustained by false negatives, we demonstrate an enhancement of assessing fall risk with univariate logistic regression using multivariate logistic regression, support vector, and hierarchical tree-based modeling techniques by an improvement of 18.80%, 31.78%, and 33.94%, respectively, in the 14 days preceding a fall event. Random forest and XGBoost models resulted in recall and precision scores of 0.805 compared to the best univariate regression model of Y-Entropy with a recall of 0.639 and precision of 0.527 for the 14-day window leading to a predicted fall event.

**Language:** en

**Keywords:** Aged; Humans; Logistic Models; Prospective Studies; Risk Assessment; \*Gait

# **The effect of dietary patterns on reducing falls and falls risk in adults: a systematic review**

Nguyen HH, Do DV, To KG, Doan HTN, Oddy WH. Curr. Nutr. Rep. 2024; ePub(ePub): ePub.

(Copyright © 2024, Holtzbrinck Springer Nature Publishing Group)

**DOI:** 10.1007/s13668-023-00516-6

**PMID:** 38194079

## **Abstract**

**PURPOSE OF REVIEW:** Falls are a major global public health issue and the second cause of unintentional injury death. Nutrition may be an important factor for falls prevention in adults, but most previous studies examined the associations between single nutrients and falls. The use of dietary patterns is an alternative method to measure whole diet and its relationship with health outcomes. Therefore, we aimed to systematically review all evidence relating to dietary pattern impacts on falls and/or falls risk in adults. **RECENT FINDINGS:** This systematic review was registered on the PROSPERO (CRD42020171987). Four databases (Medline, Embase, Cochrane Library, CINAHL Complete) were used for searching potential articles on 18th December 2021 and updated the search on 10th July 2023. We included any quantitative study reporting associations between dietary patterns and falls and/or falls risk in healthy adults  $\geq 18$  years and publishing in English as full text and peer-reviewed. Of 2866 potential articles, five studies (two cross-sectional, three cohorts) were included for the evidence synthesis. The risk of bias was low in cohort studies. Dietary patterns were derived using both "a priori" or "empirical" approaches, and self-report questionnaires used for falls/falls risk in most studies. Associations between dietary patterns and falls/falls risk were inconsistent results by sex and study design. The effect of dietary patterns on reducing falls/falls risk is not clear in the included studies, so this association needs to be confirmed in future research.

**Language:** en

**Keywords:** Adults; Falls; Systematic review; Dietary patterns; Falls risk

# **Association between fear of falling and falls following acute and chronic stroke: a systematic review with meta-analysis**

Pin TW, Winsor SJ, Chan WLS, Chau B, Ng S, Wong T, Mak M, Pang M. J. Rehabil. Med. 2024; 56: jrm18650.

(Copyright © 2024, Foundation for Rehabilitation Information)

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**PMID:** 38226564

## **Abstract**

**OBJECTIVES:** To examine the association between falls and fear of falling in people with stroke and to evaluate the differences between patients with acute stroke and those with chronic stroke with regard to any such association.

**METHODS:** Articles were searched in Medline, CINAHL, AMED, Embase, PsycINFO, Cochrane Library of Reviews and PEDro from inception until March 2023. Experimental, observational or explorative studies investigating the association between fear of falling and falls in people with stroke were included. Articles were screened by 2 independent reviewers. Data were extracted by an independent reviewer.

**RESULTS:** A total of 26 reports were included in this review (n = 2863). Fear of falling, assessed by a single-question survey, was significantly associated with falls (relative risk = 1.44; 95% confidence interval (95% CI) = 1.22, 1.70; I<sup>2</sup> = 0%) in people with acute stroke. Significant mean differences in fear of falling, based on the Falls Efficacy Scale (mean difference = 12.80; 95% CI = 1.81, 23.78; I<sup>2</sup> = 28%) and Activities-specific Balance Confidence Scale (mean difference = -9.99; 95% CI = -15.36, -4.62; I<sup>2</sup> = 57%), were also reported between fallers and non-fallers in people with chronic stroke.

**CONCLUSION:** A small, but significant, association exists between falls and fear of falling in both acute and chronic stroke patients.

**Language:** en

**Keywords:** Humans; \*Fear; \*Stroke/complications

# Improved accuracy and efficiency of primary care fall risk screening of older adults using a machine learning approach

Song W, Latham NK, Liu L, Rice HE, Sainlaire M, Min L, Zhang L, Thai T, Kang MJ, Li S, Tejada C, Lipsitz S, Samal L, Carroll DL, Adkison L, Herlihy L, Ryan V, Bates DW, Dykes PC. J. Am. Geriatr. Soc. 2024; ePub(ePub): ePub.

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## Abstract

**BACKGROUND:** While many falls are preventable, they remain a leading cause of injury and death in older adults. Primary care clinics largely rely on screening questionnaires to identify people at risk of falls. Limitations of standard fall risk screening questionnaires include suboptimal accuracy, missing data, and non-standard formats, which hinder early identification of risk and prevention of fall injury. We used machine learning methods to develop and evaluate electronic health record (EHR)-based tools to identify older adults at risk of fall-related injuries in a primary care population and compared this approach to standard fall screening questionnaires.

**METHODS:** Using patient-level clinical data from an integrated healthcare system consisting of 16-member institutions, we conducted a case-control study to develop and evaluate prediction models for fall-related injuries in older adults. Questionnaire-derived prediction with three questions from a commonly used fall risk screening tool was evaluated. We then developed four temporal machine learning models using routinely available longitudinal EHR data to predict the future risk of fall injury. We also developed a fall injury-prevention clinical decision support (CDS) implementation prototype to link preventative interventions to patient-specific fall injury risk factors.

**RESULTS:** Questionnaire-based risk screening achieved area under the receiver operating characteristic curve (AUC) up to 0.59 with 23% to 33% similarity for each pair of three fall injury screening questions. EHR-based machine learning risk screening showed significantly improved performance (best AUROC = 0.76), with similar prediction performance between 6-month and one-year prediction models.

**CONCLUSIONS:** The current method of questionnaire-based fall risk screening of older adults is suboptimal with redundant items, inadequate precision, and no linkage to prevention. A machine learning fall injury prediction method can accurately predict risk with superior sensitivity while freeing up clinical time for initiating personalized fall prevention interventions. The developed algorithm and data science pipeline can impact routine primary care fall prevention practice.

**Language:** en

**Keywords:** machine learning; primary care; community-dwelling older adults; fall and fall-related injury; risk screening



# **Exergame and cognitive training for preventing falls in community-dwelling older people: a randomized controlled trial**

Sturnieks DL, Hicks C, Smith N, Ratanapongleka M, Menant J, Turner J, Lo J, Chaplin C, Garcia J, Valenzuela MJ, Delbaere K, Herbert RD, Sherrington C, Toson B, Lord SR. *Nat. Med.* 2024; ePub(ePub): ePub.

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## **Abstract**

Exergame training, in which video games are used to promote exercise, can be tailored to address cognitive and physical risk factors for falls and is a promising method for fall prevention in older people. Here, we performed a randomized clinical trial using the smart±step gaming system to examine the effectiveness of two home-based computer game interventions, seated cognitive training and step exergame training, for fall prevention in community-dwelling older people, as compared with a minimal-intervention control group. Participants aged 65 years or older ( $n = 769$ , 71% female) living independently in the community were randomized to one of three arms: (1) cognitive training using a computerized touchpad while seated, (2) exergame step training on a computerized mat or (3) control (provided with an education booklet on healthy ageing and fall prevention). The rate of falls reported monthly over 12 months—the primary outcome of the trial—was significantly reduced in the exergame training group compared with the control group (incidence rate ratio = 0.74, 95% confidence interval = 0.56–0.98), but was not statistically different between the cognitive training and control groups (incidence rate ratio = 0.86, 95% confidence interval = 0.65–1.12). No beneficial effects of the interventions were found for secondary outcomes of physical and cognitive function, and no serious intervention-related adverse events were reported. The results of this trial support the use of exergame step training for preventing falls in community-dwelling older people. As this intervention can be conducted at home and requires only minimal equipment, it has the potential for scalability as a public health intervention to address the increasing problem of falls and fall-related injuries. Australian and New Zealand Clinical Trial Registry identifier: ACTRN12616001325493.

**Language:** en

# The role of sensory systems in the association between balance and walking in people with multiple sclerosis

Tacchino A, Skjerbæk AG, Podda J, Prada V, Monti Bragadin M, Bergamaschi V, Susini A, Hvid LG, Pedullà L, Bricchetto G. *Mult. Scler. Relat. Disord.* 2024; 83: e105440.

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## Abstract

**BACKGROUND:** In Multiple Sclerosis, it has been demonstrated that balance is related to performances in walking tasks at different levels of complexity. However, it is unknown how the different sensory systems involved in balance control contribute to walking. This observational study investigates the associations between somatosensory, vestibular, and visual systems and measures of self-reported walking and walking capacity at different complexity levels (i.e. low, medium, and high).

**METHODS:** People with MS with EDSS<6 were assessed through the Sensory Organization Test (SOT), 12-Item MS Walking Scale (MSWS-12), Timed 25-Foot Walk (T25FW), Timed Up-and-Go Test (TUG), and Six-Spot-Step-Test (SSST). T25FW, TUG and SSST are measures of low, medium and high walking capacity, respectively.

**RESULTS:** Forty-five PwMS were enrolled (EDSS:  $3.4 \pm 1.3$ ). Capacity/ability walking measures were moderate-to-highly significantly associated ( $p < 0.01$ ). Balance measures from SOT showed significant correlation ( $p < 0.05$ ) between vestibular system and all the walking measures; between visual system and T25FW, SSST and MSWS-12; between the degree to which the patient relies on the visual system to maintain balance with conflicting visual surroundings information (VIS PREF) and T25FW and TUG. In the multivariate analyses, only VIS PREF significantly correlated ( $p < 0.05$ ) with T25FW (std. Beta=0.42) and TUG (std. Beta=0.38).

**CONCLUSIONS:** Vestibular and visual systems are associated with walking capacity. However, tasks with higher complexity levels require more visual attention towards ground obstacles, as often seen in real-life activities, whereas simpler walking tasks seem to require visual attention towards the surroundings.

**Language:** en

**Keywords:** Walking; Balance; Six spot step test; Somatosensory system; Vestibular system; Visual system

## **Development and usability testing of an exercise-based primary care fall prevention clinical decision support tool**

Tejeda CJ, Garabedian PM, Rice H, Samal L, Latham NK, Dykes PC. AMIA Annu. Symp. Proc. 2023; 2023: 699-708.

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### **Abstract**

For older patients, falls are the leading cause of fatal and nonfatal injuries. Guidelines recommend that at-risk older adults are referred to appropriate fall-prevention exercise programs, but many do not receive support for fall-risk management in the primary care setting. Advances in health information technology may be able to address this gap. This article describes the development and usability testing of a clinical decision support (CDS) tool for fall prevention exercise. Using rapid qualitative analysis and human-centered design, our team developed and tested the usability of our CDS prototype with primary care team members. Across 31 Health-Information Technology Usability Evaluation Scale surveys, our CDS prototype received a median score of 5.0, mean (SD) of 4.5 (0.8), and a range of 4.1-4.9. This study highlights the features and usability of fall prevention CDS for helping primary care providers deliver patient-centered fall prevention care.

**Language:** en

**Keywords:** Aged; Humans; \*Decision Support Systems, Clinical; Primary Health Care; User-Centered Design; User-Computer Interface

## **A meta-analysis of previous falls and subsequent fracture risk in cohort studies**

Vandenput L, Johansson H, McCloskey EV, Liu E, Schini M, Akesson KE, Anderson FA, Azagra R, Bager CL, Beaudart C, Bischoff-Ferrari HA, Biver E, Bruyere O, Cauley JA, Center JR, Chapurlat R, Christiansen C, Cooper C, Crandall CJ, Cummings SR, Da Silva JAP, Dawson-Hughes B, Díez-Pérez A, Dufour AB, Eisman JA, Elders PJM, Ferrari S, Fujita Y, Fujiwara S, Glüer CC, Goldshtein I, Goltzman D, Gudnason V, Hall J, Hans D, Hoff M, Hollick RJ, Huisman M, Iki M, Ish-Shalom S, Jones G, Karlsson MK, Khosla S, Kiel DP, Koh WP, Koromani F, Kotowicz MA, Kröger H, Kwok T, Lamy O, Langhammer A, Larijani B, Lippuner K, McGuigan FEA, Mellström D, Merlijn T, Nguyen TV, Nordström A, Nordström P, O'Neill TW, Obermayer-Pietsch B, Ohlsson C, Orwoll ES, Pasco JA, Rivadeneira F, Schott AM, Shiroma EJ, Siggeirsdottir K, Simonsick EM, Sornay-Rendu E, Sund R, Swart KMA, Szulc P, Tamaki J, Torgerson DJ, van Schoor NM, van Staa TP, Vila J, Wareham NJ, Wright NC, Yoshimura N, Zillikens MC, Zwart M, Harvey NC, Lorentzon M, Leslie WD, Kanis JA. *Osteoporos. Int.* 2024; ePub(ePub): ePub.

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### **Abstract**

The relationship between self-reported falls and fracture risk was estimated in an international meta-analysis of individual-level data from 46 prospective cohorts. Previous falls were associated with an increased fracture risk in women and men and should be considered as an additional risk factor in the FRAX® algorithm.

**INTRODUCTION:** Previous falls are a well-documented risk factor for subsequent fracture but have not yet been incorporated into the FRAX algorithm. The aim of this study was to evaluate, in an international meta-analysis, the association between previous falls and subsequent fracture risk and its relation to sex, age, duration of follow-up, and bone mineral density (BMD).

**METHODS:** The resource comprised 906,359 women and men (66.9% female) from 46 prospective cohorts. Previous falls were uniformly defined as any fall occurring during the previous year in 43 cohorts; the remaining three cohorts had a different question construct. The association between previous falls and fracture risk (any clinical fracture, osteoporotic fracture, major osteoporotic fracture, and hip fracture) was examined using an extension of the Poisson regression model in each cohort and each sex, followed by random-effects meta-analyses of the weighted beta coefficients.

**RESULTS:** Falls in the past year were reported in 21.4% of individuals. During a follow-up of 9,102,207 person-years, 87,352 fractures occurred of which 19,509 were hip fractures. A previous fall was associated with a significantly increased risk of any clinical fracture both in women (hazard ratio (HR) 1.42, 95% confidence interval (CI) 1.33-1.51) and men (HR 1.53, 95% CI 1.41-1.67). The HRs were of similar magnitude for osteoporotic, major osteoporotic fracture, and hip fracture. Sex significantly modified the association between previous fall and fracture risk, with predictive values being higher in men than in women (e.g., for major osteoporotic fracture, HR 1.53 (95% CI 1.27-

1.84) in men vs. HR 1.32 (95% CI 1.20-1.45) in women, P for interaction = 0.013). The HRs associated with previous falls decreased with age in women and with duration of follow-up in men and women for most fracture outcomes. There was no evidence of an interaction between falls and BMD for fracture risk. Subsequent risk for a major osteoporotic fracture increased with each additional previous fall in women and men.

**CONCLUSIONS:** A previous self-reported fall confers an increased risk of fracture that is largely independent of BMD. Previous falls should be considered as an additional risk factor in future iterations of FRAX to improve fracture risk prediction.

**Language:** en

**Keywords:** risk factors; meta-analysis; fracture risk; hip fracture; major osteoporotic fracture; previous falls

## **Exercise as a falls prevention strategy in the care of older people**

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### **Abstract**

Older people who sustain a fall may experience a range of adverse outcomes, such as distress, injury and loss of independence. Falls increase the risk of frailty and frailty increases the risk of falls. Regular exercise is a pillar of falls prevention and can have extensive benefits for older people's health, well-being and ability to undertake activities they enjoy. As part of the multidisciplinary team, nurses have a pivotal role in implementing exercise-based falls prevention strategies for older people and in encouraging their patients to exercise. This article discusses exercise as a falls prevention strategy in hospital and in the community and supports nurses to develop their knowledge and confidence in promoting exercise in older people.

**Language:** en

**Keywords:** health promotion; recovery; frailty; falls; well-being; clinical; healthy ageing; older people; patient assessment; patients; professional; reablement