

Featured Falls Research – April

Effects of Digital-Based Exercise Interventions on Concerns About Falling, Falls Efficacy, and Physical Performance Among Older Adults: Systematic Review and Meta-Analysis

Wang Z, Zhu B, Zhou M, Xie X, Zhang X. JMIR Aging. 2026 Apr 30;9:e87070.

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PMID: 42060908

Abstract

Background: Falls are prevalent and serious health problems among older adults. Concerns about falling and reduced falls efficacy are common fall-related psychological impairments, representing 2 distinct emotional and cognitive constructs, respectively. The impact of digital-based exercise interventions on these specific constructs remains unclear.

Objective: This systematic review and meta-analysis aimed to synthesize current evidence on digital-based exercise interventions for concerns about falling and falls efficacy among older adults, with a specific focus on determining their differential effects on emotional and cognitive constructs and evaluating their impact on physical performance.

Methods: The PubMed, Web of Science, Cochrane Library, Embase, PsycINFO, CINAHL, CNKI, SinoMed, VIP, and Wanfang databases were systematically searched from their inception dates to May 2025. We searched for published randomized controlled trials on the effects of digital-based interventions on the fear of falling, concerns about falling, and falls efficacy among older adults. The study followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines and was performed using Stata 17.0 software (StataCorp LLC).

Results: Eighteen studies involving 2435 participants were included. Meta-analyses revealed significant effects of digital-based exercise interventions on falls efficacy (standardized mean difference 0.70, 95% CI 0.51-0.90; $P < .001$), balance function (mean difference [MD] 4.03, 95% CI 2.57-5.49; $P < .001$), functional mobility (MD -1.65, 95% CI -2.52 to -0.77; $P < .001$), and physical function (MD 0.57, 95% CI 0.12-1.02; $P = .006$) among older adults. However, digital-based exercise interventions had no significant effect on concerns about falling, which is the emotional construct related to falls (standardized MD -0.12, 95% CI -0.28 to 0.05; $P > .05$).

Conclusions: The meta-analysis assessed the efficacy of digital-based exercise interventions on fall-related psychological impairments among older adults and revealed that the effects differed across the constructs. These findings suggest that digital-based exercise interventions have potential benefits for improving falls efficacy and physical performance among older adults compared with controls. However, the effect of digital-based exercise interventions on concerns about falling, which is the emotional construct related to falls, remains uncertain among older adults.

Keywords: concerns about falling; digital-based; falls efficacy; meta-analysis; older adults.

Global, Regional, and National Burden of Falls Among Older Adults Aged 65 Years and Above: Secondary Data Analysis of the Global Burden of Disease Study 2021

Zhang Z, Diao Y, Fu M, Han W, Zhou H, Fan R, Xu B, Chen B. JMIR Aging. 2026 Apr 10;9:e73802.

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Abstract

Background: Falls are a leading cause of injury, disability, and death among older adults, posing significant public health challenges. However, comprehensive global analyses of fall-related burdens in older populations remain scarce.

Objective: This study aimed to explore the patterns and distribution of the global, regional, and national burden of falls among adults aged 65 years and older.

Methods: Data from the Global Burden of Disease study 2021 were used to assess the overall, disability, and mortality burden of falls among adults aged 65 years and older. Age-standardized rates of disability-adjusted life years (DALYs), years lived with disability (YLDs), and years of life lost were calculated to compare burdens across countries. Health inequalities were evaluated via the slope index of inequality and the concentration index. Frontier analysis identified optimal burden levels by sociodemographic index (SDI). Bayesian age-period-cohort models projected trends up to 2050.

Results: DALY age-standardized rates showed a U-shaped distribution across SDI regions: lower-SDI countries faced higher mortality burdens, while higher-SDI countries had elevated disability burdens. Despite an increase in absolute overall burden inequality from 1990 to 2021, absolute inequalities in YLDs and years of life lost declined, with DALYs and YLDs exhibiting relatively more balanced distributions. Frontier analysis pinpointed countries with the greatest burden reduction potential. Projections suggest decreasing overall and mortality burdens by 2050 but rising disability burdens.

Conclusions: Higher- and lower-SDI countries face distinct fall-related challenges. Reducing cross-national health inequalities and closing gaps between the observed burden and the optimal burden level achievable at a similar SDI level are critical. Despite projected declines in the overall burden (DALYs), the rising disability burden (YLDs) could present evolving challenges, potentially underscoring the importance of proactive preparedness.

Keywords: health inequality; projection; disability burden; falls; global burden of disease; mortality burden; older adults.

Falls Research – April

Identifying Risk Factors for Fall-Related Injuries Among Inpatients at a Tertiary Hospital in China: A Retrospective Cohort Study

Bian WF, Liu XJ, Wang LY, Zhao W, Ye H. Nurs Open. 2026 Apr;13(4):e70522.

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PMID: 41928559

Abstract

Aim: Although extensive research has identified many risk factors for falls, less attention has been given to those influencing fall-related injuries after a fall occurs. This retrospective study aimed to bridge this gap by identifying modifiable risk factors, with the goal of mitigating fall-related injuries.

Design: A retrospective cohort study.

Methods: We retrospectively reviewed data from 145 inpatient falls reported to the hospital's electronic adverse event reporting system between January 2020 and December 2022 at a tertiary hospital in China. This study examined intrinsic (patient-related) and extrinsic (environmental) factors associated with fall occurrence. Multiple logistic regression analyses were conducted to identify factors associated with fall-related injuries specific to fall events.

Results: The peak times for falls ranged from 6:00-8:00, 16:00-18:00, and 22:00-24:00. Patients aged over 65 years, those in bathroom settings, and those with independent mobility demonstrated higher incidences of both falls and moderate-to-severe fall-related injuries. Analysis of fall causation revealed that toilet-associated activities accounted for the highest proportion of incidents (35.43%), followed by ambulation (20.47%). Multiple logistic regression analysis revealed three reduced risk factors for fall-related injuries: appropriate footwear use (adjusted ORs = 0.38, 95% CI 0.14-0.99), self-care ability (adjusted ORs = 0.97 per 1-point increase, 95% CI 0.95-0.99), and no (adjusted ORs = 0.09, 95% CI 0.01-0.74) or partial mobility (adjusted ORs = 0.23, 95% CI 0.07-0.74).

Conclusion: Inpatient falls were clustered in the early morning, late afternoon, and night and occurred most frequently during toileting and ambulation. These findings support targeted prevention during identified peak periods and high-risk activities, prioritizing appropriate footwear, the preservation or improvement of functional independence, and context-sensitive supervision. Future studies could further elucidate targeted interventions, including rounding during high-risk periods, supervised mobilization and toileting, and the provision of appropriate footwear, to determine their efficacy in mitigating fall-related injuries.

Patient or public contribution: Although patients were not actively involved in study design due to its retrospective nature, their clinical records provided critical insights into fall-related injuries.

Keywords: fall; fall-related injuries; footwear; inpatient; mobility.

Implementation of a Virtual Reality-Based Program for Fall Risk Reduction in Older Adults in Primary Health Care

Burgos-Carrasco S, Barrientos-Cabrera Y, Rivera-Mora V, Martínez-González L, Arpe-Hernández B, Cruz-Riveros C, Fernández-Cárdenas D, Yañez-Cifuentes I, López-Andaur R. *Int J Environ Res Public Health*. 2026 Apr 15;23(4):504

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Abstract

Aging is a progressive and heterogeneous biological process influenced by multiple factors that may compromise physical and cognitive capacities and increase the risk of frailty, functional decline, and falls in older adults. Falls represent a major public health concern due to their impact on independence and long-term care demand. Immersive virtual reality (IVR) delivered through active video games (exergames) has emerged as a preventive strategy that integrates sensory, motor, and cognitive stimulation within controlled and engaging environments, particularly where traditional programs face challenges related to adherence and individual adaptation. This study aims to determine the feasibility and implementation of an IVR-based program for falls prevention in older adults at risk of frailty in primary health care (PHC). A quasi-experimental pre-post design will be conducted with an intervention group (IVR/exergames) and a conventional control group, including a total sample of 40 participants (20 per group). The protocol comprises three phases: baseline assessment and IVR familiarization; a 12-week intervention delivered twice weekly; and post-intervention assessment. The primary outcome will be fall risk assessed using the Timed Up and Go (TUG) test. Secondary outcomes include physical performance (Short Physical Performance Battery, SPPB, and handgrip dynamometry) and psychological aspects related to falls (Falls Efficacy Scale International, FES-I, and Activities-specific Balance Confidence Scale, ABC). Feasibility indicators will include recruitment, adherence, retention, and cybersickness. A reduction in TUG time is expected, providing preliminary evidence on the feasibility of integrating IVR-based programs for falls prevention within PHC systems.

Keywords: exergames; frailty; immersive virtual reality; older person; program exercises; program therapeutic; risk of falls; virtual reality

Effect of Brain Gym Exercises on Risk of Fall, Balance and Quality of Life in Obese Subjects

Elerian AA, Elkeblawy MA, Lasheen YR, Abdelhay MI. *Physiother Res Int.* 2026 Apr;31(2):e70223.

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Abstract

Background and purpose: Obesity is a widespread global health problem linked to an elevated risk of falls, detrimental effects on both static and dynamic balance, and diminished quality of life (QOL). Despite these adverse effects of obesity, research on the effectiveness of Brain Gym exercises has been conducted in various populations, but their impact has never been studied among individuals with obesity.

Methods: A pre-post randomized controlled trial aimed to examine the influence of Brain Gym exercises on fall risk, balance, as well as quality of life among obese individuals. Thirty-two subjects (15 males and 17 females) aged 18-50 years, with a Body Mass Index (BMI) of ≥ 30 kg/m² were randomly assigned to two equal groups, Group A (experimental): engaged in Brain Gym exercises for 30 min daily, three times weekly, for eight successive weeks, in addition to conventional balance training for 45 min throughout three sessions per week for eight weeks. Group B (control): received conventional balancing training. Outcome measures included: risk of falling assessed using the Modified Arabic version of the Activities-Specific Balance Confidence Scale (ABC); static balance evaluated via the Berg Balance Scale (BBS); dynamic balance assessed with the Balance Check 636 Stability Tester (Dr. Wolff, Arnsberg, Germany); as well as health-related quality of life determined through the Arabic version of the World Health Organization Quality of Life-BREF questionnaire (WHOQOL-BREF).

Results: The results indicated substantial enhancements in all assessed outcomes, including risk of falling, static balance, dynamic balance, and quality of life domains, in both groups following treatment ($p < 0.001$). The experimental group demonstrated statistically and clinically significant improvements in all parameters relative to the control group ($p < 0.001$).

Discussion: Brain Gym exercises combined with conventional training could have a further impact on the risk of fall, balance as well as quality of life among obese subjects than conventional balance training alone.

Trial registration: [NCT06587932](https://www.clinicaltrials.gov/ct2/show/study/NCT06587932).

Keywords: balance; brain gym; obesity; quality of life; risk of fall.

Energy dissipation strategy in backward falls in at-risk older adults: evidence and implications for head injury prevention

Fang JR, Chen L, Tabatabaei A, Zanotto T, Alexander NB, Sosnoff JJ. J Biomech. 2026 Jun;202:113310.

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PMID: 41996993

Abstract

Older adults are at elevated risk of sustaining head injuries from head impact during falls. It has been speculated that fall-related head impact stems from insufficient energy dissipation. To address this, this study leveraged a unique dataset of 45 experimentally induced backward falls in 25 at fall-risk older adults (mean age = 72.5 ± 6.1 years) to provide a novel event-based examination of kinematic and energy profile differences between falls with and without head impact. The differences in segment velocities, joint angles, and kinetic energy between falls with and without head impact were analyzed. Falls without head impact exhibited significantly greater trunk forward flexion prior to pelvis contact and reduced peak head vertical velocity throughout the descent compared to falls with head impact. Furthermore, falls resulting in head impact demonstrated a systemic failure in energy management, characterized by higher kinetic energy retention after pelvis and head impact (0.0 J vs. -7.8 J, $p < 0.0001$ and -41.0 J vs. -84.8 J, $p < 0.0001$). These results highlight distinct postural and energy dissipation strategies between falls with and without head impact. Greater trunk flexion during descent may facilitate more effective kinetic energy dissipation, offering biomechanical targets for injury prevention in at fall-risk older adults.

Keywords: Energy absorption; Fall biomechanics; Fall injury; Head impact; Older adults.

Quantifying reactive dynamic balance in older adults: an exploratory lag-plot-based approach towards fall risk estimation

Feld L, Hackbarth M, Himmelmann L, Speckmann EM, Koschate-Storm J, Stuckenschneider T, Zieschang T. *Gerontology*. 2026 Apr 28:1-18.

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PMID: 42048290

Abstract

Introduction: Reactive dynamic balance in older adults has become a focus of research and targeted falls prevention interventions. However, an accurate and reliable measure to assess an individual's reactive dynamic balance performance is lacking. While the Margin of Stability (MoS) is commonly used in laboratory settings, its practical applicability for fall risk assessment is limited. This study proposes exploratory perturbation-based reactive balance measures based on lag plot analysis of acceleration data from a single inertial measurement unit worn at the lower back and evaluates their predictive value for future falls.

Method: Sixty-four older adults (>60 years), all of whom had recently experienced a fall resulting in an emergency department visit, participated in a treadmill-based perturbation protocol including acceleration (right/left), deceleration (right/left), full-stop, sway (right/left), and pitch perturbations. Besides age, Short Physical Performance Battery (SPPB), gait speed, cognition, and concerns about falling were assessed. Reactive dynamic balance responses were quantified, using an exploratory approach with individual lag plot ellipses derived from acceleration data in mediolateral (ML) and anteroposterior (AP) direction. Four unperturbed gait variability measures were calculated per participant, and four exploratory perturbation-based parameters as well as two MoS parameters were calculated per participant and perturbation type. Stepwise logistic regressions were performed to evaluate the predictive value of this exploratory approach for prospective falls, reporting odds ratio (OR), and McFaddens pseudo R^2 .

Results: While the SPPB showed predictive relevance (OR=0.65, $p=0.029$, $R^2=0.14$), unperturbed gait variability and MoS did not improve model performance, when controlling for age. In contrast, exploratory perturbation-based parameters for the acceleration right perturbation significantly contributed to fall prediction. In particular, an effect was observed for the parameter associated with short-term variability (LMS_SD2^{norm}; OR=0.39, $p=0.010$, $R^2=0.20$). These results indicate that older adults with higher short-term (stride-to-stride) variability in trunk acceleration during right-leg acceleration perturbations are less prone to falls. When allowing for an additional predictive parameter, the proportion of acceleration data deviating from unperturbed walking during the perturbation phase (POE) showed also a predictive value (OR=1.13, $p=0.020$, $R^2=0.28$).

Conclusion: The findings provide first evidence, that the proposed exploratory perturbation-based acceleration parameters, especially LMS_SD2^{norm}, may quantify aspects of reactive dynamic balance performance relevant to fall risk. These measures hold promise for integration into wearable technologies for long-term monitoring and real-world fall risk assessment.

Sarcopenia and physical performance among older adults with increased body mass index and falls

Hashim NNA, Mat S, Myint PK, Delibegovic M, Kioh SH, Kamaruzzaman SB, Hairi NN, Khoo S, Tan MP. Sci Rep. 2026 Apr 21.

DOI: [10.1038/s41598-026-49574-0](https://doi.org/10.1038/s41598-026-49574-0)

PMID: 42009825

Abstract

Adiposity-related mechanisms likely impair performance and dynamic balance, leading to fall. This study aims to assess the role of sarcopenia and physical performance tests in predicting falls among individuals with increased body mass index (BMI) ($\geq 25 \text{ kg/m}^2$) compared to those with normal BMI ($< 25 \text{ kg/m}^2$). This cross-sectional study recruited 604 community-dwelling adults (≥ 60 years). Body composition, fall history, sarcopenia, timed-up and go (TUG), handgrip strength (HGS), and gait speed (GS) were assessed. Participants were grouped by BMI and fall history. Logistic regression model was adjusted for potential confounders. Individuals with increased BMI had higher odds of sarcopenia than non-fallers with normal BMI. Among BMI $< 25 \text{ kg/m}^2$ fallers, low GS was higher (OR (95% CI) 1.64 (1.04-2.58)), but was attenuated by comorbidities. Low TUG was significant in both BMI groups, but only remained significant for normal BMI fallers (OR (95% CI) 3.74 (1.31-10.72)), potentially due to anthropometric measures. Reduced HGS was significant within BMI $\geq 25 \text{ kg/m}^2$, but was influenced by fat percentage. HGS demonstrated better discriminatory ability for falls in older adults with increased BMI. The higher odds of sarcopenia among fallers with high BMI highlight the need for intervention studies addressing sarcopenic obesity as a growing risk factor for falls.

Keywords: Falls; Gait; Grip strength; Obesity; Sarcopenia.

Longitudinal associations of psychosocial factors and fear of falling in older adults: a systematic review

Jesgarz L, Gehring M, Schäfer SK, Wurm S. BMC Geriatr. 2026 Apr 29;26(1):610.

DOI: [10.1186/s12877-026-07463-1](https://doi.org/10.1186/s12877-026-07463-1)

PMID: 42056928

Abstract

Background: Fear of falling (FOF) is a phenomenon prevalent among older adults associated with adverse outcomes, including reduced mental and physical health, decreased quality of life, and an overall reduction in social participation. Based on cross-sectional and longitudinal studies, recent reviews have provided information on the prevalence of FOF and its association with different health outcomes. To gain a deeper understanding of factors relevant to interventions to prevent or reduce FOF, this review goes beyond previous evidence syntheses by focusing on psychosocial factors that are longitudinally associated with FOF. The objective of the review is to provide an overview on evidence levels of psychosocial factors assumed to be longitudinally associated with FOF.

Methods: Studies examining associations between psychosocial factors (predictors) and FOF (outcome) longitudinally were included. Cochrane CENTRAL, Embase, Scopus, and Web of Science were searched up to October 25, 2025. An ordinal rating scheme was used for data synthesis to assess beyond sociodemographic variables and other psychosocial factors. A modified version of the Newcastle-Ottawa scale was employed to evaluate study quality.

Results: Sixteen studies (n at baseline: 255-9,060) with a total of 30,724 participants reported longitudinal associations of 14 psychosocial factors with FOF. Higher depressive symptoms, anxiety, negative affect, and symptom burden, lower social activity, social participation, emotional support, and feeling older were linked to higher FOF. The relationship between depressive symptoms and higher FOF showed the most robust evidence, with six studies finding evidence for incremental validity of depressive symptoms beyond sociodemographic variables and other psychosocial factors. In contrast, higher self-efficacy, positive affect, social support, and social cohesion were associated with lower FOF. In some cases, the magnitude of associations was reduced when controlling for other variables.

Conclusion: The evidence base remained weak for psychosocial factors other than depressive symptoms. Further longitudinal research is needed on the role of psychosocial factors for FOF. Such studies enlarge the evidence base for factors identified in this review and should include additional factors (e.g., loneliness). Our findings highlight the need for further research on the relationship between depressive symptoms and FOF for the development of effective interventions.

Trial registration: Pre-registration ID: <https://doi.org/10.17605/OSF.IO/X5ZGR>.

Keywords: Fear of falling; Incidence; Longitudinal; Older people; Psychosocial.

Diagnostic accuracy of the Timed Up and Go and Five Times Sit-to-Stand tests for fall risk screening in community-dwelling older adults in northern Thailand: a retrospective study

Khieorawong T, Srithawong A. PeerJ. 2026 Apr 1;14:e21041.

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PMID: 41940379

Abstract

Background: Falls are a major public health concern among older adults, yet simple and context-specific screening tools remain under-validated in Thai settings. This study aimed to evaluate the discriminative performance of the Timed Up and Go Test (TUG) and the Five Times Sit-to-Stand Test (FTSST) for fall risk screening.

Methods: A total of 113 community-dwelling older adults in Chiang Rai, Thailand, were assessed using TUG, FTSST, and the Thai Fall Risk Assessment Tool (Thai-FRAT). Receiver operating characteristic (ROC) curves and logistic regression were used to examine diagnostic accuracy and determine optimal age-specific cut-off values.

Results: The TUG showed good discriminative performance (AUC = 0.827), whereas the FTSST demonstrated more modest discrimination (AUC = 0.705). Each one-second increase in TUG and FTSST times was associated with higher odds of fall risk (TUG: OR = 1.16, 95% CI [1.07-1.27]; FTSST: OR = 1.11, 95% CI [1.02-1.20]). Discriminative performance was higher in adults aged 60-74 years (TUG AUC = 0.871; FTSST AUC = 0.828) than in those aged ≥ 75 years (0.756 and 0.590, respectively). Overall cut-off values were 17.16 seconds for the TUG and 15.46 seconds for the FTSST, with lower thresholds in younger-old adults and higher thresholds in the oldest-old.

Conclusion: The TUG demonstrated robust discriminative performance for community-based fall risk screening, whereas the FTSST may be more suitable as a complementary tool. Incorporating age-specific cut-off values may enhance interpretation and support early identification and prevention of falls among older adults.

Keywords: Aged; Balance; Community-dwelling; Falls; Physical performance.

Effects of exercise regimens on balance ability in older patients with osteoporosis: a systematic review and Bayesian network meta-analysis of randomized controlled trials

Liu X, Chang M, Yuan H, Zheng X, Tian W, Li D, Liao D, Cui L. *Front Physiol.* 2026 Mar 31;17:1793389.

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PMID: 41988504

Abstract

To determine the optimal exercise regimen for improving balance and preventing severe falls in older patients with osteoporosis (OP). Four databases were searched until September 1, 2025. The risk of bias was assessed using Cochrane ROB2. Outcomes included Berg Balance Scale (BBS, primary), timed up and go test (TUG), bone mineral density (BMD), one-leg stand test (OLS), and number of falls. A Bayesian network meta-analysis in R4.4.1/GeMTC synthesized effects, presented as MD (95% CrI) and ranked by SUCRA. Analysis of 22 RCTs (n=1538) versus usual care showed virtual reality (VR) most effective for BBS (MD 9.2, 95% CrI 7.2, 11; SUCRA 99.66%) and TUG (MD -4.6, 95% CrI -5.8, -3.3; SUCRA 98.51%); balance training+resistance training+aerobics (BT + RT + aerobics) best improved BMD (MD 0.016, 95% CrI 0.012, 0.020; SUCRA 72.38%); trampoline best improved OLS (MD 8.8, 95% CrI 1.7, 5.5; SUCRA 72.38%); RT most significantly reduced falls (MD 0.29, 95% CrI 0.100, 0.68; SUCRA 84.86%). For older OP patients, VR is most effective in improving overall balance and mobility, with reliable evidence. Combination training, trampoline, and RT exhibit potential benefits for BMD, OLS, and fall prevention, respectively. Due to the limited amount of evidence and network strength, however, these interventions cannot yet be considered definitive clinical recommendations. More high-quality direct comparisons are required for further validation in the future.

Keywords: balance; exercise regimen; network meta-analysis; older; osteoporosis.

Effectiveness of aquatic Tai Chi on balance indicators: a systematic review

Mańko G, Ambroży T, Kasicki K, Jaszczur-Nowicki J, Ozimek M, Czech P, Gąsior P, Rydzik Ł. *Front Public Health*. 2026 Mar 30;14:1774853.

DOI: [10.3389/fpubh.2026.1774853](https://doi.org/10.3389/fpubh.2026.1774853)

PMID: 41982900

Abstract

Background: Balance disorders expose older adults to an increased risk of falls. The combination of Tai Chi and an aquatic environment may improve balance. The aim of this review was to assess the effectiveness of Ai Chi in improving balance in older adults.

Methods: The systematic review was conducted in accordance with the PRISMA guidelines. Criteria: population individuals aged ≥ 60 years with balance disorders or at risk of falling; intervention Ai Chi (Tai Chi in water); control no intervention or other exercises; outcomes balance measures. The PubMed, Scopus, Web of Science and EBSCO databases were searched without time restrictions for RCTs and quasi experimental studies. Study selection and risk-of-bias assessment were performed independently by two authors.

Results: Seven studies (6 RCTs, 1 non-randomized) with a total of 213 participants were included. Ai Chi programs lasted from 2 to 12 weeks (2-3 sessions/week). All studies showed an improvement in balance in the Ai Chi groups compared with controls. A significant improvement in static and dynamic balance (shortening of TUG time) was observed in the Ai Chi groups. In one study, only Ai Chi participants achieved a TUG score below the fall-risk threshold. Ai Chi proved to be as effective as land-based exercise and aquatic kinesiotherapy. No serious adverse events were reported.

Conclusion: Ai Chi effectively improves balance in older adults, which may reduce the risk of falls and improve mobility. It is a safe, low joint-load form of exercise recommended as an adjunct to geriatric physiotherapy. A limitation is the small number of studies of moderate quality. Further large-scale RCTs with longer follow-up are needed to confirm the long-term effects of Ai Chi.

Systematic review registration: PROSPERO, Identifier (CRD420251162371).

Keywords: aging; aqua therapy; exercise; fall risk; older adults; well being.

Neighborhood environmental characteristics and the risk of falls among older adults: A 3-year longitudinal follow-up of the Japan gerontological evaluation study

Matsumoto Y, Chen YR, Matsuoka Y, Matsumoto K, Yoshida H, Kondo K, Hanazato M. Arch Gerontol Geriatr. 2026 Aug;147:106258.

DOI: [10.1016/j.archger.2026.106258](https://doi.org/10.1016/j.archger.2026.106258)

PMID: 42025148

Abstract

Objective: Falls are a significant global public health concern as they are a leading cause of fall-related deaths and long-term care needs, particularly among older adults. Using longitudinal data, this study aimed to examine the association between neighborhood environmental characteristics and fall risk.

Methods: We analyzed data from the Japan Gerontological Evaluation Study. This study included 27,346 functionally independent adults aged ≥ 65 years nested within 416 school districts. The outcome variable, falls, was assessed in 2016, whereas the explanatory variable, eight neighborhood environmental characteristics, was evaluated in 2013. Covariates were measured in 2010. Multilevel modified Poisson regression was conducted to account for individuals nested within school districts, providing a more granular understanding of neighborhood effects.

Results: In total, 25% of the participants reported that they had experienced a fall. Compared with living in an area with a low presence of each environmental factor, living in a high presence of "parks or foot paths suitable for exercise or walking" was associated with an 11% lower fall risk (risk ratio, 0.89). The moderate presence of "locations difficult for walking, such as hills or steps" was associated with a 6% reduced risk (risk ratio, 0.94). No significant associations were observed with other neighborhood environmental characteristics.

Conclusion: Walkable, activity-supportive environments, such as accessible parks and foot paths, may reduce the risk of falls among older adults. Moderately challenging terrain can be protective against fall risk. These findings provide insights for designing community-based fall prevention strategies in the context of global population aging.

Keywords: Falls; Japan gerontological evaluation study; Longitudinal study; Multilevel analysis; Neighborhood environment; Older adults.

Functional Sensorimotor-Based Training for Balance and Gait Enhancement in Sedentary Older Women: A Randomized Clinical Trial

Sedaghati P, Talebi Kenari F. Health Sci Rep. 2026 Apr 26;9(5):e72115.

DOI: [10.1002/hsr2.72115](https://doi.org/10.1002/hsr2.72115)

PMID: 42052320

Abstract

Background and aims: Sensorimotor training has emerged as a promising intervention to enhance gait and balance and potentially reduce fall risk. However, evidence on its effectiveness and the short-term durability of these effects is limited, especially in sedentary older women. This study therefore aimed to investigate the impact of functional sensorimotor-based training on balance, gait performance, and fall risk in this population.

Methods: This randomized controlled clinical trial investigated the effects of sensorimotor training on balance and gait in sedentary older women. Thirty participants aged 60-75 years residing in nursing homes in Guilan province were randomly assigned to an experimental group ($n = 15$) or a control group ($n = 15$). Assessments were conducted at pre-test, post-test (after 8 weeks), and follow-up, measuring balance, gait parameters, joint position sense, and lower-limb function. The experimental group completed a 50-min functional sensorimotor-based training program, three times per week for 8 weeks, while the control group engaged only in general physical education activities. Data were analyzed using RMANOVA, followed by Bonferroni post hoc tests, with significance set at $p < 0.01$. Analyses were performed using SPSS version 25.

Results: The results showed that there was a significant difference between the experimental and control groups in variables of the Fear of falling ($F = 9.066$; $p = 0.001$; $\eta^2 = 0.40$), Time Up & Go ($F = 23.495$; $p = 0.01$; $\eta^2 = 0.45$), Time of Walking ($F = 89.42$; $p = 0.001$; $\eta^2 = 0.85$), and 5Sit& up ($F = 22.118$; $p = 0.001$; $\eta^2 = 0.62$). In the experimental group, improvements in balance, gait, joint position sense, and lower-limb function were partially retained at follow-up. Compared with pre-test values, changes in FOF ($p = 0.012$, $d = 0.28$), TUG ($p = 0.001$, $d = 1.22$), 10MWT speed ($p = 0.772$, $d = 0.17$), and 5Sit& Up ($p = 0.001$, $d = 1.02$) indicated the preliminary durability of the sensorimotor training effects over the short-term follow-up.

Conclusions: The findings provide preliminary evidence that sensorimotor training may improve lower-limb function, balance, gait, and joint proprioception in sedentary older women. Several motor and sensory outcomes showed notable gains, suggesting that this intervention could support postural control, walk efficiency, and potentially reduce fall risk in geriatric rehabilitation settings.

Trial registration: Iranian Registry of Clinical Trials (IRCT) No. IRCT20160815029373N8, Date: 04/07/2025.

Keywords: elderly rehabilitation; fall risk; functional mobility; motor performance; proprioception.

Multi-Factorial and Multi-Component Fall Prevention Interventions Initiated From the Emergency Department: A Systemic Review and Meta-Analysis

Southerland LT, Mowbray FI, Tarnovsky IA, Lo AX, Lee S, Harper K, Ryer SV, Maddow CL, Carpenter CR, Malsch AJ, Ragsdale L, Liu SW. Acad Emerg Med. 2026 Apr;33(4):e70245.

DOI: [10.1111/acem.70245](https://doi.org/10.1111/acem.70245)

PMID: 42032852

Abstract

Background: Fall risk screening and prevention interventions initiated from the Emergency Department (ED) are endorsed by current national guidelines. We aimed to evaluate the effectiveness of ED-based multi-factorial and multi-component interventions to prevent falls.

Methods: We conducted a systematic review and meta-analysis of interventions for fall prevention initiated in the ED for older patients (age ≥ 60 years). Multi-component and multi-factorial interventions were included. We excluded studies without a control or comparison group. The published literature was searched from 2019 to May 2024. Risk of bias was assessed with the Newcastle Ottawa tool for observation studies and the Cochrane Risk of Bias v2 for randomized trials. A meta-analysis was completed for the outcomes with multiple studies.

Results: The search resulted in 6312 abstracts with 2571 duplicates, for 3741 unique citations. A total of 18 studies were included in the systematic review; 5 were rated as high risk of bias/low quality. The articles were heterogenous in the intervention type (8 multi-factorial and 8 multi-component), setting (ED focused vs. outpatient), intervention components (i.e., nurses, physicians, therapists), and size (103-1435 participants). The interventions did not decrease risk of falls at 3 months (risk difference 0.05 95% CI [0.00; 0.09]), 6 months (0.07 [-0.04; 0.18]) or 12 months (-0.02 [-0.11; 0.07]). ED revisits at 1 month (-0.01 [-0.03; 0.00]), 3 months (-0.04 [-0.14; 0.06]), and 12 months (0.02 [-0.05; 0.25]) were also unchanged. Mortality and hospitalization rates were also unaffected. Improvement in functional status was noted in 4 of 5 studies reporting this outcome.

Conclusions: Multi-factorial and multi-component fall prevention interventions initiated from the ED did not decrease falls or recurrent healthcare use. These interventions may improve functional status in older adults at fall risk. Comparisons are limited by the heterogeneity in types of interventions, intervention compliance, and timing of outcomes.

Keywords: emergency department; fall prevention; meta-analysis.

Multidisciplinary interventions and outcomes of the Geriatric Faller Protocol in an emergency diagnostic treatment unit: an internal audit

Tan HM, Yang C, Tay XY, Yap AFHW, Low KX, Ong ZY, Ting CWJ, Ho SF. Singapore Med J. 2026 Apr 1;67(4):224-231.

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Abstract

Introduction: This is a descriptive review of the implementation of the Geriatric Faller Protocol (GFP) in the Department of Emergency Medicine (DEM) Emergency Diagnostic Treatment Unit, Singapore General Hospital, along with a post-implementation internal audit over a 6-month period from 1 July 2024 to 31 December 2024.

Methods: The clinical records of patients admitted to GFP during the 6-month period were retrospectively reviewed. Data of patients were collated under the categories: (a) sociodemographics and clinical profile, (b) medication profile, (c) injury profile, (d) non-pharmaceutical interventions, (e) pharmaceutical interventions and (f) intervention outcome measures.

Results: Of the 115 patients admitted to GFP, 14 were excluded and 101 were included in the analysis (median age 81 years; 70.3% female). Most (79.2%) patients had a Clinical Frailty Scale of between 4 and 7. Acute hospital admission was avoided in 67.3% of cases; five reattended DEM within 30 days, of which only two were fall related. Falls were the primary reason for presentation (94.1%), with over half resulting in head or facial injuries. Polypharmacy was prevalent in 75% of patients (median number of medications: 9; interquartile range: 5-12), and 57.4% self-managed their medications.

Conclusion: Front-loading of assessments and interventions by a multidisciplinary team for patients under GFP suggested possible hospital admission avoidance and a reduction in short-term adverse outcomes.

Keywords: Emergency department; Geriatric Faller Protocol; extended diagnostic treatment unit; geriatric pharmaceutical interventions; multidisciplinary intervention.

Non-Linear Center-of-Pressure Features Associated with Fall History in Older Adults: An Exploratory Analysis

Wakabayashi D, Okada Y. *Sensors (Basel)*. 2026 Apr 8;26(8):2298.

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Abstract

Postural sway derived from center-of-pressure (CoP) trajectories is widely used to assess balance and fall risk in older adults, but conventional linear metrics mainly quantify sway magnitude and may overlook temporal organization. Guided by the loss-of-complexity hypothesis, we re-examined associations between fall history and linear and non-linear CoP metrics in an open-access dataset. Quiet-standing trials under eyes-open and eyes-closed conditions were analyzed in adults ≥ 60 years (fallers $n = 19$; non-fallers $n = 57$). To reduce confounding, propensity score matching was performed using age, sex, body mass index, activities of daily living level, illness status, number of medications, disability status, and orthosis/prosthesis use. Linear and non-linear indices, including recurrence quantification analysis, detrended fluctuation analysis, fractal dimension, multiscale entropy, stabilogram diffusion analysis, and sway density measures, were examined. After matching, no CoP metric differed significantly between groups. However, SHAP-based exploratory analysis suggested that non-linear features related to temporal structure and multiscale organization contributed more prominently to model output than conventional magnitude-based metrics. Given the limited sample size, these findings should be interpreted as exploratory and hypothesis-generating.

Keywords: SHAP; center of pressure; fall; loss of complexity; multiscale entropy; non-linear dynamics; older adults; postural sway; recurrence quantification analysis.

Association between maximal lower leg strength and static and dynamic balance as well as gait velocity in older adults

Warneke K, Stotz A, Konrad A, Zech A. Front Aging. 2026 Mar 30;7:1736517.

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PMID: 41982255

Abstract

Purpose: Falls cause serious injuries with partially long immobilization time and decreased quality of life in older adults. The risk factors comprise instability in gait and balance, which were moderately correlated with the strength capacity. While the literature focused on upper-limb strength, in this work, we sought to evaluate the relationship between maximal plantar flexion and dorsiflexion strength and walking and balance parameters in older adults.

Methods: A total of 51 healthy and active participants (age: 78.5 ± 5.8 years) participated in the study. Lower-leg maximal strength was determined isometrically. Selected gait parameters (normal and maximal walking velocity), static balance [center of pressure (CoP) sway in different standing conditions], and the timed up and go (TUG) and sit-to-stand (STS) were determined. Correlations [Pearson (r_p)/Spearman (r_s)] were calculated in general and stratified by sex.

Results: Walking velocity, STS, and TUG were significantly influenced by lower-leg strength (r_s up to 0.79 in males). Static balance showed no meaningful relationships. In general, fewer correlations in female participants reached the level of significance and showed smaller effect sizes.

Discussion: Although smaller sex-subgroup sample sizes might limit confidence in the results, male participants showed higher correlations between strength and walking velocity (up to $r_s = 0.79$) and individual balance parameters ($r_s = 0.77$) than female participants ($r_s = 0.56$ for gait, $r_s = 0.72$ for TUG). The results align with previous studies showing a potential influence of strength on gait parameters; however, a causal relationship must be confirmed by longitudinal study designs. Nevertheless, based on the results, there is a need for future sex-specific studies on the necessity of sex-specific balance and fall-prevention routines.

Keywords: dynamic balance; elderly; lower-leg strength; static balance; walking speed.

Identifying subtypes and determinants of fall risk perception in older adults: a latent profile analysis

Yang X, Xiang H, Qian W, Xu Q, Zhang Y, Chen H, Han X, Yao M. *Front Public Health*. 2026 Mar 26;14:1759157.

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Abstract

Background: Falls have long been a significant safety concern worldwide, not only compromising the physical and psychological health of older adults and limiting their social engagement but also imposing substantial economic and caregiving burdens. Evidence on fall risk perception among Chinese community-dwelling older adults remains limited, especially for those transitioning to community living after hospital discharge.

Objective: This research examined the subtypes of fall risk perception of Chinese community-dwelling older adults in the post-discharge transition and to explore subgroup characteristics and associated factors.

Methods: A cross-sectional survey was conducted between January 2024 to March 2025 in Hangzhou, Zhejiang Province. A self-designed questionnaire was used to collect demographic and health-related information, The Fall Risk Perception Scale for Community-dwelling Older Adults was used to assess the fall risk perception, the objective fall risk was assessed by Morse Fall Scale. Latent profile analysis (LPA) was performed to extract latent classes of fall risk perception, and multinomial regression analyses were used to identify differences between these categories.

Results: A total of 468 older adults were included, with 56.0% were male. Three fall risk perception subtypes were identified by LPA: Low Perception-Social Context Desensitized Type (29.2%), Moderate Perception - Balanced Type (43.4%), and High Perception - Bio-behaviorally Salient Type (27.4%). Individuals who were aged with 70-79 (OR = 0.46, 95% CI: 0.27-0.77), with college education or above (OR = 0.31, 95% CI: 0.13-0.76), those who underwent surgery during hospitalization (OR = 0.26, 95% CI: 0.15-0.43), reported difficulty falling asleep (OR = 0.40, 95% CI: 0.20-0.82), and those with a history of falls (OR = 0.44, 95% CI: 0.24-0.81) were significantly more likely to be in the High Perception - Bio-behaviorally Salient Type. Compared to objective fall risk level, a third of participants (31.4%) correctly estimated their fall risk, 23.1% overestimated it and 45.5% underestimated it.

Conclusion: Most older adults possess a Moderate Perception - Balanced Type toward fall risk. Key determinants of heightened risk perception included advanced age, higher education, fall history, and recent surgical experience. Tailored, profile-specific risk communication strategies are essential to improve perceptual accuracy during the hospital-to-home transition may support post-discharge fall prevention.

Keywords: fall; fall risk; healthy aging; older adults; risk perception.