Featured Falls Research – May

Effect of Surface Perturbation Treadmill Training Program on Strategies and Kinematics of Reactive Stepping during Standing in Older Adults: A Single-Blinded Randomized Controlled Trial

Batcir S, Gimmon Y, Kurz I, Edelman S, Levitsky Gil N, Adar R, Rabaev E, Debi R, Shani G, Shapiro A, Melzer I. Gerontology. 2025 Mar 28:1-14. doi: 10.1159/000545480.

Abstract

Introduction: Perturbation-based balance training reduces fall rates dramatically by triggering and improving balance recovery skills. We aimed to investigate whether multidirectional surface perturbation treadmill training, which explicitly challenges age-related impairments in reactive responses, can improve balance recovery responses in standing and reduce annual falls.

Methods: This was a two-arm parallel-group randomized controlled trial with concealed allocation, blinded assessors, data analyzers, and intention-to-treat analysis. Fifty-three older adults aged 80.1 ± 5.2 years, living in retirement housing, were randomized into two groups: (1) surface perturbation-based hands-free treadmill training (SPTT, n = 27) and (2) control group, hands-free treadmill walking training without perturbations (TT, n = 26). Both received a 12-week, 24-session training program. For primary outcomes, we evaluated balance recovery, pre- and post-intervention, by stepping thresholds, percentage of stepping responses, total probability of stepping, and kinematics of reactive stepping to lateral-surface perturbations in standing. Fall incidents were monitored prospectively 1 year after training for a secondary outcome.

Results: Both groups showed a significant decrease in the percentage of multiple-step responses (p = 0.013) and a shorter total recovery time to recover balance (p = 0.006). Compared with the TT, the SPTT led to a more significant reduction in single-step and multiple-step thresholds (p = 0.003 and p = 0.002, respectively), total probability of stepping (p = 0.008), shorter first-step length (p = 0.003), total steps path length (p = 0.007), and decreased total center-of-mass (CoM) displacement (p = 0.040) during recovery stepping. One-year prospective fall monitoring revealed nine fall events in the SPTT group compared to 17 in the TT group. Although these numbers are insignificant, they imply a potential generalization that SPTT can reduce annual falls.

Conclusion: A 12-week SPTT reduces the risk of falls by improving reactive balance responses in retirement-housing older adults. Findings suggest that the primary benefit of SPTT was better control in the CoM following perturbations. This study addressed the generalizability of PBT benefits from walking to standing and the personalization of perturbation training to enhance effectiveness and real-life applicability.

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Dose-response relationship of treadmill perturbation-based balance training for improving reactive balance in older adults at risk of falling: results of the FEATURE randomized controlled pilot trial

Hezel N, Buchner T, Becker C, Bauer JM, Sloot LH, Steib S, Werner C. Eur Rev Aging Phys Act. 2025 May 16;22(1):8.

Abstract

Background: The inability to appropriately react to balance perturbations is a common cause of falls. Perturbation-based balance training (PBT) is especially beneficial for improving reactive balance and shows high potential for fall prevention. However, its dose-response relationship, feasibility, and acceptability remain to be determined among older adults at risk of falling. The FEATURE study aimed to compare the efficacy of two treadmill PBT protocols with different session numbers to improve reactive balance, and to evaluate their feasibility and acceptability in this population.

Methods: In this randomized controlled pilot trial, 36 older adults at risk of falling were allocated to receive either six (6PBT) or two treadmill PBT sessions (2PBT). Reactive balance in standing (Stepping Threshold Test [STT]) and walking (Dynamic Stepping Threshold Test [DSTT]) was assessed as primary outcome at baseline (T1), post-intervention (T2), and 6-week follow-up (T3). Secondary outcomes included measures on physical, psychological, and cognitive functioning. Feasibility was assessed via PBT adherence, planned perturbations completed, and adverse events; acceptability via questionnaire. Between-group changes over time were compared using repeated-measures analyses of variance with Bonferroni-corrected post-hoc tests. Data analyses followed the intention-to-treat principle.

Results: A significant time effect was observed for the DSTT (p = 0.008), with both groups significantly improving from T1 to T2 (ps < 0.01). A significant interaction effect (p = 0.027) revealed that only the 6PBT group maintained these improvements (T1 vs. T3: p < 0.001) and scored significantly higher than the 2PBT group at T3 (p = 0.015). No significant interaction effects were found for the STT or any secondary outcome, but improvements over time were observed for dynamic balance, gait capacity, functional mobility, physical activity, concerns about falling, and executive functioning (time effects: ps < 0.05). PBT adherence, planned perturbations completed, and acceptability were high in both groups, with no significant between-group differences. No intervention-related serious adverse events were reported.

Conclusions: Findings suggest that a low number of treadmill PBT sessions can lead to task-specific improvements in reactive balance during walking, with a higher practice dose enhancing sustainability. Treadmill PBT appears feasible and well-accepted among older adults at risk of falling, regardless of sessions received.

The effect of proprioceptive neuromuscular facilitation techniques compared to general aerobic exercise on balance, fear of falling, and quality of life in older adults living in nursing homes: a randomized controlled trial

Abstract

Background: With aging, changes occur in various body systems, such as cardiovascular, respiratory, neuromusculoskeletal, and vestibular, leading to a decreased quality of life (QOL) and an increased fear of falling (FOF). Exercise and physical activity reduce the progression of aging complications. Therefore, we examined the effect of proprioceptive neuromuscular facilitation techniques compared to aerobic exercise on balance, fear of falling, and quality of life in older adults living in nursing homes.

Methods: Fifty-two older adults aged over 60 (31 males, 21 females) living in nursing homes were included. After initial evaluation, individuals were randomly assigned to two treatment groups (PNF techniques and aerobic exercise). Both treatment groups received 12 treatment sessions over 4 weeks. Balance, fear of falling, and quality of life were assessed at baseline and after a 4-week intervention. Analysis of covariance (ANCOVA) and paired samples t-test were utilized to between and within-group changes of variables.

Results: The results showed no significant differences in balance, fear of falling, and quality of life between groups after the intervention (P > 0.05). In the within-group comparison, only the PNF techniques group showed significant improvement in the Berg Balance Scale (BBS) after the intervention (P < 0.05).

Conclusion: The findings suggest that PNF techniques compared with aerobic exercise could not contribute to improved balance, fear of falling, and quality of life. Therefore, more clinical trial studies with a control group are needed to determine the exact effects of these techniques.

Effects of Integrating Wearable Activity Trackers With a Home-Based Multicomponent Exercise Intervention on Fall-Related Parameters and Physical Function in Older Adults: Randomized Controlled Trial

Abstract

Background: Older adults with a history of falling often encounter challenges in participating in group exercise programs. Recent technological advances, such as activity trackers, can potentially enhance home-based exercise programs by providing continuous physical activity monitoring and feedback.

Objective: The aim of the study is to explore whether integrating wearable activity trackers with a home-based exercise intervention is effective in reducing fear of falling and improving physical function in older adults.

Methods: This was a 12-week, parallel-group, randomized controlled trial involving 30 older adults (≥60 years) with a history of falling. Participants were randomly assigned in a 1:1 ratio to either a group combining an activity tracker with a home-based multicomponent exercise intervention, which included in-person exercise sessions, exercise videos, and objective feedback via phone calls (AT+EX group) or to a group using the activity tracker only for self-monitoring (AT-only group). The primary and secondary outcomes included fall-related parameters (fear of falling assessed by the Activities-Specific Balance Confidence [ABC] and the Falls Efficacy Scale-International [FES-I] scales), depression (Short Geriatric Depression Scale), cognition (Montreal Cognitive Assessment), physical function (grip strength, Short Physical Performance Battery, Timed Up and Go [TUG] test, and 2-Minute Step Test), and body composition. Changes in the average daily step count were monitored and analyzed.

Results: Overall, 28 (mean age 74.0, SD 6.4 years; n=23, 77% female) participants completed the 12-week follow-up period (28/30, 93%). In the activity tracker and exercise group (AT+EX group), significant improvements were observed in fear of falling (15.5 points of ABC: P=.002; -5.1 points of FES-I: P=.01). The activity tracker alone group (AT-only group) also showed a significant improvement in FES-I score (-5.5 points: P=.01). Physical function significantly improved in the AT+EX group (1.1 points of Short Physical Performance Battery: P=.004; -1.4 seconds of TUG; P=.008; and 26.7 steps of 2-Minute Step Test: P=.001), whereas the AT-only group showed significant improvement only in the TUG test (-1.3 seconds: P=.002). However, no significant between-group differences were observed in the ABC score, FES-I score, or physical function. Despite no significant increase in daily step counts, both groups maintained close to 10,000 steps per day throughout the 12 weeks.

Conclusions: Both groups showed improvements in the FES-I and TUG test scores without significant between-group differences. Wearable technology, with or without an exercise intervention, seems to be an effective tool in reducing the fear of falling and improving physical function in older adults susceptible to falls.

Keywords: activity tracker; aging; exercise; fall; falling; fear of falling; geriatrics; gerontology; home exercise; intervention; multicomponent exercise; older adults; older

person; physical activity; physical activity intervention; physical function; randomized controlled trial; self-monitoring; step counts; wearable activity tracker; wearable technology.

Effectiveness of exercise prescription variables to reduce fall risk among older adults: a meta-analysis

Zhu TR, Xu HQ, Wei JP, Quan HL, Han XJ, Li TX, Shi JP. Eur Rev Aging Phys Act. 2025 May 13;22(1):7..

Abstract

Objective: This meta-analysis explored the relationship between various exercise prescription variables and their effects on fall risk reduction in older adults, enabling the selection of targeted and evidence-based intervention prescription variables tailored to individual risk-assessment results.

Method: Databases including PubMed, Embase, Web of Science, and the Cochrane Library were systematically searched for randomized controlled trials that investigated the impact of exercise intervention on fall prevention. Study quality was assessed using the Cochrane risk-of-bias tool. Meta-analyses, subgroup analyses, sensitivity analyses, and assessments of publication bias were performed using Stata 16.0.

Results: A total of 43 articles comprising 51 studies and involving 2,743 participants were included. The results indicated significant improvements in fall risk assessment indices due to Mind-body Exercise (MBE), Multi-component Physical Activity (MCPA), and Muscle-strengthening Activity(MSA). Subgroup analyses revealed differential optimal type, cycle (week), frequency (day/week), and session time (minutes) across assessment tools, such as the unipedal stance test with eyes open (MCPA, < 8, 3, 45 ≤ Time < 60), functional reach (MCPA, < 8, < 3, ≥ 60), the "get-up and go" test (MSA, ≥ 24, < 3, 30 ≤ Time < 45), Berg balance scale (MBE, 8 ≤ Time < 12, 3, 30 ≤ Time < 45), Five stands sit-to-stand (MCPA, ≥ 24, > 3, 30 ≤ Time < 45), the 30-s chair-stand test (MSA, 12 ≤ Time, < 3, 45 ≤ Time < 60), short physical performance battery (MCPA, 12 ≤ Time < 24, < 3, ≥ 60), and Falls Efficacy Scale-International (MBE, 8 ≤ Time < 12, < 3, 45 ≤ Time < 60).

Conclusion: The findings suggest that prescription variables combining MCPA and MBE, ≥ 8-week programs, and ≥ 30-min sessions, effectively reduce fall risk through concurrent enhancement of balance, strength, and self-efficacy; their integration into community-based protocols with individualized resistance-balance combinations optimizes functional outcomes in older adults.

Keywords: Elderly; Exercise Intervention; Fall Risk; Meta-analysis.

Falls Research – May

Multimodal Factors Affect Longitudinal Changes in Dynamic Balance in Community-Dwelling Older Adults

Abstract

Purpose: Dynamic balance, an important contributor to fall risk in older adults, involves maintaining the center of pressure while in locomotive states and is. Fall risk appraisal (FRA) is defined as assessing an older adult's awareness of their physiological and perceived fall risk. This longitudinal study aimed to evaluate how multimodal factors predict fluctuations in dynamic balance in community-dwelling low-income older adults, utilizing fear of falling (FoF), static balance, fall history, and moderate-to-vigorous physical activity (MVPA).

Patients and methods: The longitudinal study included 140 community-dwelling, low-income older adults, with 124 women and 16 men. FoF was assessed using the Short Falls Efficacy Scale International (Short FES-I) and static balance using BTracks Balance Test (BBT). Both were utilized to define FRA Distance, an integrated quantification of physiological and perceived balance deficits. MVPA was assessed using accelerometers, fall history using self-report, and dynamic balance using the Timed Up and Go (TUG) test. The study was conducted at 4 timepoints at T1 (baseline), T2 (2 months), T3 (4 months), and T4 (6 months).

Results: Using mixed effects multilevel models, TUG scores were predicted by time, %MVPA, and FRA distance ratio. The effect of FRA distance ratio was primarily driven by FoF, and the effect of %MVPA varied by age. Additionally, while fall history did not show a predictive relationship with TUG scores, it did predict FRA distance.

Conclusion: Dynamic balance fluctuated over time and was influenced by multimodal factors, namely MVPA and FRA, which captured the interplay between static balance and FoF. Fall history did not directly predict dynamic balance but played a role in FRA, implicating the subjective effects of fall history. These findings demonstrate how physical activity, FRA, and their interactions can predict changes in dynamic balance. Future work can utilize the results to evaluate low-cost interventions for community-dwelling older adults.

Keywords: balance; fear of falling; older adults; physical activity.

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Narrow Walk, Condition II, Semi-Tandem, Tandem, and Single Leg Stance Test Failure Could Predict Falls in Older Adults

Abstract

Current fall prevention guidelines are largely reactive to a history of falls and are thus an ineffective approach to primary fall prevention. This work aims to identify objective measures that predict fall risk to facilitate broader implementation in primary care settings. Longitudinal data were available from 952 men (48%) and women aged 60 to 97 enrolled in the Baltimore Longitudinal Study of Aging who had an index and subsequent visit approximately 2.5 years apart. Participants received objective measures at index visit and answered "yes" or "no" to the question "Have you fallen in the past 12 months?" at both visits. Main predictors included muscle strength (hamstrings/quadriceps), narrow walk, progressive static balance (semi-tandem, full tandem, single leg stance) tests and performance on conditions I and II of the modified Clinical Test of Sensory Interaction in Balance (mCTSIB). Each test was parameterized using validated methods. Logistic regression models adjusted for age, sex, race, and BMI were used to predict fall risk. Persons who failed the semi-tandem, full tandem, single leg stance, narrow walk, and condition II had, respectively, 2.59 (95% CI 1.51, 4.46), 1.57 (95% CI 1.06, 2.33), 1.54 (95% CI 1.15, 2.06), 2.21 (95% CI 1.37, 3.58), and 3.56 (95% CI 1.01, 12.57) times the odds of a future fall than persons who did not fail these tests. Observation of standing balance by assessing sway with eyes closed (condition II), ability to hold progressively challenging standing positions, or inability to traverse a narrow walk are all prognostic of a future fall. As these tests require no special equipment and take only 30 s to administer, identifying older persons at elevated risk of falling is feasible. Whether identifying persons at risk of falling can proactively prevent a future fall remains to be demonstrated.

Keywords: aging; balance assessment; fall prevention; older adults; primary care.

Falls Research
May 2025

The mediating role of intrinsic capacity in balance and falls among older adults

Abstract

The intrinsic capacity (IC) and balance function of older adults are closely related to falls. IC is not only directly related to falls but may also play a mediating role in balance and falls. This study aims to explore the mediating role of IC in balance and falls. A total of 284 elderly patients were divided into fall group (n = 131) and non-fall group (n = 153) based on whether they had experienced falls. All patients underwent assessments of IC, including locomotion (SPPB), vitality (MNA-SF), sensory (self-reported vision/hearing), cognition (MOCA), and psychological status (SAS/SDS). Patients underwent the sensory organization test and limits of stability test. (1) Using fall history as a binary dependent variable and various balance indicators as independent variables, visual (VIS) (p = 0.011, OR 0.957), vestibular function (p < 0.001, OR 0.958), and direction control (p = 0.042, OR 0.967) were negatively associated with falls. (2) After incorporating IC scores, sensory function (p < 0.001, OR 0.154), SPPB (p = 0.003, OR 0.758), and SOT-Composite (p < 0.001, OR 0.900) were negatively associated with falls, while SAS (p = 0.008, OR 1.068) was positively associated with falls. (3) IC score mediated the relationship between movement velocity (MVL) and falls. Among the five dimensions of IC, the SPPB and the MNA-SF mediated the relationship between MVL and falls, and the SPPB mediated the relationship between maximum excursion (MXE) and falls. The SAS mediated the relationship between SOM, VIS and falls, while the SDS mediated the relationship between SOM, EPE and falls. There are multiple mediating effects of IC between balance function and falls.

Keywords: Balance function; Elderly; Falls; Intrinsic capacity.

Falls Research
May 2025

Perceived Balance Predicts Falls in Community-Dwelling Older Adults: A Longitudinal Study Using the National Health and Aging Trend Study (NHATS) Data

Abstract

Background and objectives: Falls are an increasing problem among older adults. Older adults' self-report of falls is the primary method of fall risk identification. However, up to 72% of Medicare beneficiaries who have fallen do not report falls and fall-related injuries to their healthcare providers. Research suggest that older adults prefer the term "balance problems" instead of "fall risk." The purpose of this study was to examine if perceived balance problem is a predictor of self-reported falls after controlling for known predictors of falls among older adults.

Research design and methods: The Health Belief Model served as the theoretical framework. A longitudinal secondary analysis was conducted using data from a subsample of independently living participants (N = 5446) from the National Health and Aging Trends Study. Baseline data was from year 2015, and the outcome was self-reported falls in 2016.

Results: Complex samples multiple logistic regression analyses revealed that the single item perceived balance problem question (OR = 1.69, p < .001) predicted falls in 2016, whereas, the balance performance measure, Short Physical Performance Battery, did not (OR = 0.98, p = .06). Non-Hispanic White participants were more likely to report falling compared to non-Hispanic Black and Hispanic participants, as were females compared to males. A hospital stay in 2015, co-morbidities, fear of falling, and a fall in 2015 were also predictive of falls.

Discussion and implications: Assessing older adults' perceived balance is important in primary care to identify fall risk and recommend appropriate home modifications, assistive devices, and/or interventions.

Keywords: Balance Performance; Fear of Falling; Health Belief Model; Short Physical Performance Battery.

The effectiveness of progressions of difficulty during an exercise program to improve balance and gait in older individuals: A randomized clinical trial

Dos Santos MPG, Lemos T, da Silva DCL, Martins CP, Martins JVP, de Oliveira LAS. Braz J Phys Ther. 2025 May-Jun;29(3):101207.

Abstract

Background: Little is discussed about the effectiveness and systematization of progressions of difficulty during balance exercises. Exercise progression provides continuous stimulation and assists physical therapists in offering challenges to patients.

Objective: To investigate the effectiveness of an exercise program with systematic progression of difficulty for older individuals.

Methods: Randomized clinical trial, with 22 older individuals allocated to experimental (EG, N = 12) or control (CG, N = 10) group. In EG, individuals performed an exercise program with progressions of difficulty for 12-weeks (2 days/week, 1 h/session). In the control group the participants performed the same program without progressions of difficulty. The Berg Balance Scale (BBS), Timed up and Go (TUG), and modified Dynamic Gait Index (mDGI) were assessed after and before the 24 exercise sessions. An intention-to-treat approach and multiple imputation by chained equations were utilized. Raw data were transformed into standardized individual differences (SID) and analyzed using one-way ANCOVA to test group effects, with baseline and age as covariates. A one-sample t-test was used to compare SIDs against zero. Effect sizes were estimated using partial eta squared (η_p^2) and Cohen's d.

Results: ANCOVA revealed no significant group effect across any of the variables. Baseline values emerged as significant predictor of changes in BBS (P = 0.038, η_p^2=0.219), TUG (P = 0.042, η_p^2=0.210), and mDGI (P < 0.001, η_p^2=0.545), suggesting a substantial differences among participants with lower baseline values. Age also emerged as a significant predictor of change for mDGI (P = 0.002, η_p^2=0.431). Comparison with zero-value produced significant differences for BBS and mDGI, indicating increases in post-intervention for both groups.

Conclusion: Applying progressions of difficulty to the exercises, did not lead to greater improvements than not applying them. CLINICAL TRIAS: https://ensaiosclinicos.gov.br/rg/RBR-8dpxgcf.

Keywords: Accidental falls; Aged; Postural balance.

Biomechanical adaptation to compensate balance recovery in people with knee osteoarthritis

Abstract

Background: Older adults with knee osteoarthritis are twice as likely to fall compared to healthy counterparts. Furthermore, in healthy older adults, greater trunk flexion is associated with increased falling. While spatio-temporal and strength measures have been connected to balance dysfunction in osteoarthritis, to date no studies have investigated compensation of both upper and lower body kinematics on balance recovery in this population.

Methods: Forty-eight older people with knee osteoarthritis (age 71.02 ± 6.76 years, 54 % females, BMI 29.10 ± 4.58) and 15 asymptomatic controls (age 72.47 ± 4.81, 27 % females, BMI 26.17 ± 3.06) completed balance recovery during a simulated forwards fall. Ankle, knee, hip, trunk and head kinematics were collected and analysed using three trial types (no additional, cognitive dual-task and physical dual-task). Two-way MANCOVA were conducted to identify group differences in ankle, knee, hip, and trunk angle, and head position (control and knee osteoarthritis), trial differences (no additional, cognitive and physical dual-task) and group by trial differences.

Findings: Postural differences in older adults with knee osteoarthritis included greater knee flexion (p = .02) and lower hip and trunk flexion (p < .01).

Interpretation: Following a simulated fall, older adults with knee osteoarthritis showed greater knee flexion at first contact which might suggest inability to resist forwards motion of the body. The more extended hip in this group and the resulting compensation of the upper body posture may lead to no difference in number of steps taken when compared to controls.

Keywords: Dual-task; Falls; Induced-fall; Posture; Tether-release.

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Effectiveness of cognitive-motor dual task training in preventing falls in community older adults: A meta-analysis and systematic review

Abstract

Background: Cognitive-motor dual task training has shown great significance in reducing the risk of falls and improving gait and balance function in the older persons, and is increasingly emerging in the field of sports rehabilitation. However, the effects of cognitive-motor dual task training are not well-understood.

Objective: To evaluate the effectiveness of cognitive-motor dual task training in preventing falls in community older adults.

Design: Systematic review.

Methods: A librarian-designed search of the Cochrane Library, PubMed, Web of Science, EMBASE, CINAHL, CBM, CNKI, and Wanfang databases was conducted to identify studies in English or Chinese on randomized controlled trials up to 10 May 2024. Two researchers independently screened the literature by reading the titles and abstracts of the trials to determine whether a study was eligible for inclusion. Primary and secondary outcomes were compared between the intervention and control groups. A fixed- or random-effects meta-analysis model was used to determine the mean difference, based on the results of the heterogeneity test.

Results: Compared to traditional fall prevention interventions, cognitive-motor dual-task training can effectively improve the gait, static and dynamic(≥12-week) balance function of community older adults, enhance executive function, and reduce the risk of falls. The effect of dual-task training on enhancing lower-extremity muscle strength and reducing the fear of falling in community-dwelling older adults remains controversial.

Conclusions: Cognitive-motor dual-task training interventions could effectively prevent falls in community older individuals. Higher quality, larger sample size, and long-term follow-up studies are needed to further verify the long-term effectiveness of cognitive-motor dual-task training in preventing falls in community older individuals.

No patient or public contribution: Our paper is a systematic review and meta-analysis and such details don't apply to our work.

Keywords: Cognitive-motor dual task; community; falls; meta-analysis; older adults.

Frailty is associated with a history of falls among mobility-limited older adults-cross-sectional multivariate analysis from the BIOFRAIL study

Hansen P, Nygaard H, Schultz M, Dela F, Aagaard P, Ryg J, Suetta C. Eur Geriatr Med. 2025 May 27.

Abstract

Aim: To identify differences in characteristics between mobility-limited older adults with a history of falls and those at risk of falling but who have not yet fallen.

Findings: Frailty and muscle strength were characteristics distinguishing between older adults with a history of falls and those absent of falls despite an increased risk of falling.

Message: Frailty should be incorporated alongside handgrip strength (HGS) and sit-to-stand (STS) tests into routine evaluations of mobility-limited older adults referred for fall assessment.

Purpose: We aimed to identify differences in characteristics between mobility-limited older adults with a history of falls and those at risk of falling, and to identify the parameter with the strongest predictive value on the risk of falling.

Methods: Data included anthropometry, HGS, 30-s and 5-reps STS tests, maximal isometric knee extensor strength, gait speed (6 m), postural balance (tandem test), and muscle mass (BIA). Frailty was assessed using the Clinical Frailty Scale (CFS) and sarcopenia was evaluated according to the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) guidelines. Outcomes of falls (past year), and depression (Geriatric Depression Scale 15) were self-reported.

Results: Totally, 505 mobility-limited older adults (mean age 79.7 ± 6.3 years, 64.8% females) were included. Of these, 400 (79.2%) had experienced one or more falls within the past year (fallers), while 105 (20.8%) had not experienced a fall (at risk). Patients with experienced falls were more likely to feel depressed, had reduced handgrip strength, and reduced performance in both STS tests compared to those who had not fallen. Frailty was the strongest individual parameter associated with a history of prior falls, even after adjusting for covariates such as depression and 30-s STS (aOR 3.80; 95% CI 1.70-8.50).

Conclusions: Present study identified frailty as a key factor independently associated with a history of falls in this population. Additionally, handgrip strength and STS performance were key characteristics distinguishing between older adults with a history of falls within the past 12 months and those at risk of falling.

Falls Research
May 2025

An Exploratory Study on Virtual Reality Technology for Fall Prevention in Older Adults with Mild Cognitive Impairment

Abstract

Introduction: Virtual Reality (VR) training has potential evidence for reducing the risks of falls of older adults with mild cognitive impairment (MCI). There are indications of a positive training effect of a cognitive-motor intervention method to improve the postural balance and cognition for safer walking. This study aimed to evaluate the training effects of VR training for reducing the risks of falls among older adults with mild cognitive impairment (MCI).

Methods: An experimental design was employed to evaluate how the participants attended a full-immersive VR Cave Automatic Virtual Environment (CAVE) training program. Fifty-five participants were randomly assigned to the VR group or the control group. The VR group received 16 training sessions over 8-10 weeks, while the control group received a non-VR falls prevention program. The primary outcome assessed any falls after the study, and the secondary outcomes assessed changes in cognition and executive function, walk speed and balance performances, and the psychological factor such as fear of falling relating to the risk factors of fall.

Results: The VR group showed significantly greater improvement than the control group in terms of measures of cognitive-motor performance across group and time interaction. However, there were inconsistent results in functional mobility and fall efficacy between the two groups.

Conclusion: This study provides promising evidence on the VR CAVE training for reducing the risks of falls among older adults with MCI from Hong Kong. VR technology-based applications are an emerging area in current aged care and rehabilitation services.

Keywords: cave automatic virtual environment (CAVE); cognitive-motor training; fall prevention; fall risks; mild cognitive impairment (MCI); older adults; virtual reality (VR).

Discriminative ability of functional performance tests on risk of falling among older adults with knee osteoarthritis: A cross-sectional study

Abstract

Identifying fall risk among older adults with knee osteoarthritis (OA) is essential for targeted prevention. Although functional tests assessing mobility, strength, and balance are widely used, no consensus exists on the most effective test to identify fall risk in this population. This study aimed to compare functional performance tests and fall risk between older adults with and without knee OA, compare the tests in older adults with and without fall risk in both groups, and determine cutoff scores for these tests to identify fall risk among older adults with knee OA. This cross-sectional study included 106 participants aged ≥ 60 years (53 in each group). The participants completed the Thai falls risk assessment test and performed 5 functional performance tests, including the timed-up and go test (TUGT), functional reach test, alternate-step test (AST), 5 times sit-to-stand test (FTSST), and 10-meter walk test (10MWT). The independent t-test and Mann-Whitney U test were used to compare outcomes, and receiver operating characteristic curves were used to identify the optimal cutoff scores. Older adults with knee OA had a higher fall risk and performed significantly worse on the TUGT, AST, FTSST, and 10MWT than those without knee OA. The TUGT and AST scores effectively distinguished the fall risk between older adults with and without knee OA. cutoff scores of 10.5 and 24.5 seconds for the TUGT and AST, respectively, had acceptable area under curve values, effectively discriminating fall risk among older adults with knee OA. Older adults with knee OA exhibit a higher risk of falls and reduced functional abilities. The TUGT and AST may serve as useful fall-risk screening tools among this population.

Keywords: assessment; fall risk; older adults; osteoarthritis; physical performance.

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Self-reported hearing measures can predict risk of falling and balance problems

Abstract

Introduction: Falls in the elderly are a major source of injury that can result in disability and hospitalization. Early detection of balance deterioration and the risk of falling is thus crucial to preventive care. Older adults with hearing loss are 2.4 times more likely to experience falls than their normal-hearing peers. This study explored the utility of a self-reported hearing measure (The Amsterdam Inventory for Auditory Disability and Handicap-AIADH) as a predictor of balance problems and the risk of falling.

Methods: A sample of 148 individuals (18-90 years) completed two objective hearing tests (Standard Pure-Tone Audiometry and Words-in-Noise), one self-reported hearing inventory-AIADH, one balance test-Timed Up and Go, and the Activity-Specific Balance Confidence Scale that self-reports balance. The analysis included correlation and regression analyses, moderation, sensitivity, and specificity analyses.

Results: The findings suggest that AIADH constitutes a good predictor of a decline in balance and an increased risk of falling, which complements objective hearing measures in adults aged forty and over. Prediction accuracy rises with age. The findings also reveal that out of all the AIADH subscales, the detection subscale is the best predictor of balance problems and risk of falling.

Conclusions: Thus, using an available self-report hearing inventory can be a useful and potentially cost-effective tool for the early detection of balance problems and hearing deterioration. Health authorities should consider incorporating this type of evaluation as a remote screening tool for large populations at risk.

Falls prevention and management for older adults in home care services in Norway: a retrospective patient record review

Abstract

Purpose: To evaluate Norwegian home care services' adherence to the World Falls Guidelines 2022 (WFG2022) recommendations on assessment and management of falls among older adults with a history of falling, and to evaluate the degree to which identified fall risk factors were addressed with interventions to prevent falls.

Methods: We conducted a retrospective patient record review of older adults who receive home care services and have a history of falls from four municipal home care service city districts in Oslo, Norway. We collected data from electronic patient records on patient characteristics, the assessed fall risk factors, and implemented interventions to prevent falls. Adherence was analysed as the proportion of patients who received fall prevention care in line with WGF2022 recommendations.

Results: The records of 225 patients were reviewed, of which 157 (70%) patients were between the ages of 70 and 89 years, and 131 (58%) were women. A total of 54 (24%) patients had intermediate fall-risk and 171 (76%) patients had high fall-risk. Of the 54 patients with intermediate fall-risk, 50% received an assessment of balance, gait, or muscle strength, and 22% were subsequently offered exercise. Sixty-one percent of intermediate-risk patients received multifactorial fall risk assessments, and 19% received multifactorial interventions. Exercise was the most used intervention to prevent falls, but it was provided to fewer than half of the patients. Other relevant interventions, such as osteoporosis treatment and medication management, were provided to fewer than 10% of patients.

Conclusion: The results highlight substantial gaps in the comprehensive management of fall prevention where considerably fewer patients received follow-up interventions to prevent falls compared to those who had fall risk factors identified. These results underscore the urgent need for enhanced implementation of fall prevention care within municipal home care services.

Keywords: Chart review; Fall prevention; Fall risk assessment; Older adults; Primary care; Retrospective patient record review.

Effect of a Six-Month Dance Intervention on Postural Control and Fall-Related Outcomes in Older Adults with Mild Cognitive Impairment: A Randomized Controlled Trial

Thiel U, Halfpaap N, Labott BK, Herold F, Langhans C, Heinrichs K, Müller P, Müller NG, Hökelmann A.

Abstract

Background/objectives: Older adults with mild cognitive impairment often exhibit reduced postural control and increased fall risk. As fall-related injuries consume substantial healthcare resources, the development of fall-preventive interventions is of public health relevance. This study aims to investigate the effects of a six-month dance intervention on postural control and fall-related measures in older adults with mild cognitive impairment.

Methods: In this randomized controlled trial, 55 participants were allocated to either an intervention group or a control group. The intervention group performed two 90-min dance training sessions per week for six months, while the control group maintained their usual activities of daily living. Postural control was operationalized via balance performance, which was measured with the Sensory Organization Test and the Limits of Stability Test. Neuromuscular function of the lower extremities was assessed via muscle contraction velocity using tensiomyography. Fear of falling was quantified with the Falls Efficacy Scale, and participants reported fall history over the past year. It was hypothesized that older adults with mild cognitive impairment participating in the six-month dance training would show significantly greater improvements in postural control and fall-related outcomes than those in the control group.

Results: A mixed analysis of variance (time × group) revealed no significant improvements in balance performance or neuromuscular function following the dance intervention ($p > 0.05$). However, several main effects for time were observed in the Sensory Organization Test, Limits of Stability Test, and muscle contraction velocity. Scores on the Falls Efficacy Scale improved significantly in the intervention group, reflecting reduced fear of falling, although only shown by a paired-samples t-test ($t(23) = 2.276$, $p = 0.032$, $d = 0.465$).

Conclusions: This study did not provide evidence that a six-month dance intervention improves postural or neuromuscular functions. However, it cannot be ruled out that such null findings are related to confounding factors, such as insufficient training specificity or duration. Nonetheless, the fear of falling was significantly reduced in the intervention group, suggesting potential benefits for perceived fall risk in older adults with mild cognitive impairment.

Keywords: aging; cognitive dysfunction; exercise therapy; postural balance; rehabilitation.

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Status and influencing factors of balance in middle-aged and older adults with Parkinson's disease: a national longitudinal study

Abstract

Background: To examine the current status and influencing factors of balance in middle-aged and older adults with Parkinson's disease (PD) and explore the correlations of these factors with balance.

Methods: The China Health and Retirement Longitudinal Study (CHARLS) Database in 2015, 2018 and 2020 were utilized as the data source, from which the missing value samples were excluded and 1,390 participants aged ≥45 years were recruited. Using the chi-square test, balance comparisons were made among middle-aged and older adults PD patients under different indicators. The influences of different factors on the patient balance were investigated through regression analysis.

Results: Regression analysis revealed the correlations of age, gender, smoking, falls, hypertension, diabetes and physical activity with balance in PD patients. A significant association between aging and declined balance was found, with middle-aged and older adults PD patients aged > 65 years showing a higher probability of declined balance (OR = 0.716, p = 0.016). Male middle-aged and older adults PD patients exhibited better balance than female counterparts (OR = 1.829, p = 0.001). Previous smoking (OR = 0.580, p = 0.004), falls (OR = 0.769, p = 0.035), hypertension (OR = 0.738, p = 0.019) and diabetes (OR = 0.734, p = 0.027) were positively correlated with the declined balance in PD patients. Light physical activity could significantly improve balance in middle-aged and older adults PD patients (OR = 1.672, p < 0.001).

Conclusion: Balance impairment is a major concern for middle-aged and older adults with PD. Our findings highlight that age, gender, smoking, history of falls, hypertension, diabetes, and physical activity significantly influence balance. Specifically, old age, male gender, light physical activity (such as walking), and lower risks of hypertension and diabetes are linked to better balance. Clinicians should focus on managing these risk factors and promoting light physical activity to improve balance and reduce fall risks.

Keywords: CHARLS; Parkinson's disease; balance; middle-aged and older patients; national longitudinal study.

Optimal exercise parameters of Baduanjin for balance in older adults: a systematic review and meta-analysis

Yang Y, Li E, Gong Z, Tualaulelei M, Zhao Z, Zhang Z. Front Public Health. 2025 Mar 19;13:1541170.

Abstract

Purpose: Baduanjin represents an affordable and secure method of exercising both the mind and body, and has been observed to enhance balance in older adults. Nevertheless, the existing research on the impact of Baduanjin on various balance functions is still insufficient, and the optimal dosage parameters for performing Baduanjin exercises have not been studied.

Methods: To conduct a systematic review and meta-analysis, five English databases and three Chinese databases were performed. Relevant studies were searched by GOOGLE SCHOLAR, Web of Science, Cochrane, Embase, Pubmed, CNKI, SinoMed, and WangfangMed using "Baduanjin" and "balance." Subgroup analyses were conducted to investigate the influence of different exercise parameters on the observed outcomes. Meta-regression was employed to identify potential moderating factors. The Physical Therapy Evidence Database (PEDro) scale was used for quality assessment.

Results: A total of 40 studies were included in the analysis, while the majority of studies report promising outcomes, the overall quality of these studies is relatively low. The results of the meta-analysis showed Baduanjin significantly enhanced static balance (SMD = 0.87, 95%CI: 0.69-1.05), dynamic balance (SMD = 0.85, 95%CI: 0.50-1.19), proactive balance (SMD = -1.00, 95%CI: -1.33--0.67) and balance test battery (SMD = 1.04, 95%CI: 0.81-1.28) in older adults. Additionally, the findings indicated a notable reduction in the risk of falls (SMD = -2.19, 95%CI: -3.35--1.04) and an improvement in fall efficacy (SMD: 0.57, 95%CI: 0.36-0.78).

Conclusion: Baduanjin has been demonstrated to improve balance and reduce the risk of falls in older adults. Studies have found that significant gains begin to be achieved with a minimum of 12 weeks of practice and that 30-49 min of practice, 5-7 times per week, works best for developing different balances. However, most of the included studies were limited by a lack of blinding and follow-up visits, and there was an insufficient number of short-term or long-term studies to establish complete optimal parameters robustly.

Systematic review registration: https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=548345, identifier: CRD42024548345.

Keywords: Baduanjin; Qigong; balance; dosages; traditional exercise.

Gait and balance metrics comparison among different fall risk groups and principal component analysis for fall prediction in older people

Yin L, Nam H, Wei Y, Feng T, Li F, Wang Y, Zhang Y, Wang L. Age Ageing. 2025 Mar 28;54(4):afaf076.

Abstract

Background: Falls are a leading cause of morbidity and mortality among older adults, often linked to gait and balance impairments.

Objective: To compare gait and balance metrics across fall risk levels in community-dwelling older adults and identify principal components predictive of fall risk.

Design: Retrospective cohort study.

Setting: General community.

Subjects: Three hundred older adults were stratified into low, moderate and high fall risk groups using the STEADI toolkit.

Methods: Gait and balance metrics were compared across groups. Principal component analysis (PCA) reduced dimensionality, and binary logistic regression assessed the predictive value of components.

Results: High-risk individuals showed slower cadence, shorter step length, wider step width, greater gait variability and increased centre of pressure (CoP) and centre of mass (CoM) sway. PCA identified four gait and seven balance components, explaining 71.62% and 75.88% of variance, respectively. Logistic regression revealed Gait_principal component (PC)2 (instability) (OR = 2.545, P < .001), Gait_PC3 (rhythm control) (OR = 1.659, P = .006), Balance_PC1 (CoP sway during single-leg stance) (OR = 1.628, P = .007), Balance_PC2 (CoM sway velocity variability) (OR = 1.450, P = .032) and Balance_PC4 (CoP sway during double-leg stance, eyes closed) (OR = 1.616, P = .004) as significant predictors. The model achieved 77.2% accuracy, with a sensitivity of 73.1% and a specificity of 79.4%.

Conclusions: Gait instability, rhythm control and increased postural sway are key predictors of fall risk. Integrating gait and balance metrics enhances fall risk stratification, supporting clinical decision-making.

Keywords: falls; gait; older adults; older people; postural balance; principal component analysis; risk assessment.