

## Safety Literature 12<sup>th</sup> March 2023

### Age and gender differences in fall-related factors affecting community-dwelling older adults

Suh M, Kim DH, Cho I, Ham OK. J. Nurs. Res. 2023; ePub(ePub): ePub.

(Copyright © 2023, Taiwan Nurses Association, Publisher Lippincott Williams and Wilkins)

**DOI** 10.1097/jnr.0000000000000545 **PMID** 36863032

#### Abstract

**BACKGROUND:** Falls are one of the major adverse events affecting older adults that can result in serious injuries. Hospitalizations and deaths because of fall-related injuries have been increasing. Nevertheless, there is a dearth of studies examining the physical condition and current exercise habits of older adults. Moreover, studies analyzing the role of factors related to fall risk by age and gender in large populations are also scarce.

**PURPOSE:** This study was designed to investigate the prevalence of falls among community-dwelling older adults and elucidate the effects of age and gender on the related factors using a biopsychosocial model.

**METHODS:** This cross-sectional study utilized data from the 2017 National Survey of Older Koreans. On the basis of the biopsychosocial model, the biological factors related to falls included chronic diseases, number of medications, visual difficulties, activity of daily living (ADL) dependence, lower-limb muscle strength, and physical performance; psychological factors included depression, cognitive ability, regular smoking, alcohol consumption, nutritional status, and exercise; and the social factors included educational level, annual income, living conditions, and instrumental ADL dependence.

**RESULTS:** Of the 10,073 older adults surveyed, 57.5% were women and approximately 15.7% had experienced falls. The results of the logistic regression showed that, in men, falls were significantly associated with taking more medications and being able to climb 10 stair steps; in women, falls were significantly associated with poor nutritional status and instrumental ADL dependence; and in both genders, falls were significantly associated with greater depression, ADL dependence, and the presence of more chronic diseases and negatively associated with physical performance.

**CONCLUSIONS/IMPLICATIONS FOR PRACTICE:** The results suggest that practicing kneeling and squatting is the most effective strategy for reducing fall risk in older adult men and that improving nutritional status and strengthening physical ability is the most effective strategy for reducing fall risk in older adult women.

Language: en

## **Clinical sensor-based fall risk assessment at an orthopedic clinic: a case study of the staff's views on utility and effectiveness**

Ehn M, Kristoffersson A. *Sensors* (Basel) 2023; 23(4): e1904.

(Copyright © 2023, MDPI: Multidisciplinary Digital Publishing Institute)

DOI 10.3390/s23041904 PMID 36850500

### **Abstract**

In-hospital falls are a serious threat to patient security and fall risk assessment (FRA) is important to identify high-risk patients. Although sensor-based FRA (SFRA) can provide objective FRA, its clinical use is very limited and research to identify meaningful SFRA methods is required. This study aimed to investigate whether examples of SFRA methods might be relevant for FRA at an orthopedic clinic. Situations where SFRA might assist FRA were identified in a focus group interview with clinical staff. Thereafter, SFRA methods were identified in a literature review of SFRA methods developed for older adults. These were screened for potential relevance in the previously identified situations. Ten SFRA methods were considered potentially relevant in the identified FRA situations. The ten SFRA methods were presented to staff at the orthopedic clinic, and they provided their views on the SFRA methods by filling out a questionnaire. Clinical staff saw that several SFRA tasks could be clinically relevant and feasible, but also identified time constraints as a major barrier for clinical use of SFRA. The study indicates that SFRA methods developed for community-dwelling older adults may be relevant also for hospital inpatients and that effectiveness and efficiency are important for clinical use of SFRA.

Language: en

### **Keywords**

Aged; Humans; prevention; Risk Assessment; Focus Groups; assessment; falls; healthcare; wearable sensors; fall risk; hospital; \*Hospitals; \*Independent Living; inertial sensors; technology adoption

## **Comparison of three fall risk assessment tools in older hospitalized patients in Turkey: analysis of sensitivity and specificity**

Kuş B, Büyükyılmaz F, Ardiç A. Aging Clin. Exp. Res. 2023; ePub(ePub): ePub

(Copyright © 2023, Holtzbrinck Springer Nature Publishing Group)

**DOI** 10.1007/s40520-023-02369-z **PMID** 36859749

### **Abstract**

**BACKGROUND:** As a result of falls, older patients experience injury and loss of function, and their length of hospital stay and care costs increase.

**AIM:** This study was conducted to determine fall risks and compare the sensitivity and specificity of three fall risk assessment tools.

**METHODS:** Older patients' fall risk levels were determined according to the Itaki, Hendrich-II, and Morse tools within 2 h following their admission to the wards. A methodological design was used in the study, which included 388 hospitalized elderly patients. The mean age of the patients was  $72.29 \pm 5.6$  years, and 57.7% were female.

**RESULTS:** According to the ROC curve values of Sensitivity and 1-Specificity, the cut-off points for the Hendrich-II, Itaki, and Morse fall tools were accepted as 27.5, 8.5, and 6.5, respectively. According to the analysis results, the ratios of the areas under the ROC curve for the Itaki, Morse, and Hendrich-II fall tools were 0.794, 0.773, and 0.724, respectively, which were found to be statistically significant for all three tools ( $p \leq 0.001$ ).

**CONCLUSIONS:** The Itaki Fall Risk Tool was found to be the most sensitive one among the three instruments in assessing the fall risk of older hospitalized patients. The Itaki Fall Risk Tool was followed by the Morse and Hendrich-II tools, respectively, in terms of sensitivity.

Language: en

### **Keywords**

Hospital; Fall risk tools; Hendrich II; Itaki; Morse; Older patients

## Effects of a multicomponent physical exercise programme on perceived health-related quality of life and on depressive symptoms in older adults living in long-term nursing homes

Ugartemendia-Yerobi M, Kortajarena M, Elordi U, Zinkunegi-Zubizarreta N, Zarrazquin I, Calvo-Aguirre JJ, Irazusta A. *Int. J. Nurs. Sci.* 2023; 10(1): 16-22.

(Copyright © 2023, Chinese Nursing Association, Publisher Elsevier Publishing)

**DOI** 10.1016/j.ijnss.2022.12.015 **PMID**36860716

### Abstract

**OBJECTIVES:** This study aimed to investigate the impact of a multicomponent exercise programme on perceived health-related quality of life (HRQoL) and depressive symptomatology in older people living in a long-term nursing home (LTNH).

**METHODS:** A quasi-experimental study was conducted. Forty-one older people were conveniently selected from the largest LTNH in the Basque Country. The participants were assigned to either an intervention group ( $n = 21$ ) or a control group ( $n = 20$ ). The intervention group participated in 50-min moderate intensity multicomponent physical exercise sessions (strength and balance, three sessions a week for 3 months). The control group participants continued their usual activities in the LTNH. Assessments were completed at baseline and reassessed after the 12-week intervention by the same nurse researchers who filled out the questionnaires: the 36-item Short Form Survey (SF-36) and the Geriatric Depression Scale (GDS).

**RESULTS:** Thirty-eight participants completed the study (19 participants in each group). In the SF-36 parameters, physical functioning increase in the intervention group tends with a mean increase of 11.06 units (a 17.2% increase over the pre). In the role-emotional, the increase in the intervention group is with a mean increase of 5.27 units (a 29.1% increase over the pre) ( $P < 0.05$ ). In social functioning, the increase in the control group is significant with a mean increase of 13.16 units (a 15.4% increase over the pre) ( $P < 0.05$ ). There are no significant changes in the rest of the parameters, there are no differences between groups in the evolutionary pattern either.

**CONCLUSIONS:** As for the effects of the multicomponent exercise programme on HRQoL and depressive symptomatology, no statistically significant effects were obtained in the outcome data among older adults living in LTNHs. An increase in the sample size could confirm the trends obtained. The results may help inform the design of future studies.

Language: en

### Keywords

Aged; Depression; Exercise; Quality of life; Homes for the aged

## Effects of power training on functional capacity related to fall risk in older adults: a systematic review and meta-analysis

Jiménez-Lupión D, Chirisa-Ríos L, Martínez-García D, Rodríguez-Pérez M, Jerez-Mayorga D. Arch. Phys. Med. Rehabil. 2023; ePub(ePub): ePub.

(Copyright © 2023, Elsevier Publishing)

DOI 10.1016/j.apmr.2023.01.022 PMID 36868491

### Abstract

**OBJECTIVE:** Functional capacity is one of the main risk factors for falls among older adults. The aim of this systematic review and meta-analysis was to determine the effect of power training on functional capacity test (FCT) related to fall risk in older adults. **DATA SOURCES:** Systematic searches were conducted in four databases, including PubMed, Web of Science, Scopus and SPORTDiscus, from inception to November 2021. **STUDY SELECTION:** Randomized controlled trials (RCTs) assessing the effect of power training on functional capacity compared to another type of training program or control group in older adults with the ability to exercise independently. **DATA EXTRACTION:** Two independent researchers evaluated eligibility and used the PEDro scale to assess risk of bias. The information extracted was related to article identification (authors, country and year of publication), participant characteristics (sample, gender and age), strength training protocols (exercises/intensity/weeks) and the outcome of the FCT used related to fall risk. The Cochran Q statistic and I(2) statistics was used to assess heterogeneity. Random-effects model were conducted to pool the effect sizes expressed as mean differences (MD). **DATA SYNTHESIS:** Twelve studies (478 subjects) were selected for systematic review. A meta-analysis comprised 6 studies (217 subjects) where the outcome measure was the 30-second Sit to Stand (30s-STs) test, and another comprised 4 studies (142 subjects) where the outcome measure was the Timed Up and Go (TUG) test. There was an improvement in performance in favor of the experimental group in both the TUG subgroup (MD -0.31 s; 95% CI -0.63, 0.00 s;  $p = 0.05$ ), and the 30s-STs subgroup (MD 1.71 reps; 95% CI -0.26, 3.67 reps;  $p = 0.09$ ). **CONCLUSIONS:** In conclusion, power training increases functional capacity related to fall risk further than other types of exercise in older adults.

Language: en

### Keywords

Elderly; frail persons; high-velocity resistance training

## **Evaluation of the use of a nursing diagnosis Risk for Falls in the Community of Madrid (Spain) Primary Care System**

Domínguez-Fernández S, Ajejas-Bazán MJ, Pérez-Rivas FJ. Int. J. Nurs. Knowl. 2023; ePub(ePub): ePub.

(Copyright © 2023, John Wiley and Sons)

**DOI** 10.1111/2047-3095.12421 **PMID** 36859804

### **Abstract**

**PURPOSE:** The purpose of this study was to describe the use of the nursing diagnosis Risk for Falls in Primary Care System of the Community of Madrid.

**METHODS:** A retrospective review of the clinical histories was carried out in 262 health centers from January 2005 to December 2015. The study population are the patients who have recorded in their electronic health record the nursing diagnosis Risk for Falls.

**FINDINGS:** Frequency of use of the Risk for Falls ND in the Community of Madrid was 53,340 diagnoses, increasing from 650 nursing diagnosis in 2005 to 14,695 in 2015. NOC Nursing Outcomes total identified were 109,145, which represents an average of 2.05 NOC Nursing Outcomes per diagnosis. NOC Nursing Outcomes frequently appeared as follows: Fall Prevention Behavior (35.9%), Safe Home Environment (11.3%), and Risk Control (10.5%). NIC Nursing Interventions total identified were 104,293, representing an average of 1.96 NIC nursing interventions per diagnosis. NIC Nursing Interventions frequently appeared as follows: Fall Prevention (45.9%), Environmental Management: Safety (27%), and Risk Identification (5.8%).

**CONCLUSIONS:** Nursing diagnosis of Risk for Falls and the care process related to this diagnosis is starting to be used by the primary care nurses of the Community of Madrid.

**IMPLICATION FOR NURSING PRACTICE:** Risk factors related to the nursing diagnosis of risk for falls identified in our study can be addressed with activities that nurses must implement to prevent falls. Nursing methodology in general and specifically the diagnosis of risk for falls must be included in guides and protocols for the prevention of falls, and its use should be promoted by primary care nurses

Language: en

### **Keywords**

accidental falls; primary health care; nursing diagnosis; nursing methodology research; nursing process

## **Incidence and risk factors of falls in older adults after discharge: a prospective study**

Long S, Hu L, Luo Y, Li Y, Ding F. *Int. J. Nurs. Sci.* 2023; 10(1): 23-29.

(Copyright © 2023, Chinese Nursing Association, Publisher Elsevier Publishing)

**DOI** 10.1016/j.ijnss.2022.12.010 **PMID** 36860715

### **Abstract**

**OBJECTIVES:** This study aimed to determine the incidence of falls and risk factors associated with falling in discharged older adults.

**METHODS:** A prospective study was conducted on older adults who had been issued a discharge order in a Class A tertiary hospital in Chongqing, China, from May 2019 to August 2020. The risk of falling, depression, frailty, and daily activities were evaluated at discharge using the mandarin version of the fall risk self-assessment scale, Patient Health Questionnaire-9 (PHQ-9), FRAIL scale, and Barthel Index, respectively. The cumulative incidence function estimated the cumulative incidence of falls in older adults after discharge. And the risk factors of falls were explored using the sub-distribution hazard function in the competing risk model.

**RESULTS:** In a total of 1,077 participants, the total cumulative incidence of falls at 1, 6 and 12 months after discharge was 4.45%, 9.03%, and 10.80%, respectively. The cumulative incidence of falls in older adults with depression (26.19%, 49.93%, and 58.53%, respectively) and those with physical frailty (21.59%, 41.67%, and 48.73%, respectively) was much higher than that in those without depression and physical frailty ( $P < 0.05$ ). Depression, physical frailty, Barthel Index, length of hospital stay, re-hospitalization, being cared for by others, and the self-assessed risk of falling were directly associated with falls.

**CONCLUSIONS:** The incidence of falls among older adults discharged from the hospital has a cumulative effect with the lengthening of the discharge time. It is affected by several factors, especially depression and frailty. We should develop targeted intervention strategies to reduce falls for this group.

Language: en

### **Keywords**

Aged; Depression; Accidental falls; Activities of daily living; Frailty

## Order of onset of physical frailty and cognitive impairment and risk of repeated falls in community-dwelling older adults

Ge ML, Chu NM, Simonsick EM, Kasper JD, Xue QL. J. Am. Med. Dir. Assoc. 2023; ePub(ePub): ePub.

(Copyright © 2023, Lippincott Williams and Wilkins)

DOI 10.1016/j.jamda.2023.01.020 PMID 36852758

### Abstract

**OBJECTIVES:** To examine whether physical frailty onset before, after, or in concert with cognitive impairment is differentially associated with fall incidence in community-dwelling older adults.

**DESIGN:** A longitudinal observational study. **SETTING AND PARTICIPANTS:** Data from 1337 older adults age  $\geq 65$  years and free of physical frailty or cognitive impairment at baseline were obtained from the National Health Aging Trends Study (2011–2017), a nationally representative cohort study of US older adult Medicare beneficiaries.

**METHODS:** Participants were assessed annually for frailty (physical frailty phenotype) and cognitive impairment (bottom quintile of clock drawing test or immediate and delayed recall; or proxy-report of diagnosis of dementia or AD8 score of  $\geq 2$ ). Incident falls were ascertained annually via self-report. Multinomial logistic regression was performed to estimate the association between order of first onset of cognitive impairment and/or frailty and incident single or repeated falls in the 1-year interval following their first onset.

**RESULTS:** Of the 1,337, 832 developed cognitive impairment first (termed "CI first"), 286 developed frailty first (termed "frailty first") and 219 had co-occurrence of cognitive impairment and frailty within one year (termed "CI-frailty co-occurrence") over 5 years. Overall, 491 (34.5%) had at least 1 fall during the 1-year interval following the onset of physical frailty and/or cognitive impairment. After adjustment, "CI-frailty co-occurrence" was associated with a more than 2-fold increased risk of repeated falls than "CI first" (odds ratio 2.35, 95% confidence interval 1.51–3.67;  $P < .001$ ). No significant difference was found between participants with "frailty first" and "CI first" ( $P = .07$ ). In addition, the order of onset was not associated with risk of a single fall.

**CONCLUSIONS AND IMPLICATIONS:** Older adults experiencing "CI-frailty co-occurrence" had the greatest risk of repeated falls compared with those with "CI first" and "frailty first". Fall risk screening should consider the order and timing of onset of physical frailty and cognitive impairment.

Language: en

### Keywords

older adults; falls; cognitive impairment; Physical frailty

## **Paid caregivers' experiences of falls prevention and care in China's senior care facilities: a phenomenological study**

Luo Y, Ran H, Deng Y, Li H, Zhang M, Zhao L. *Front. Public Health* 2023; 11: e973827.

(Copyright © 2023, Frontiers Editorial Office)

**DOI** 10.3389/fpubh.2023.973827 **PMID** 36875422

### **Abstract**

**BACKGROUND:** In China, as population aging accelerates, senior care facilities have gradually become a mainstream option. According to the World Health Organization (WHO), the annual rate of falls has increased from 30 to 50% in senior care facilities. A study found that older adults who live in senior care facilities are three times more likely to fall than those who live in the community. The quality of care is highly related to the occurrence of falls. Therefore, exploring paid caregivers' experiences is very important to prevent falls in senior care facilities.

**OBJECTIVE:** The aim of this study was to explore paid caregivers' experiences of fall prevention and care in China's senior care facilities. Furthermore, we discussed the situation and provided suggestions.

**DESIGN:** This is a phenomenological study using face-to-face, in-depth, semi-structured interviews. **SETTING:** The study was conducted at four senior care facilities in Changsha, Hunan, China. **PARTICIPANTS:** Fourteen paid caregivers in four senior care facilities, including nursing assistants and senior nurses, participated in this study.

**METHODS:** A purposive sample method was used to select 14 nursing assistants and senior nurses from four different senior care facilities in Changsha from March to April 2022. Every participant individually completed a face-to-face, in-depth, semi-structured interview. Based on the phenomenological research methodology, the thematic analysis method and the Colaizzi analysis method were used for data analysis and theme extraction.

**RESULTS:** Based on interview data, a total of seven themes were distilled: (1) paid caregivers' professional requirements; (2) paid caregivers' attitude toward falls; (3) paid caregivers' fall training and education; (4) paid caregivers' knowledge about falls; (5) paid caregivers' fall risk assessment; (6) paid caregivers' fall prevention; and (7) paid caregivers' fall treatment.

**CONCLUSION:** In China's senior care facilities, paid caregivers need to be responsible and pay appropriate attention to older adults. First, senior nurses and nursing assistants need to enhance communication and cooperation. Second, they must learn about deficiencies in fall risk assessment and try their best to improve their capability. Third, they must adopt appropriate education methods to improve fall prevention capability. Finally, the protection of privacy should be taken seriously.

Language: en

Keywords

Aged; Humans; Educational Status; China; Aging; fall prevention; \*Accidental Falls;  
\*Caregivers; paid caregivers' experiences; phenomenological study; qualitative analysis;  
senior care facility

# **Positive self-perceptions of aging increase physical resilience to facilitate social re-engagement of older adults who fall: analysis based on health and retirement study data**

Zhang Z, Wang J, Ma B, Wang J, Jia Y, Chen O. Arch. Phys. Med. Rehabil. 2023; ePub(ePub): ePub.

(Copyright © 2023, Elsevier Publishing)

**DOI** 10.1016/j.apmr.2023.02.006 **PMID** 36868492

## **Abstract**

**OBJECTIVE:** To determine whether self-perceptions of aging (SPA) predict physical resilience following a fall and whether SPA and physical resilience affect subsequent social engagement in older adults with a fall.

**DESIGN:** Prospective cohort study. **SETTING:** General community. **PARTICIPANTS:** Older adults who reported a fall within 2 years after baseline data collection (n=1707, mean age 72.9 years, 60.9% women). **MAIN OUTCOME MEASURE:** Physical resilience indicates the ability to resist or recover from functional decline from a stressor. The change in frailty status from directly after the fall to up to two years of follow-up was used to generate four physical resilience phenotypes. Social engagement was dichotomized based on the presence at one of the five social activities at least once a month. The 8-item Attitudes Toward Own Aging Scale was used to assess SPA at baseline. Multinomial logistic regression and nonlinear mediation analysis were used.

**RESULTS:** Positive prefall SPA predicted more resilient phenotypes after a fall. Both positive SPA and physical resilience affected subsequent social engagement. Physical resilience partially mediated the association between SPA and social re-engagement (mediated percentage of 14.5 %,  $P = 0.004$ ). This mediation effect was fully driven by those with previous falls.

**CONCLUSION:** Positive SPA promotes physical resilience in older adults with a fall, both of which affect subsequent social engagement. Physical resilience partially mediated the effect of SPA on social engagement but only for previous fallers. Multidimensional recovery incorporating psychological, physiological and social aspects should be stressed in the rehabilitation of older adults who fall.

Language: en

## **Keywords**

recovery; fall; physical resilience; self-perceptions of aging; social engagement

## Proportion of falls reported in persons with Parkinson's disease: a meta-analysis

Van Bladel A, Herssens N, Bouche K, Cambier D, Maes L, Lefeber N. Clin. Rehabil. 2023; ePub(ePub): ePub.

(Copyright © 2023, SAGE Publishing)

DOI 10.1177/02692155231158565 PMID 36851866

### Abstract

**OBJECTIVE:** Falls can be highly debilitating and have an important negative impact on the quality of life of patients with Parkinson's disease (PD). The aim of this systematic review and meta-analysis is to provide an up-to-date overview of the prevalence of  $\geq 1$  fall and  $\geq 2$  falls in idiopathic PD. **DATA SOURCES:** MEDLINE, Web of Science, Embase and Cinahl databases were systematically searched until 04 July 2022 for prospective studies reporting fall prevalence in persons with idiopathic PD.

**METHODS:** Pooled prevalence rates with 95% confidence intervals (CIs) were computed using random-effects models. Heterogeneity among studies was assessed using the  $I(2)$  statistic.

**RESULTS:** A total of 54 studies (7546 participants) were included, and random-effects meta-analysis yielded a pooled proportional fall rate of 0.48 (95% CI [0.43-0.52],  $I(2) = 93\%$ , 46 studies, 6874 participants) for classification 1 ( $\geq 1$  fall) and a pooled proportional fall rate of 0.32 (95% CI [0.27-0.37],  $I(2) = 78\%$ , 31 studies, 5672 participants) for classification 2 ( $\geq 2$  falls). Subgroup analysis on the classification of falls, and length and method of monitoring falls did not reveal significant differences and did not reduce between-study variability.

**CONCLUSION:** Pooled estimates suggest that one in two persons with PD fall at least once, and one in three fall at least twice within the registered time period. Substantial variability remains after pooling fall prevalence rates according to the length and method of monitoring. Therefore, no recommendations can be made concerning these methodological aspects. Future research on falls in PD is encouraged to implement best practice recommendations to monitor and report fall data.

Language: en

### Keywords

Falls; prevalence; Parkinson's disease

## **Psychometric properties of the falls efficacy scale-international, cut-off points, and validating its short version among iranian older people**

Norouzi Z, Ghoochani BZ, Kaveh MH, Sokout T, Asadollahi A, Abyad A. Oman Med. J. 2023; 38(1): e460.

(Copyright © 2023, Oman Medical Specialty Board)

**DOI** 10.5001/omj.2023.39 **PMID** 36873798

### **Abstract**

**OBJECTIVES:** Older people have a fear of falling, which is far more difficult than falling itself. We measured the extent of this feeling using a short and valid Falls Efficacy Scale-International (FES-I) 7-item questionnaire for the aging community in Iran.

**METHODS:** The present psychometric work deals with outlining the validation and translation of FES-I (short version) among 9117 Persian-speaking elderly people with a mean age of  $70.2 \pm 8.3$  years (54.1% female and 45.9% male) in July 2021. Investigations were performed on confirmatory factor analysis, exploratory factor analysis, internal consistency, and construct validity along with test-retest reliability, receiver operating characteristic analysis, inter-rater, and convergent validity.

**RESULTS:** 72.4% of the subjects were living alone, 92.9% required support in activities of daily living, and 93.0% experienced falling in the past two years. A one-factor solution was assigned by exploratory factor analysis for FES-I. Thus, this model was proved by the confirmatory factor analysis with valid fit indices. Based on Cronbach's alpha, intra-cluster correlation coefficient, and McDonald's omega ( $\geq 0.80$ ), internal consistency was confirmed. The exact cut-off value was represented by the receiver operating characteristic analysis for male/female and between with/without fear of falling among older samples with higher measures of specificity and sensitivity. Moreover, a significant effect of age, aging in place, loneliness, hospitalization rate, frailty, and sense of anxiety (effect size  $\geq 0.80$ ,  $p \leq 0.05$ ) on fear of falls was detected using analysis of variance.

**CONCLUSIONS:** The psychometric properties of the original scale were preserved by the Persian version of FES-I seven items as a self-reported measure of fear of falling. It could be assuredly a measure in both community and clinical settings. The possible uses and limitations of the Iranian FES-I were also discussed.

Language: en

### **Keywords**

Accidental Falls; Iran; Fear; Aging; Psychometrics; Activities of Daily Living

## **Recent trends in wearable device used to detect freezing of gait and falls in people with Parkinson's disease: a systematic review**

Huang T, Li M, Huang J. *Front. Aging Neurosci.* 2023; 15: e1119956.

(Copyright © 2023, Frontiers Research Foundation)

**DOI** 10.3389/fnagi.2023.1119956 **PMID** 36875701

### **Abstract**

**BACKGROUND:** The occurrence of freezing of gait (FOG) is often observed in moderate to last-stage Parkinson's disease (PD), leading to a high risk of falls. The emergence of the wearable device has offered the possibility of FOG detection and falls of patients with PD allowing high validation in a low-cost way.

**OBJECTIVE:** This systematic review seeks to provide a comprehensive overview of existing literature to establish the forefront of sensors type, placement and algorithm to detect FOG and falls among patients with PD.

**METHODS:** Two electronic databases were screened by title and abstract to summarize the state of art on FOG and fall detection with any wearable technology among patients with PD. To be eligible for inclusion, papers were required to be full-text articles published in English, and the last search was completed on September 26, 2022. Studies were excluded if they; (i) only examined cueing function for FOG, (ii) only used non-wearable devices to detect or predict FOG or falls, and (iii) did not provide sufficient details about the study design and results. A total of 1,748 articles were retrieved from two databases. However, only 75 articles were deemed to meet the inclusion criteria according to the title, abstract and full-text reviewed. Variable was extracted from chosen research, including authorship, details of the experimental object, type of sensor, device location, activities, year of publication, evaluation in real-time, the algorithm and detection performance.

**RESULTS:** A total of 72 on FOG detection and 3 on fall detection were selected for data extraction. There were wide varieties of the studied population (from 1 to 131), type of sensor, placement and algorithm. The thigh and ankle were the most popular device location, and the combination of accelerometer and gyroscope was the most frequently used inertial measurement unit (IMU). Furthermore, 41.3% of the studies used the dataset as a resource to examine the validity of their algorithm. The results also showed that increasingly complex machine-learning algorithms had become the trend in FOG and fall detection.

**CONCLUSION:** These data support the application of the wearable device to access FOG and falls among patients with PD and controls. Machine learning algorithms and multiple

types of sensors have become the recent trend in this field. Future work should consider an adequate sample size, and the experiment should be performed in a free-living environment. Moreover, a consensus on provoking FOG/fall, methods of assessing validity and algorithm are necessary. Systematic Review Registration: PROSPERO, identifier CRD42022370911.

Language: en

**Keywords**

wearable device; Parkinson's disease; fall – Wound; FOG detection algorithm; freezing of gait (FOG)

## **Risk factors for incident falls in Singaporean community-dwelling adult men and women: a prospective cohort study**

Yip WF, Ge L, Heng BH, Tan WS. BMJ Open 2023; 13(3): e057931.

(Copyright © 2023, BMJ Publishing Group)

**DOI** 10.1136/bmjopen-2021-057931 **PMID** 36868598

### **Abstract**

**OBJECTIVES:** Our study aimed to identify the risk factors of incident falls between men and women.

**DESIGN:** Prospective cohort study. **SETTING:** The study recruited participants from the Central region of Singapore. Baseline and follow-up data were collected via a face-to-face survey. **PARTICIPANTS:** Community-dwelling adults aged 40 years and above from the Population Health Index Survey. **OUTCOME MEASURE:** Incident falls were defined as the experience of a fall between the baseline and 1-year follow-up but having no falls 1 year prior to baseline. Multiple logistic regressions were performed to determine the association of sociodemographic factors, medical history and lifestyle with incident falls. Sex subgroup analyses were conducted to examine sex-specific risk factors for incident falls.

**RESULTS:** 1056 participants were included in the analysis. At 1-year follow-up, 9.6% of the participants experienced an incident fall. Incidence of falls in women was 9.8% compared with 7.4% in men. In the multivariable analysis for the overall sample, older age (OR: 1.88, 95% CI: 1.10 to 2.86), being pre-frail (OR: 2.13, 95% CI: 1.12 to 4.00) and having depression or feeling depressed/anxious (OR: 2.35, 95% CI: 1.10 to 4.99) were associated with higher odds for incident falls. In subgroup analyses, older age was a risk factor for incident falls in men (OR: 2.68, 95% CI: 1.21 to 5.90) and pre-frail was a risk factor for incident falls in women (OR: 2.82, 95% CI: 1.28 to 6.20). There was no significant interaction effect between sex and age group (p value=0.341) and sex and frailty status (p value=0.181).

**CONCLUSION:** Older age, presence of pre-frailty and having depression or feeling depressed/anxious were associated with higher odds of incident falls. In our subgroup analyses, older age was a risk factor for incident falls in men and being pre-frail was a risk factor for incident falls in women. These findings provide useful information for community health services in designing falls prevention programmes for community-dwelling adults in a multi-ethnic Asian population.

Language: en

### **Keywords**

epidemiology; public health; geriatric medicine

## **Safety concerns in mobility-assistive products for older adults: content analysis of online reviews**

Mali N, Restrepo F, Abrahams A, Sands L, Goldberg DM, Gruss R, Zaman N, Shields W, Omaki E, Ehsani J, Ractham P, Kaewkitipong L. J. Med. Internet. Res. 2023; 25: e42231.

(Copyright © 2023, Centre for Global eHealth Innovation)

**DOI** 10.2196/42231 **PMID** 36862459

### **Abstract**

**BACKGROUND:** Older adults who have difficulty moving around are commonly advised to adopt mobility-assistive devices to prevent injuries. However, limited evidence exists on the safety of these devices. Existing data sources such as the National Electronic Injury Surveillance System tend to focus on injury description rather than the underlying context, thus providing little to no actionable information regarding the safety of these devices. Although online reviews are often used by consumers to assess the safety of products, prior studies have not explored consumer-reported injuries and safety concerns within online reviews of mobility-assistive devices.

**OBJECTIVE:** This study aimed to investigate injury types and contexts stemming from the use of mobility-assistive devices, as reported by older adults or their caregivers in online reviews. It not only identified injury severities and mobility-assistive device failure pathways but also shed light on the development of safety information and protocols for these products.

**METHODS:** Reviews concerning assistive devices were extracted from the "assistive aid" categories, which are typically intended for older adult use, on Amazon's US website. The extracted reviews were filtered so that only those pertaining to mobility-assistive devices (canes, gait or transfer belts, ramps, walkers or rollators, and wheelchairs or transport chairs) were retained. We conducted large-scale content analysis of these 48,886 retained reviews by coding them according to injury type (no injury, potential future injury, minor injury, and major injury) and injury pathway (device critical component breakage or decoupling; unintended movement; instability; poor, uneven surface handling; and trip hazards). Coding efforts were carried out across 2 separate phases in which the team manually verified all instances coded as minor injury, major injury, or potential future injury and established interrater reliability to validate coding efforts.

**RESULTS:** The content analysis provided a better understanding of the contexts and conditions leading to user injury, as well as the severity of injuries associated with these mobility-assistive devices. Injury pathways-device critical component failures; unintended device movement; poor, uneven surface handling; instability; and trip hazards-were identified for 5 product types (canes, gait and transfer belts, ramps, walkers and rollators, and wheelchairs and transport chairs). Outcomes were normalized per 10,000 posting counts (online reviews) mentioning minor injury, major injury, or potential future injury by product category. Overall, per 10,000 reviews, 240 (2.4%) described mobility-assistive equipment-related user injuries, whereas 2318 (23.18%) revealed potential future injuries.

**CONCLUSIONS:** This study highlights mobility-assistive device injury contexts and severities, suggesting that consumers who posted online reviews attribute most serious injuries to a defective item, rather than user misuse. It implies that many mobility-assistive device injuries may be preventable through patient and caregiver education on how to evaluate new and existing equipment for risk of potential future injury.

Language: en

### **Keywords**

injury prevention; older adults; consumer-reported injuries; mobility-assistive devices; online reviews; product failures

**The effect of body awareness on trunk control, affected upper extremity function, balance, fear of falling, functional level, and level of independence in patients with stroke**

Sarıçan Y, Erdoğanoglu Y, Pepe M. Top. Stroke Rehabil. 2023; ePub(ePub): ePub.

(Copyright © 2023, Informa - Taylor and Francis Group)

**DOI** 10.1080/10749357.2023.2185995 **PMID** 36871579

**Abstract**

**OBJECTIVES:** This study was conducted to examine the effects of body awareness on trunk control, affected upper extremity function, balance, fear of falling, functional level, and level of independence in patients with stroke.

**METHODS:** 35 individuals between the ages of 21 and 78 who were diagnosed with stroke were included in the study. The body awareness of the individuals participating in the study was determined with the Body Awareness Questionnaire (BAQ), trunk control with Trunk Impairment Scale (TIS), the affected upper extremity functions with Motor Activity Log-28 (MAL,-28), and Fugl-Meyer Upper Extremity Assessment (FMUEA), balance with Berg Balance Scale (BBS), fear of falling with Tinetti Falls Efficacy Scale (TFES), functional level with Barthel Activities of Daily Living Index (BI) and level of independence with Functional Independence Measures (FIM).

**RESULTS:** For patients participating in the study, 26% were female, 74% were male and 43% showed left, 57% showed right hemisphere involvement. In simple linear regression analysis, BAQ measurement had a statistically significant effect on TIS ( $F = 25.439$   $p = 0.001$ ), MAL-28 ( $F = 7.852$   $p = 0.008$ ), FMUEA ( $F = 12.155$   $p = 0.001$ ), BBS ( $F = 13.506$   $p = 0.001$ ), TFES ( $F = 13.119$   $p = 0.001$ ), BI ( $F = 19.977$   $p = 0.001$ ) and FIM ( $F = 22.014$   $p = 0.001$ ) in patients with stroke.

**CONCLUSIONS:** In conclusion, body awareness was found to be one of the factors affecting trunk control, affected upper extremity function, balance, fear of falling, functional level, and level of independence in patients with stroke. It was thought that there was a need for assessment of body awareness and include bodyawareness in rehabilitation programs in patients with stroke.

Language: en

**Keywords**

Stroke; body awareness; hemiplegia; trunk control; upper extremity function

## **The effect of exercise on falls in people living with dementia: a systematic review**

Jehu DA, Davis JC, Gill J, Oke O, Liu-Ambrose T. J. *Alzheimers Dis.* 2023; ePub(ePub): ePub.

(Copyright © 2023, IOS Press)

DOI 10.3233/JAD-221038 PMID 36872779

### **Abstract**

**BACKGROUND:** People living with dementia (PWD) are at a heightened risk for falls. However, the effects of exercise on falls in PWD are unclear.

**OBJECTIVE:** To conduct a systematic review of randomized controlled trials (RCTs) examining the efficacy of exercise to reduce falls, recurrent falls, and injurious falls relative to usual care among PWD.

**METHODS:** We included peer-reviewed RCTs evaluating any exercise mode on falls and related injuries among medically diagnosed PWD aged  $\geq 55$  years (international prospective register of systematic reviews (PROSPERO) ID:CRD42021254637). We excluded studies that did not solely involve PWD and were not the primary publication examining falls. We searched the Cochrane Dementia and Cognitive Improvement Group's Specialized Register and grey literature on 08/19/2020 and 04/11/2022; topical categories included dementia, exercise, RCTs, and falls. We evaluated the risk of bias (ROB) using the Cochrane ROB Tool-2 and study quality using the Consolidated Standards of Reporting Trials.

**RESULTS:** Twelve studies were included ( $n=1,827$ ; age= $81.3 \pm 7.0$  years; female= $59.3\%$ ; Mini-Mental State Examination= $20.1 \pm 4.3$  points; intervention duration= $27.8 \pm 18.5$  weeks; adherence= $75.5 \pm 16.2\%$ ; attrition= $21.0 \pm 12.4\%$ ). Exercise reduced falls in two studies [Incidence Rate Ratio (IRR) range= $0.16$  to  $0.66$ ; fall rate range: intervention= $1.35$ - $3.76$  falls/year, control= $3.07$ - $12.21$  falls/year]; all other studies ( $n=10$ ) reported null findings. Exercise did not reduce recurrent falls ( $n=0/2$ ) or injurious falls ( $n=0/5$ ). The RoB assessment ranged from some concerns ( $n=9$ ) to high RoB ( $n=3$ ); no studies were powered for falls. The quality of reporting was good ( $78.8 \pm 11.4\%$ ).

**CONCLUSION:** There was insufficient evidence to suggest that exercise reduces falls, recurrent falls, or injurious falls among PWD. Well-designed studies powered for falls are needed.

Language: en

### **Keywords**

injury; older adults; falls; systematic review; exercise; Dementia; fall-risk; recurrent; secondary prevention

**Access to a dementia-friendly garden on behavioural and psychological symptoms of dementia, falls and psychotropic medication use in residents of an aged care home in Melbourne, Australia**

Lai R, Foladkar M, Dhaliwal G, Kibria A, Gualano RC, Healy ML. *Australas. Psychiatry* 2023; ePub(ePub): ePub.

(Copyright © 2023, Royal Australian and New Zealand College of Psychiatrists, Publisher SAGE Publishing)

**DOI** 10.1177/10398562231160363 **PMID** 36862020

**Abstract**

**OBJECTIVE:** Residents of care homes need access to outdoors. This may improve behavioural and psychological symptoms of dementia (BPSD) and quality of life in residents living with dementia. Barriers including lack of accessibility and increased falls risk, which may be mitigated using dementia-friendly design. This prospective cohort study followed a group of residents in the first 6 months after the opening of a new dementia-friendly garden.

**METHOD:** Nineteen residents participated. The Neuropsychiatric Inventory - Nursing Home Version (NPI-NH) and psychotropic medication use were collected at baseline, 3 and 6 months. The facility's falls rate during this time and feedback from staff and residents' next of kin were collected.

**RESULTS:** Total NPI-NH scores decreased, though not significantly. Feedback was positive overall; the falls rate decreased. Usage of the garden was low.

**CONCLUSIONS:** Despite its limitations, this pilot study adds to the literature about the importance of access to the outdoors for people who are experiencing BPSD. Staff remain concerned about falls risk despite the dementia-friendly design, and many residents do not access outdoors frequently. Further education may help to remove barriers to encouraging residents to access the outdoors.

Language: en

**Keywords**

Australia; Dementia; gardens; nursing homes

## **Assessing the influence of cognitive response conflict on balance control: an event-related approach using response-aligned force-plate time series data**

Johannsen L, Stephan DN, Straub E, Döhring F, Kiesel A, Koch I, Müller H. Psychol. Res. 2023; ePub(ePub): ePub.

(Copyright © 2023, Holtzbrinck Springer Nature Publishing Group)

**DOI** 10.1007/s00426-023-01809-9 **PMID** 36862201

### **Abstract**

Process interference or sharing of attentional resources between cognitive tasks and balance control during upright standing has been well documented. Attentional costs increase with greater balancing demands of a balance activity, for example in standing compared to sitting. The traditional approach for analyzing balance control using posturography with a force plate integrates across relative long trial periods of up to several minutes, which blends any balance adjustments and cognitive operations within this period. In the present study, we pursued an event-related approach to assess if single cognitive operations resolving response selection conflict in the Simon task interfere with concurrent balance control in quiet standing. In addition to traditional outcome measures (response latency, error proportions) in the cognitive Simon task, we investigated the effect of spatial congruency on measures of sway control. We expected that conflict resolution in incongruent trials would alter short-term progression of sway control. Our results demonstrated the expected congruency effect on performance in the cognitive Simon task and the mediolateral variability of balance control within 150 ms before the onset of the manual response was reduced to a greater degree in incongruent compared to congruent trials. In addition, mediolateral variability before and after the manual response was generally reduced compared to variability following target presentation, where no effect of congruency was observed. Assuming that response conflict in incongruent conditions requires suppression of the incorrect response tendencies, our results may imply that mechanisms of cognitive conflict resolution may also carry over to intermittent balance control mechanisms in a direction-specific manner.

Language: en

## Correlations between reach, lean and ladder tipping risk

Deschler CL, Pliner EM, Sturnieks DL, Lord SR, Beschoner KE. J. Biomech. 2023; 150: e111508.

(Copyright © 2023, Elsevier Publishing)

DOI 10.1016/j.jbiomech.2023.111508 PMID 36867950

### Abstract

Overreaching is a common cause of ladder falls, which occur frequently among older adults in the domestic setting. Reaching and body leaning during ladder use likely influence the climber-ladder combined center of mass and subsequently center of pressure (COP) position (location of the resultant force acting at the base of the ladder). The relationship between these variables has not been quantified, but is warranted to assess ladder tipping risk due to overreaching (i.e. COP traveling outside the ladder's base of support). This study investigated the relationships between participant maximum reach (hand position), trunk lean, and COP during ladder use to improve assessment of ladder tipping risk. Older adults ( $n = 104$ ) were asked to perform a simulated roof gutter clearing task while standing on a straight ladder. Each participant reached laterally to clear tennis balls from a gutter. Maximum reach, trunk lean, and COP were captured during the clearing attempt. COP was positively correlated with maximum reach ( $p < 0.001$ ;  $r = 0.74$ ) and trunk lean ( $p < 0.001$ ;  $r = 0.85$ ). Maximum reach was positively correlated with trunk lean ( $p < 0.001$ ;  $r = 0.89$ ). The relationship between trunk lean and COP was stronger than that between maximum reach and COP, denoting the importance of body positioning on ladder tipping risk. For this experimental setup, regression estimates indicate reaching and lean distance of 113 cm and 29 cm from the ladder midline, respectively, would lead to ladder tipping on average. These findings assist with developing thresholds of unsafe reaching and leaning on a ladder, which can aid in reducing ladder falls.

Language: en

### Keywords

Balance; And falls; Ladder falls; Reaching; Slips; Trips

## Effect of physical activity intervention on gait speed by frailty condition: a randomized clinical trial

Custodero C, Agosti P, Anton SD, Manini TM, Lozupone M, Panza F, Pahor M, Sabbà C, Solfrizzi V. J. Am. Med. Dir. Assoc. 2023; ePub(ePub): ePub.

(Copyright © 2023, Lippincott Williams and Wilkins)

**DOI** 10.1016/j.jamda.2023.01.023 **PMID** 36878264

### Abstract

**OBJECTIVES:** There is uncertainty about effects of physical activity on physical performance, such as gait speed, among community-dwelling older adults according to their physical frailty status. We determined whether a long-term, moderate-intensity physical activity program was associated with different responses on gait speed over 4 m and 400 m based on physical frailty status.

**DESIGN:** Post hoc analysis from the Lifestyle Interventions and Independence for Elders (LIFE) (NCT01072500), a single-blind randomized clinical trial testing the effect of physical activity intervention compared with health education program. **SETTING AND**

**PARTICIPANTS:** We analyzed data on 1623 community-dwelling older adults ( $78.9 \pm 5.2$  years) at risk for mobility disability.

**METHODS:** Physical frailty was assessed at baseline using the Study of Osteoporotic Fractures frailty index. Gait speed over 4 m and 400 m was measured at baseline, and 6, 12, and 24 months.

**RESULTS:** We estimated significantly better 400-m gait speed at 6, 12, and 24 months for nonfrail older adults in the physical activity group, but not for frail participants. Among frail participants, physical activity showed a potentially clinically meaningful benefit on 400-m gait speed at 6 months (0.055; 95% CI 0.016-0.094;  $P = .005$ ), compared with the healthy educational intervention, only in those who, at baseline, were able to rise from a chair 5 times without using their arms.

**CONCLUSIONS AND IMPLICATIONS:** A well-structured physical activity program produced a faster 400-m gait speed potentially able to prevent mobility disability among physically frail individuals with preserved muscle strength in lower limbs.

Language: en

### Keywords

older adults; physical activity; gait speed; Frailty; randomized clinical trial

## Effects of power training on functional capacity related to fall risk in older adults: a systematic review and meta-analysis

Jiménez-Lupión D, Chirisa-Ríos L, Martínez-García D, Rodríguez-Pérez M, Jerez-Mayorga D. Arch. Phys. Med. Rehabil. 2023; ePub(ePub): ePub.

(Copyright © 2023, Elsevier Publishing)

DOI 10.1016/j.apmr.2023.01.022 PMID 36868491

### Abstract

**OBJECTIVE:** Functional capacity is one of the main risk factors for falls among older adults. The aim of this systematic review and meta-analysis was to determine the effect of power training on functional capacity test (FCT) related to fall risk in older adults. **DATA SOURCES:** Systematic searches were conducted in four databases, including PubMed, Web of Science, Scopus and SPORTDiscus, from inception to November 2021. **STUDY SELECTION:** Randomized controlled trials (RCTs) assessing the effect of power training on functional capacity compared to another type of training program or control group in older adults with the ability to exercise independently. **DATA EXTRACTION:** Two independent researchers evaluated eligibility and used the PEDro scale to assess risk of bias. The information extracted was related to article identification (authors, country and year of publication), participant characteristics (sample, gender and age), strength training protocols (exercises/intensity/weeks) and the outcome of the FCT used related to fall risk. The Cochran Q statistic and I(2) statistics was used to assess heterogeneity. Random-effects model were conducted to pool the effect sizes expressed as mean differences (MD). **DATA SYNTHESIS:** Twelve studies (478 subjects) were selected for systematic review. A meta-analysis comprised 6 studies (217 subjects) where the outcome measure was the 30-second Sit to Stand (30s-STs) test, and another comprised 4 studies (142 subjects) where the outcome measure was the Timed Up and Go (TUG) test. There was an improvement in performance in favor of the experimental group in both the TUG subgroup (MD -0.31 s; 95% CI -0.63, 0.00 s;  $p = 0.05$ ), and the 30s-STs subgroup (MD 1.71 reps; 95% CI -0.26, 3.67 reps;  $p = 0.09$ ). **CONCLUSIONS:** In conclusion, power training increases functional capacity related to fall risk further than other types of exercise in older adults.

Language: en

### Keywords

Elderly; frail persons; high-velocity resistance training

## **Falls as the result of interplay between nurses, patient and the environment: using text-mining to uncover how and why falls happen**

Takase M. Int. J. Nurs. Sci. 2023; 10(1): 30-37.

(Copyright © 2023, Chinese Nursing Association, Publisher Elsevier Publishing)

**DOI** 10.1016/j.ijnss.2022.12.003 **PMID** 36860705

### **Abstract**

**OBJECTIVES:** This study aimed to explore, from the perspectives of nurses, how patients, the environment, and the practice of nurses interact with each other to contribute to patient falls.

**METHODS:** A retrospective review of incident reports on patient falls, registered by nurses between 2016 and 2020, was conducted. The incident reports were retrieved from the database set up for the project of the Japan Council for Quality Health Care. The text descriptions of the "background of falls" were extracted verbatim, and analyzed by using a text-mining approach.

**RESULTS:** A total of 4,176 incident reports on patient falls were analyzed. Of these falls, 79.0% were unwitnessed by nurses, and 8.7% occurred during direct nursing care. Document clustering identified 16 clusters. Four clusters were related to patients, such as the decline in their physiological/cognitive function, a loss of balance, and their use of hypnotic and psychotropic agents. Three clusters were related to nurses, and these included a lack of situation awareness, reliance on patient families, and insufficient implementation of the nursing process. Six clusters were concerned with patients and nurses, including the unproductive use of a bed alarm and call bells, the use of inappropriate footwear, the problematic use of walking aids and bedrails, and insufficient understanding of patients' activities of daily living. One cluster, chair-related falls, involved both patient and environmental factors. Finally, two clusters involved patient, nurse, and environmental factors, and these falls occurred when patients were bathing/showering or using a bedside commode.

**CONCLUSIONS:** Falls were caused by a dynamic interplay between patients, nurses, and the environment. Since many of the patient factors are difficult to modify in a short time, the focus has to be placed on nursing and environmental factors to reduce falls. In particular, improving nurses' situation awareness is of foremost importance, as it influences their decisions and actions to prevent falls.

Language: en

### **Keywords**

Nurses; Data mining; Environment; Accidental falls; Fall risk; Patients

**Influence of history of falls and physical function on obstacle-straddling behavior**

Sudo D, Maeda Y. J. Phys. Ther. Sci. 2023; 35(3): 175-181.

(Copyright © 2023, Society of Physical Therapy Science)

**DOI** 10.1589/jpts.35.175 **PMID** 36866013

**Abstract**

[Purpose] This study aimed to clarify the relationship between falls and lower leg motion during obstacle crossing, in which stumbling or tripping is the most common cause of falls in the elderly population. [Participants and Methods] This study included 32 older adults who performed the obstacle crossing motion. The heights of the obstacles were 20, 40, and 60 mm. To analyze the leg motion, a video analysis system was used. The hip, knee, and ankle joint angles during the crossing motion were calculated by the video analysis software, Kinovea. To evaluate the risk of falls, one leg stance time and timed up and go test were measured, and data on fall history were collected using a questionnaire. Participants were divided into two groups: high-risk and low-risk groups, according to the degree of fall risk. [Results] The high-risk group showed greater changes in hip flexion angle in the forelimb. The hip flexion angle in the hindlimb and the angle change of lower extremities among the high-risk group became larger. [Conclusion] Participants in the high-risk group should lift their legs high when performing the crossing motion to ensure foot clearance and avoid stumbling over the obstacle.

Language: en

**Keywords**

Fall risk; Joint angle; Obstacle avoidance

## **Instructor and client views of a community falls prevention service and the impact of the COVID-19 pandemic: a qualitative exploration of a service in England**

Jayes L, Morling JR, Carlisle S, Bogdanovica I, Langley T. J. Frailty Sarcopenia Falls 2023; 8(1): 9-22.

(Copyright © 2023, Hylonome Publications)

**DOI** 10.22540/JFSF-08-009 **PMID** 36873823

### **Abstract**

**OBJECTIVES:** Falls are the most common cause of injury related deaths in people over 75 years. The aim of this study was to explore the experience of providers (instructors) and service users (clients) of a fall's prevention exercise programme and the impact of the COVID-19 pandemic in Derbyshire, UK.

**METHODS:** Ten one-to-one interviews with class instructors and five focus groups with clients (n=41). Transcripts were analysed using inductive thematic analysis.

**RESULTS:** Most clients were initially motivated to attend the programme to improve their physical health. All clients reported improvements in their physical health as a result of attending the classes; additional benefits to social cohesion were also widely discussed. Clients referred to the support provided by instructors during the pandemic (online classes and telephone calls) as a 'life-line'. Clients and instructors thought more could be done to advertise the programme, especially linking in with community and healthcare services.

**CONCLUSIONS:** The benefits of attending exercise classes went beyond the intended purpose of improving fitness and reducing the risk of falls, extending into improved mental and social wellbeing. During the pandemic the programme also prevented feelings of isolation. Participants felt more could be done to advertise the service and increase referrals from healthcare settings.

Language: en

### **Keywords**

Exercise; COVID-19; Frailty; Falls Prevention

## **Recent trends in wearable device used to detect freezing of gait and falls in people with Parkinson's disease: a systematic review**

Huang T, Li M, Huang J. *Front. Aging Neurosci.* 2023; 15: e1119956.

(Copyright © 2023, Frontiers Research Foundation)

**DOI** 10.3389/fnagi.2023.1119956 **PMID** 36875701

### **Abstract**

**BACKGROUND:** The occurrence of freezing of gait (FOG) is often observed in moderate to last-stage Parkinson's disease (PD), leading to a high risk of falls. The emergence of the wearable device has offered the possibility of FOG detection and falls of patients with PD allowing high validation in a low-cost way.

**OBJECTIVE:** This systematic review seeks to provide a comprehensive overview of existing literature to establish the forefront of sensors type, placement and algorithm to detect FOG and falls among patients with PD.

**METHODS:** Two electronic databases were screened by title and abstract to summarize the state of art on FOG and fall detection with any wearable technology among patients with PD. To be eligible for inclusion, papers were required to be full-text articles published in English, and the last search was completed on September 26, 2022. Studies were excluded if they; (i) only examined cueing function for FOG, (ii) only used non-wearable devices to detect or predict FOG or falls, and (iii) did not provide sufficient details about the study design and results. A total of 1,748 articles were retrieved from two databases. However, only 75 articles were deemed to meet the inclusion criteria according to the title, abstract and full-text reviewed. Variable was extracted from chosen research, including authorship, details of the experimental object, type of sensor, device location, activities, year of publication, evaluation in real-time, the algorithm and detection performance.

**RESULTS:** A total of 72 on FOG detection and 3 on fall detection were selected for data extraction. There were wide varieties of the studied population (from 1 to 131), type of sensor, placement and algorithm. The thigh and ankle were the most popular device location, and the combination of accelerometer and gyroscope was the most frequently used inertial measurement unit (IMU). Furthermore, 41.3% of the studies used the dataset as a resource to examine the validity of their algorithm. The results also showed that increasingly complex machine-learning algorithms had become the trend in FOG and fall detection.

**CONCLUSION:** These data support the application of the wearable device to access FOG and falls among patients with PD and controls. Machine learning algorithms and multiple

types of sensors have become the recent trend in this field. Future work should consider an adequate sample size, and the experiment should be performed in a free-living environment. Moreover, a consensus on provoking FOG/fall, methods of assessing validity and algorithm are necessary. Systematic Review Registration: PROSPERO, identifier CRD42022370911.

Language: en

**Keywords**

wearable device; Parkinson's disease; fall – Wound; FOG detection algorithm; freezing of gait (FOG)

## **Results from a campus population survey of near misses, crashes, and falls while e-scooting, walking, and bicycling**

Sanders RL, Nelson TA. Transp. Res. Rec. 2023; 2677(2): 479-489.

(Copyright © 2023, Transportation Research Board, National Research Council, National Academy of Sciences USA, Publisher SAGE Publishing)

**DOI** 10.1177/03611981221107010 **PMID** unavailable

### **Abstract**

Dockless e-scooters were used for 86?million trips in the United States in 2019, indicating great potential as a new transportation mode in U.S. cities and on university campuses. Yet, little is known about how e-scooter users interact with people walking, bicycling, and driving. Although several studies have examined e-scooter injuries reported in hospital data, transportation-related near misses are chronically understudied in general, and even more so for this newer mode of transportation. In this paper we present the results of an online survey of 1,256 university staff (22% response rate) in Tempe, AZ. Using a single population, we compared the prevalence of self-reported incidents and injuries among those who use e-scooters, walk, and bicycle. Our results indicated a higher percentage of respondents reported incidents associated with walking (25%) than e-scooting (11%) or bicycling (9%), but e-scooter users were the most likely to report incidents resulting in a crash. E-scooter users were also more likely to report issues related to pavement, equipment, or losing control, whereas people walking and bicycling were more likely to report conflicts with other roadway users. Our findings suggest important areas for policy and infrastructure innovation, including prioritizing separate space for e-scooters to mitigate conflicts with pedestrians, and continuing to evolve rider training and speed governance to help keep e-scooter users safe. Other findings underscore the importance of measuring near misses to develop a comprehensive picture of transportation safety.

Language: en

## **Skeleton-based fall detection with multiple inertial sensors using spatial-temporal graph convolutional networks**

Yan J, Wang X, Shi J, Hu S. *Sensors* (Basel) 2023; 23(4): e2153.

(Copyright © 2023, MDPI: Multidisciplinary Digital Publishing Institute)

**DOI** 10.3390/s23042153 **PMID** 36850753

### **Abstract**

The application of wearable devices for fall detection has been the focus of much research over the past few years. One of the most common problems in established fall detection systems is the large number of false positives in the recognition schemes. In this paper, to make full use of the dependence between human joints and improve the accuracy and reliability of fall detection, a fall-recognition method based on the skeleton and spatial-temporal graph convolutional networks (ST-GCN) was proposed, using the human motion data of body joints acquired by inertial measurement units (IMUs). Firstly, the motion data of five inertial sensors were extracted from the UP-Fall dataset and a human skeleton model for fall detection was established through the natural connection relationship of body joints; after that, the ST-GCN-based fall-detection model was established to extract the motion features of human falls and the activities of daily living (ADLs) at the spatial and temporal scales for fall detection; then, the influence of two hyperparameters and window size on the algorithm performance was discussed; finally, the recognition results of ST-GCN were also compared with those of MLP, CNN, RNN, LSTM, TCN, TST, and MiniRocket. The experimental results showed that the ST-GCN fall-detection model outperformed the other seven algorithms in terms of accuracy, precision, recall, and F(1)-score. This study provides a new method for IMU-based fall detection, which has the reference significance for improving the accuracy and robustness of fall detection.

Language: en

### **Keywords**

Humans; Skeleton; \*Accidental Falls; \*Musculoskeletal System; Activities of Daily Living; fall detection; multiple inertial sensors; Reproducibility of Results; skeleton; spatial-temporal graph convolutional networks

## **The timing and amplitude of the muscular activity of the arms preceding impact in a forward fall is modulated with fall velocity**

Borrelli J, Creath R, Rogers MW. J. Biomech. 2023; 150: e111515.

(Copyright © 2023, Elsevier Publishing)

**DOI** 10.1016/j.jbiomech.2023.111515 **PMID** 36867953

### **Abstract**

Protective arm reactions have been shown to be an important injury avoidance mechanism in unavoidable falls. Protective arm reactions have been shown to be modulated with fall height, however it is not clear if they are modulated with impact velocity. The aim of this study was to determine if protective arm reactions are modulated in response to a forward fall with an initially unpredictable impact velocity. Forward falls were evoked via sudden release of a standing pendulum support frame with adjustable counterweight to control fall acceleration and impact velocity. Thirteen younger adults (1 female) participated in this study. Counterweight load explained more than 89% of the variation of impact velocity. Angular velocity at impact decreased ( $p < 0.001$ ), drop duration increased from 601 ms to 816 ms ( $p < 0.001$ ), and the maximum vertical ground reaction force decreased from 64%BW to 46%BW ( $p < 0.001$ ) between the small and large counterweight. Elbow angle at impact (129 degrees extension), triceps (119 ms) and biceps (98 ms) pre-impact time, and co-activation (57%) were not significantly affected by counterweight load ( $p$ -values  $> 0.08$ ). Average triceps and biceps EMG amplitude decreased from 0.26 V/V to 0.19 V/V ( $p = 0.004$ ) and 0.24 V/V to 0.11 V/V ( $p = 0.002$ ) with increasing counterweight respectively. Protective arm reactions were modulated with fall velocity by reducing EMG amplitude with decreasing impact velocity. This demonstrates a neuromotor control strategy for managing evolving fall conditions. Future work is needed to further understand how the CNS deals with additional unpredictability (e.g., fall direction, perturbation magnitude, etc.) when deploying protective arm reactions.

Language: en

### **Keywords**

Injury; Falls; Control; Upper extremity

## **Validity of temporo-spatial characteristics of gait as an index for fall risk screening in community-dwelling older people**

Baba T, Watanabe M, Ogihara H, Handa S, Sasamoto K, Okada S, Okuizumi H, Kimura T. J. Phys. Ther. Sci. 2023; 35(3): 265-269.

(Copyright © 2023, Society of Physical Therapy Science)

**DOI** 10.1589/jpts.35.265 **PMID** 36866012

### **Abstract**

[Purpose] This study aimed to identify kinematic gait indicators for a fall risk screening test through quantitative comparisons of gait characteristics measured using mobile inertial sensors between faller and non-faller groups in a population of community-dwelling older people. [Participants and Methods] We enrolled 50 people aged  $\geq 65$  years who used long-term care prevention services, interviewed them to determine their fall history during the past year, and divided them into faller and non-faller groups. Gait parameters (velocity, cadence, stride length, foot height, heel strike angle, ankle joint angle, knee joint angle, and hip joint angle) were assessed using the mobile inertial sensors. [Results] Gait velocity and left and right heel strike angles were significantly lower and smaller, respectively, in the faller versus non-faller group. Receiver operating characteristic curve analysis revealed areas under the curve of 0.686, 0.722, and 0.691 for gait velocity, left heel strike angle, and right heel strike angle, respectively. [Conclusion] Gait velocity and heel strike angle during gait assessed using mobile inertial sensors may be important kinematic indicators in a fall risk screening test to estimate the likelihood of falls among community-dwelling older people.

Language: en

### **Keywords**

Gait; Fall risk screening; Mobile inertial sensor