

## Safety Literature 5<sup>th</sup> June 2022

### **A collaborative implementation strategy to increase falls prevention training using the age-friendly health systems approach**

Severance JJ, Rivera S, Cho J, Hartos J, Khan A, Knebl J. *Int. J. Environ. Res. Public Health* 2022; 19(10): e5903.

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**DOI** 10.3390/ijerph19105903 **PMID** 35627440

#### **Abstract**

Falls in the home and in community environments are the leading cause of injuries and long-term disabilities for the aging population. The purpose of this study was to examine outcomes of a partnership among an academic institution, government agency, community organizations, and emergency management services to implement a falls prevention training program using an Age-Friendly Health Systems approach. In this prospective study, partners identified gaps in services and targeted and non-targeted delivery areas for implementation of an evidence-based falls prevention intervention addressing the 4Ms of Age-Friendly Health Systems—Mobility, Medications, Mentation, and What Matters. Descriptive statistics were calculated for program implementation and participant demographic variables, and paired t-test analysis compared scores for self-assessed general health and falls efficacy prior to and after program participation. Twenty-seven falls prevention classes were implemented, with over half (52%) in targeted areas. A total of 354 adults aged 50 and older participated, with N = 188 participants (53%) completing the program by attending at least five of eight sessions. Of completers, 35% resided in targeted areas. The results showed a statistically significant improvement in falls efficacy by program completers in targeted and non-targeted areas. However, there was no statistically significant difference in self-rated health. Overall, the findings of this study indicate that collaboration to deliver falls prevention training can be effective in reaching at-risk older adults. By mobilizing collaborative partnerships, limited resources can be allocated towards identifying at-risk older adults and improving community-based falls prevention education.

Language: en

#### **Keywords**

aging; mobility; fall prevention; Age-Friendly Health Systems; falls efficacy

## **Effectiveness of yoga versus exercise for reducing falling risk in older adults: physical and psychological indices**

Bartos LJ, Meek GA, Berger BG. *Percept. Mot. Skills* 2022; ePub(ePub): ePub.

(Copyright © 2022, SAGE Publishing)

**DOI** 10.1177/00315125221100820 **PMID** 35613041

### **Abstract**

Our purpose in this study was to examine the effectiveness of yoga to address multiple risk factors of falling in active and low active older adults. Community-dwelling older adults (N = 35) over the age of 65 actively participated in either a yoga program, an exercise program, or a no-program control. Participants completed measures associated with falling risks. Physical measures included lower body strength, static balance, and lower body flexibility. Psychological measures included perceived self-efficacy with respect to falls and health-related quality of life. We determined between-group differences using planned comparisons, effect size, confidence intervals, and probability of superiority.

RESULTS of planned comparisons and practical significance testing indicated that yoga participants scored higher than the exercise and control participants on both right and left lower body flexibility tests. Yoga participants also scored higher than the control participants on right leg static balance, and the right and left lower body flexibility tests. The exercise participants scored higher than yoga participants on the RAND-36 Quality of Life subscales of Energy/Fatigue, Pain, and General Health. The probability of superiority results indicated that the no-program older adult participants would benefit by enrolling in the yoga rather than the exercise program to reduce physical risks of falling. These findings were discussed in relation to promoting physical activity programs to reduce risks of falling, and the roles of the protocol, practical significance, and measures employed when determining program effectiveness.

Language: en

### **Keywords**

older adults; exercise; yoga; falling; health-related quality of life; risk factors of falling

## **Gastrocnemius medial head stiffness is associated with potential fall risk in community-dwelling older adults**

Kim N, Park J, Shin H, Bae Y. *Healthcare (Basel)* 2022; 10(5): e785.

(Copyright © 2022, MDPI: Multidisciplinary Digital Publishing Institute)

DOI 10.3390/healthcare10050785 PMID 35627922

### **Abstract**

The aim of this study is to compare the muscle strength, balance ability, thickness, and stiffness of the tibialis anterior and gastrocnemius muscle in the elderly, with (fallers) and without (non-fallers) fall experience, and confirmed the correlation between the variables mentioned above and muscle stiffness in the faller. We selected 122 elderly participants, comprising 40 fallers and 82 non-fallers, and measured the muscle strength of the tibialis anterior (TA) and the gastrocnemius (GA). Balance ability was measured by the functional reach test (FRT), timed up and go test (TUG), short physical performance battery (SPPB), and gait speed (GS). We used shear wave elastography (SWE) to determine the thickness of the TA and the medial (GMed) and lateral head (GLat) of the gastrocnemius and the stiffness during relaxation and contraction. Balance ability, except muscle strength, was significantly lower in fallers compared with non-fallers. The GMed and GLat thickness were significantly lower in fallers than that in non-fallers. In fallers, the thickness, rest, and contractive stiffness of GMed were correlated with the FRT, GS, SPPB. Low rest and GMed contractive stiffness were related to lower balance ability in fallers. The muscle stiffness measurement using SWE was a novel method to assess potential fall risk.

Language: en

### **Keywords**

elderly; fall risk; balance ability; gastrocnemius muscle; shear wave elastography

## **Mobile technology for falls prevention in older adults**

Hsieh KL, Chen L, Sosnoff JJ. *J. Gerontol. A Biol. Sci. Med. Sci.* 2022; ePub(ePub): ePub.

(Copyright © 2022, Gerontological Society of America)

DOI 10.1093/gerona/glac116 PMID 35640254

### **Abstract**

Falls are the leading cause of accidental death in older adults that result from a complex interplay of risk factors. Recently, the need for person-centered approach utilizing personalization, prediction, prevention and participation, known as the P4 model, in fall prevention has been highlighted. Features of mobile technology make it a suitable technological infrastructure to employ such an approach. This narrative review aims to review the evidence for using mobile technology for personalized fall risk assessment and prevention since 2017 in older adults. We aim to identify lessons learned and future directions for using mobile technology as a fall risk assessment and prevention tool. Articles were searched in PubMed and Web of Science with search terms related to older adults, mobile technology, and falls prevention. A total of 23 articles were included. Articles were identified as those examining aspects of the P4 model including prediction (measurement of fall risk), personalization (usability), prevention, and participation. Mobile technology appears to be comparable to gold-standard technology in measuring well-known fall risk factors including static and dynamic balance. Seven applications were developed to measure different fall risk factors and tested for personalization, and/or participation aspects, and four were integrated into a falls prevention program. Mobile health technology offers an innovative solution to provide tailored fall risk screening, prediction, and participation. Future studies should incorporate multiple, objective fall risk measures and implement them in community settings to determine if mobile technology can offer tailored and scalable interventions.

Language: en

### **Keywords**

fall risk; smartphone; fall prevention

## **Optimizing post-acute care patient safety: a scoping review of multifactorial fall prevention interventions for older adults**

Leland NE, Lekovitch C, Martínez J, Rouch S, Harding P, Wong C. J. Appl. Gerontol. 2022; ePub(ePub): ePub.

(Copyright © 2022, SAGE Publishing)

**DOI** 10.1177/07334648221104375 **PMID** 35618304

### **Abstract**

Accidental falls are preventable adverse events for older post-acute care (PAC) patients. Yet, due to the functional and medical care needs of this population, there is little guidance to inform multidisciplinary prevention efforts. This scoping review aims to characterize the evidence for multifactorial PAC fall prevention interventions. Of the 33 included studies, common PAC intervention domains included implementing facility-based strategies (e.g., staff education), evaluating patient-specific fall risk factors (e.g., function), and developing an individualized risk profile and treatment plan that targets the patient's constellation of fall risk factors. However, there was variability across studies in how and to what extent the domains were addressed. While further research is warranted, health system efforts to prevent accidental falls in PAC should consider a patient-centered multifactorial approach that fosters a culture of safety, addresses individuals' fall risk, and champions a multidisciplinary team.

Language: en

### **Keywords**

geriatrics; rehabilitation; accidental falls; fall prevention; post-acute care

## **STEADI self-report measures independently predict fall risk**

Ritchey K, Olney A, Chen S, Phelan EA. *Gerontol. Geriatr. Med.* 2022; 8: e23337214221079222.

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**DOI** 10.1177/23337214221079222 **PMID** 35647219

### **Abstract**

Falls are a significant contributor to disability and death among older adults. Despite practice guidelines to increase falls screening in healthcare settings, preventive care for falls continues to be infrequently delivered. Simplifying screening by relying on self-report of balance, gait, or strength concerns, alone may increase the frequency of falls screening. We assessed the diagnostic accuracy of self-report measures of gait, strength, and balance from the Centers for Disease Control and Prevention's Stopping Elderly Accidents, Deaths, and Injuries (STEADI) for identification of fall risk. The criterion standard for fall risk was the Timed Up-and-Go (TUG). Assessments were conducted with 95 adults aged 65 years or older in an outpatient osteoporosis clinic between May 2015 and September 2016. Receiver operating characteristic curve analysis found that two self-report questions ("I feel unsteady with walking" and "I need my arms to stand from a chair") had high discriminatory ability (AUC 0.906; 95% CI 0.870-0.942) to identify those at high fall risk; additional questions did not substantially improve discrimination. These findings suggest that two self-report questions identify those at risk of falling who would benefit from interventions (e.g., physical therapy). Performance testing as part of routine falls screening of older persons in the outpatient setting may be unnecessary.

Language: en

### **Keywords**

prevention; falls; veterans; clinical geriatrics

## **The effect of a resistance training, detraining and retraining cycle on postural stability and estimated fall risk in institutionalized older persons: a 40-week intervention**

Rodrigues RN, Carballeira E, Silva F, Caldo-Silva A, Abreu C, Furtado GE, Teixeira AM. *Healthcare (Basel)* 2022; 10(5): e776.

(Copyright © 2022, MDPI: Multidisciplinary Digital Publishing Institute)

**DOI** 10.3390/healthcare10050776 **PMID** 35627913

### **Abstract**

Physical inactivity and low levels of muscle strength can lead to the early development of sarcopenia and dynapenia, which may increase the number and risk of falls in the elderly population. Meanwhile, exercise programs can stop or even revert the loss of muscle mass, strength, power, and functional capacity and consequently decrease the risk of falls in older adults. However, there is a lack of studies investigating the effect of strengthening programs in octogenarians. The present study investigates the effects of 40 weeks of a training-detraining-retraining cycle of muscle strength exercise program on postural stability and estimated fall risk in octogenarians. Twenty-seven institutionalized participants were allocated into two groups: the muscular strength exercise group (MSEG, n = 14) and control group (CG, n = 13). After the first training period, the MSEG improved postural stability and decreased the estimated fall risk by 7.9% compared to baseline. In comparison, CG worsened their stability and increased their risk of falling by more than 17%. No significant changes were found between groups in the detraining and the retraining period. This study demonstrated that strength exercise effectively improved postural control and reduced fall risk scores. In addition, the interventions were able to reduce the forward speed of postural control deterioration in octogenarians, with great increments in the first months of exercise.

Language: en

### **Keywords**

older adults; fall risk; postural stability; strength exercise; technology-based assessment

## **The effects of combined physical and cognitive interventions on direct and indirect fall outcomes for the elderly with mild cognitive impairment: a systematic review**

Mai Ba H, Kim J. *Healthcare (Basel)* 2022; 10(5): e862.

(Copyright © 2022, MDPI: Multidisciplinary Digital Publishing Institute)

**DOI** 10.3390/healthcare10050862 **PMID** 35628001

### **Abstract**

This review was intended to determine the effectiveness of physical and cognitive training (PCT) on falls and fall-related factors and cognitive function among community-dwelling elderly people with mild cognitive impairment (MCI). A systematic literature search was performed of the MEDLINE, CINAHL, Web of Sciences, Scopus, ProQuest, Embase, and Google Scholar databases for articles published from 2010 to 2020. The studies that combined PCT to assess their impacts on fall outcomes both directly and indirectly were included. Study quality was assessed using the standardized JBI Critical Appraisal Tool for RCTs. The standardized data extraction tool from JBI-MAStARI was used to extract data of included studies. Seven RCTs involving 740 participants were included. The overall fall incidence did not significantly decrease after the interventions. However, PCT significantly impacted the cognitive function and physical activities of elderly people with MCI, particularly improving their balancing ability, gait speed, muscular strength, and executive functions. This study indicated that combining PCT improves balance ability, gait speed, and executive functioning in the elderly with MCI, which may help to minimize fall occurrence.

Language: en

### **Keywords**

elderly; falls; cognitive therapy; mild cognitive impairment; physical training

## **Factors associated with walking adaptability and its association with falling in polio survivors**

Tuijtelars J, Jeukens-Visser M, Nollet F, Brehm MA. Arch. Phys. Med. Rehabil. 2022; ePub(ePub): ePub.

(Copyright © 2022, Elsevier Publishing)

DOI 10.1016/j.apmr.2022.05.005 PMID 35644215

### **Abstract**

**OBJECTIVE** To explore factors associated with walking adaptability and associations between walking adaptability and falling in polio survivors.

**Design** Cross-sectional study.

**Setting** Outpatient expert polio clinic.

**Participants** Polio survivors (n=46) who fell in the previous year and/or reported fear of falling.

**Interventions** Not applicable.

**Main outcome measures** Walking adaptability was assessed on an interactive treadmill and operationalized as variable target-stepping and reactive obstacle-avoidance performance. Further, we collected walking speed and assessed leg muscle strength, balance performance (Berg Balance Scale and Timed-Up-and-Go Test), balance confidence (Activities-specific Balance Confidence scale), ambulation level, orthosis use, fear of falling and number of falls in the previous year.

**Results** With walking speed included as covariate, muscle weakness of the most affected leg and balance confidence explained 54% of the variance in variable target-stepping performance. For reactive obstacle-avoidance performance, muscle weakness of the most affected leg and knee extensor strength of the least affected leg explained 32% of the variance. Only target-stepping performance was significantly related to the number of falls reported in the previous year ( $R^2=0.277$ ,  $p<0.001$ ), and mediated the relation between leg muscle weakness and balance confidence with falling.

**Conclusion** Our exploratory study suggests that leg muscle weakness and reduced balance confidence limit walking adaptability in polio survivors. As poorer target-stepping rather than obstacle-avoidance performance was associated with falling, our results indicate that a limited ability to ensure safe foot placement may be a fall risk factor in this group. These findings should be confirmed in a larger sample.

Language: en

### **Keywords**

Accidental Falls; Locomotion; Mobility Limitations; Postpoliomyelitis Syndrome

## **Implementation strategies supporting fall prevention interventions in a long-term care facility for older persons: a systematic review protocol**

Albasha N, McCullagh R, Cornally N, McHugh S, Timmons S. *BMJ Open* 2022; 12(5): e055149.

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**DOI** 10.1136/bmjopen-2021-055149 **PMID** 35623755

### **Abstract**

**INTRODUCTION:** Falls are common among older people in long-term care facilities (LCFs). Falls lead to significant morbidity, mortality and reduced quality of life among residents. Fall prevention interventions have been shown to reduce falls in LCFs. However, this may not always translate to effectiveness in real-world situations. We will conduct a systematic review (SR) to identify the implementation strategies used in fall prevention interventions in LCF, describing the effectiveness of strategies in terms of key implementation outcomes and fall reduction.

**METHODS AND ANALYSIS:** The search will include scientific papers in electronic databases, including PubMed, CINAHL, Embase, PsycINFO, Scopus and Web of Science, and published theses. The SR will consider all original research that empirically evaluated or tested implementation strategies to support fall prevention interventions in LCF, published in English or Arabic between 1 January 2001 and 31 December 2021, where data are presented on the implementation strategy (eg, audit and feedback, champions) and/or implementation outcome (eg, fidelity). Clinical trials, quasi-experimental studies and quality improvement studies will be eligible for inclusion. Two researchers will complete abstract screening, data abstraction and quality assessments independently. The screening process will be presented using a Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram. Data will be extracted into a standardised table, including the country, year, authors, type of study, primary clinical outcome (falls rate and/or risk reduction as available), implementation strategy and implementation outcomes. Implementation strategies will be defined and categorised using the Expert Recommendation for Implementing Change Taxonomy. Implementation outcomes will be defined and categorised using the Implementation Outcomes Taxonomy, and clinical outcomes of the intervention effectiveness for falls preventions will be reported as formulated in each study, with a final narrative synthesis of data. **ETHICS AND DISSEMINATION:** Ethical approval is not required for this study, and the results will be disseminated via peer-reviewed journals and presented at international conferences. **PROSPERO REGISTRATION NUMBER:** CRD42021239604.

Language: en

### **Keywords**

change management; clinical trials; education & training (see medical education & training); geriatric medicine; quality in health care

## **Reducing slip risk: a feasibility study of gait training with semi-real-time feedback of foot-floor contact angle**

Ma CZH, Bao T, Dicesare CA, Harris I, Chambers A, Shull PB, Zheng YP, Cham R, Sienko KH. *Sensors (Basel)* 2022; 22(10): e3641.

(Copyright © 2022, MDPI: Multidisciplinary Digital Publishing Institute)

**DOI** 10.3390/s22103641 **PMID** 35632054

### **Abstract**

Slip-induced falls, responsible for approximately 40% of falls, can lead to severe injuries and in extreme cases, death. A large foot-floor contact angle (FFCA) during the heel-strike event has been associated with an increased risk of slip-induced falls. The goals of this feasibility study were to design and assess a method for detecting FFCA and providing cues to the user to generate a compensatory FFCA response during a future heel-strike event. The long-term goal of this research is to train gait in order to minimize the likelihood of a slip event due to a large FFCA. An inertial measurement unit (IMU) was used to estimate FFCA, and a speaker provided auditory semi-real-time feedback when the FFCA was outside of a 10-20 degree target range following a heel-strike event. In addition to training with the FFCA feedback during a 10-min treadmill training period, the healthy young participants completed pre- and post-training overground walking trials.

RESULTS showed that training with FFCA feedback increased FFCA events within the target range by 16% for "high-risk" walkers (i.e., participants that walked with more than 75% of their FFCAs outside the target range) both during feedback treadmill trials and post-training overground trials without feedback, supporting the feasibility of training FFCA using a semi-real-time FFCA feedback system.

Language: en

### **Keywords**

feedback; foot–floor contact angle; gait training; inertial measurement unit; slip

**The newfound opportunities of wearable systems based on biofeedback in the prevention of falls. comment on Tanwar et al. pathway of trends and technologies in fall detection: a systematic review. Healthcare 2022, 10, 172**

Morone G, Maccioni G, Giansanti D. Healthcare (Basel) 2022; 10(5): e940.

(Copyright © 2022, MDPI: Multidisciplinary Digital Publishing Institute)

DOI 10.3390/healthcare10050940 PMID 35628077

**Abstract**

We are writing to you as the corresponding authors of the interesting systematic review study "Pathway of Trends and Technologies in Fall Detection: A Systematic Review" [1].

We found this work to be particularly stimulating, and feel it provides great added value in the field.

Specifically, we believe, first of all, that this review has the great merit of simultaneously focusing both on important key aspects of the integration of systems for fall detection/prediction and prevention in the health domain, and on aspects relating to technological innovation and deployment in the three most important fields, where neuromotor problems due to pathologies or aging have a strong impact: falls from bed, falls from sitting, and falls from walking and standing. When the Special Issue "Cybersecurity and the Digital Health: An Investigation on the State of the Art and the Position of the Actors" ([https://www.mdpi.com/journal/healthcare/special\\_issues/cybersecurity\\_digital\\_health](https://www.mdpi.com/journal/healthcare/special_issues/cybersecurity_digital_health) (accessed on 1 May 2022)) [2] was launched, one of the objectives [3] was to give scholars the opportunity to broaden the boundaries of studies in this area.

Mainly, studies on cybersecurity turn more toward IT aspects, which is defined as the activity carried out in defending computers, servers, mobile devices, electronic systems, networks, and data from malicious attacks or software defaults. Therefore, what is often addressed is so-called information security and data security.

We very much appreciated your contribution because it has precisely achieved the goal of expanding and exploring new areas in this sector, enlarging the concept of cyber-systems as tools for the development of physical security approaches for people...

Language: en

## **Toe grip force of the dominant foot is associated with fall risk in community-dwelling older adults: a cross-sectional study**

Matsuno S, Yoshimura A, Yoshiike T, Morita S, Fujii Y, Honma M, Ozeki Y, Kuriyama K. *J. Foot Ankle Res.* 2022; 15(1): e42.

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**DOI** 10.1186/s13047-022-00548-1 **PMID** 35637529

### **Abstract**

**BACKGROUND:** It is unclear whether the toe grip force (TGF) of the dominant foot (DF) and the lower limb function asymmetry (LLFA) in older adults are associated with fall risk. Therefore, this study aimed to investigate the effect of lower limb properties (such as TGF, muscle strength, and plantar sensation) on the risk of falls in older adults, while considering the foot dominance and asymmetry of lower limb function.

**METHODS:** This study was a cross-sectional study. We determined whether the lower limb function of the DF and non-dominant foot (non-DF) and LLFA had any effect on the fall risk in 54 older adults (mean  $\pm$  standard deviation:  $72.2 \pm 6.0$ , range: 60-87 years). We examined the participants' fall history, Mini-Mental State Examination (MMSE) score, lower limb function, and LLFA. To determine fall risk factors, we performed logistic regression analysis, with presence or absence of falls as the dependent variable.

**RESULTS:** The independent variables were age, sex, MMSE score, two-point discrimination of the heel (non-DF) as plantar sensation index, and the TGF of both feet. Only the TGF of the DF was identified as a risk factor for falls ( $p < 0.05$ ).

**CONCLUSIONS:** In older adults, clinicians should focus on the TGF of the DF as a risk factor for falls. **TRIAL REGISTRATION:** This study was retrospectively registered. [https://center6.umin.ac.jp/cgi-bin/ctr/ctr\\_up\\_rec\\_fl.cgi](https://center6.umin.ac.jp/cgi-bin/ctr/ctr_up_rec_fl.cgi).

Language: en

### **Keywords**

Dominant foot; Limb dominance; asymmetry; lower limb; Lower limb function asymmetry; Toe grip force

## **Trip, slip and fall: ICD-10 and fall from height**

Manral I, Radhakrishna KV, Rudra A. Med. Legal Update 2022; 22(2): 58-64.

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**DOI** 10.37506/mlu.v22i2.3232 **PMID** unavailable

### **Abstract**

**BACKGROUND:** ICD 10 has unified the diagnosis, in this study, we have studied fall from height as per ICD 10 classification of cases who reported to emergency department of tertiary care hospital in Maharashtra. Unintentional fall from height represents a significant cause of injury in urban populations.

**Results:** In this retrospective study, data pertaining to cases which were examined and treated at a tertiary care centre in Western India was analysed from 2014-2016. A total of 44 cases qualified our criteria of unintentional fall from height. 83% of the population study were male. 21-40 years of age were most commonly affected. Alcohol was a common factor amongst the falls. As the year progressed number of cases have decreased. W10 ICD 10, fall from stairs were the most common cause of fall. Head injuries (42%) followed by extremities injuries were the most common.

**Conclusion:** A significant number of non - fatal cases occur due to unintentional fall from height. There is a need to study the demographic profile of injured persons, assess the severity of their injuries and identify certain risk factors associated with such non-fatal injuries due to fall from height.

**Keywords:** Fall from height, ICD 10, falls, TBI

**Language:** en