

## Safety Literature 12<sup>th</sup> January 2020

### A novel hybrid deep neural network to predict pre-impact fall for older people based on wearable inertial sensors

Yu X, Qiu H, Xiong S. *Front. Bioeng. Biotechnol.* 2020; 8: e63.

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#### Abstract

Falls in the elderly is a major public health concern due to its high prevalence, serious consequences and heavy burden on the society. Many falls in older people happen within a very short time, which makes it difficult to predict a fall before it occurs and then to provide protection for the person who is falling. The primary objective of this study was to develop deep neural networks for predicting a fall during its initiation and descending but before the body impacts to the ground so that a safety mechanism can be enabled to prevent fall-related injuries. We divided the falling process into three stages (non-fall, pre-impact fall and fall) and developed deep neural networks to perform three-class classification. Three deep learning models, convolutional neural network (CNN), long short term memory (LSTM), and a novel hybrid model integrating both convolution and long short term memory (ConvLSTM) were proposed and evaluated on a large public dataset of various falls and activities of daily living (ADL) acquired with wearable inertial sensors (accelerometer and gyroscope). Fivefold cross validation results showed that the hybrid ConvLSTM model had mean sensitivities of 93.15, 93.78, and 96.00% for non-fall, pre-impact fall and fall, respectively, which were higher than both LSTM (except the fall class) and CNN models. ConvLSTM model also showed higher specificities for all three classes (96.59, 94.49, and 98.69%) than LSTM and CNN models. In addition, latency test on a microcontroller unit showed that ConvLSTM model had a short latency of 1.06 ms, which was much lower than LSTM model (3.15 ms) and comparable with CNN model (0.77 ms). High prediction accuracy (especially for pre-impact fall) and low latency on the microboard indicated that the proposed hybrid ConvLSTM model outperformed both LSTM and CNN models. These findings suggest that our proposed novel hybrid ConvLSTM model has great potential to be embedded into wearable inertial sensor-based systems to predict pre-impact fall in real-time so that protective devices could be triggered in time to prevent fall-related injuries for older people.

Language: en

#### Keywords

deep neural network; fall risk; inertial sensor; machine learning; pre-impact fall



## **Associations with rates of falls among home care clients in Ontario, Canada: a population-based, cross-sectional study**

Manis DR, McArthur C, Costa AP. *BMC Geriatr.* 2020; 20(1): e80.

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**DOI** 10.1186/s12877-020-1483-6 **PMID** 32106824

### **Abstract**

**BACKGROUND:** Accidental falls among older adults are a leading cause of injury-related hospitalizations. Reducing falls is an ongoing quality improvement priority for home care, given that many home care clients experience falls. In this study, we identify factors associated with the rate of falls among home care clients.

**METHODS:** We conducted a population-based, cross-sectional study using secondary data from the Hamilton, Niagara, Haldimand, and Brant health region of Ontario, Canada from January 1 - March 31, 2018. We captured person-level characteristics with falls from the Resident Assessment Instrument - Home Care (RAI-HC). Negative binomial regression was used to model the rate of falls.

**RESULTS:** Functional characteristics of home care clients had strong, statistically significant associations with the rate of falls. Declines in activities of daily living, assistive device use for locomotion indoors, polypharmacy, and health conditions, such as dizziness or lightheadedness, and parkinsonism, were associated with a higher rate of falls. Males who used assistive devices had a higher rate of falls compared to females; however, males with neurological and cardiovascular health conditions had a decrease in the rate of falls compared to females. Home care clients with parkinsonism who used a cane and took eight or more drugs had stronger associations with an increased rate of falls compared to those who do not have parkinsonism.

**CONCLUSIONS:** Functional characteristics, polypharmacy, and health conditions are associated with increased rates of falls among home care clients. Home care clients who are at a greater risk of falls may require environmental adjustments in their home to reduce or eliminate the possibility of falling.

Language: en

### **Keywords**

Accidental falls; Assistive devices; Canada; Home care; Older adults

## **Barriers and facilitators for screening older adults on fall risk in a hospital setting: perspectives from patients and healthcare professionals**

Barmantloo LM, Dontje ML, Koopman MY, Olij BF, Oudshoorn C, Mackenbach JP, Polinder S, Erasmus V. *Int. J. Environ. Res. Public Health* 2020; 17(5): e1461.

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**DOI** 10.3390/ijerph17051461 **PMID** 32106465

### **Abstract**

We aimed to gain insight into the barriers and facilitators to fall risk screening of older adults visiting the hospital as experienced by patients and healthcare professionals, and to examine the differences between chronic- and acute-care patients. We invited patients ( $\geq 70$  years) attending the nephrology and emergency department to participate in the screening. Patients and their healthcare professionals were asked to complete a self-administered questionnaire based on the "Barriers and Facilitators Assessment Instrument". Differences in barriers and facilitators between acute- and chronic-care patients were examined with chi-square tests. A total of 216 patients were screened, and 103 completed the questionnaire. They considered many factors as facilitators, and none as barriers. Acute-care patients were more positive than chronic-care patients about healthcare worker characteristics, such as knowledge and skills. After screening, patients were more open to receiving advice regarding fall prevention. The 36 healthcare professionals considered program characteristics to be facilitators and mainly factors regarding healthcare worker characteristics as barriers to implementation. For patients, the outpatient setting seemed to be a good place to be screened for fall risk. Healthcare professionals also suggested that program characteristics could enhance implementation. However, healthcare professionals' mindsets and the changing of routines are barriers that have to be addressed first.

Language: en

### **Keywords**

Fall prevention; barriers; facilitators; healthcare professionals; implementation; older adults; screening

## Combined impact of physical frailty and social isolation on rate of falls in older adults

Hayashi T, Umegaki H, Makino T, Huang CH, Inoue A, Shimada H, Kuzuya M. *J. Nutr. Health Aging* 2020; 24(3): 312-318.

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DOI 10.1007/s12603-020-1316-5 PMID 32115613

### Abstract

**OBJECTIVES:** The aim of this study was to examine the impact of the combination of physical frailty and social isolation on falling in community-dwelling older adults.

**DESIGN:** A cross-sectional study of data obtained at registration in a randomized control trial. **SETTING:** Community-based study of participants recruited from Toyota, Japan. **PARTICIPANTS:** 380 community-dwelling older adults (47.9% women, mean age = 72.3 ± 4.6 years). **MEASUREMENTS:** Participants were categorized as non-frail or pre-frail/frail based on the Fried frailty criteria (slowness, weakness, exhaustion, low activity, and weight loss). Social isolation was examined using the Lubben Social Network Scale (LSNS-6), and scores lower than 12 points indicated social isolation. Participants were divided into four groups depending on pre-frail/frail status and social isolation, and experiences of multiple falls over the past year were compared between the groups.

**RESULTS:** Participants were classified into robust (n = 193), physical frailty (PF; n = 108), social isolation (SI; n = 43), and PF with SI (PF+SI; n = 36) groups. A total of 38 (10.0%) participants reported multiple falls. Logistic regression analysis showed that PF and SI groups were not independently associated with falling (PF: OR 1.64, 95% CI 0.65-4.16, SI: OR 2.25, 95% CI 0.77-6.58), while PF+SI group was significantly associated with falling compared with the robust group (OR 3.06, 95% CI 1.00-9.34, p = 0.049) after controlling for confounding factors.

**CONCLUSION:** Our findings support the assertion that coexistence with physical frailty and social isolation were associated with falling in the older adults.

Language: en

### Keywords

Physical frailty; cross-sectional study; falling; social isolation

## Contamination in complex healthcare trials: the falls in care homes (FinCH) study experience

Robinson K, Allen F, Darby J, Fox C, Gordon AL, Horne JC, Leighton P, Sims E, Logan PA. *BMC Med. Res. Methodol.* 2020; 20(1): e46.

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DOI 10.1186/s12874-020-00925-z PMID 32106827

### Abstract

**BACKGROUND:** Trials are at risk of contamination bias which can occur when participants in the control group are inadvertently exposed to the intervention. This is a particular risk in rehabilitation studies where it is easy for trial interventions to be either intentionally or inadvertently adopted in control settings. The Falls in Care Homes (FinCH) trial is used in this paper as an example of a large randomised controlled trial of a complex intervention to explore the potential risks of contamination bias. We outline the FinCH trial design, present the potential risks from contamination bias, and the strategies used in the design of the trial to minimise or mitigate against this. The FinCH trial was a multi-centre randomised controlled trial, with embedded process evaluation, which evaluated whether systematic training in the use of the Guide to Action Tool for Care Homes reduced falls in care home residents. Data were collected from a number of sources to explore contamination in the FinCH trial. Where specific procedures were adopted to reduce risk of, or mitigate against, contamination, this was recorded. Data were collected from study e-mails, meetings with clinicians, research assistant and clinician network communications, and an embedded process evaluation in six intervention care homes. During the FinCH trial, there were six new falls prevention initiatives implemented outside the study which could have contaminated our intervention and findings.

**METHODS** used to minimise contamination were: cluster randomisation at the level of care home; engagement with the clinical community to highlight the risks of early adoption; establishing local collaborators in each site familiar with the local context; signing agreements with NHS falls specialists that they would maintain confidentiality regarding details of the intervention; opening additional research sites; and by raising awareness about the importance of contamination in research among participants.

**CONCLUSION:** Complex rehabilitation trials are at risk of contamination bias. The potential for contamination bias in studies can be minimized by strengthening collaboration and dialogue with the clinical community. Researchers should recognise that clinicians may contaminate a study through lack of research expertise.

Language: en

### Keywords

Care home research; Contamination; Falls; Randomised controlled trials



## **Descriptive evaluation and accuracy of a mobile app to assess fall risk in seniors: retrospective case-control study**

Rabe S, Azhand A, Pommer W, Müller S, Steinert A. JMIR Aging 2020; 3(1): e16131. Charité - Universitätsmedizin Berlin, corporate member of Freie Universität Berlin, Humboldt-Universität zu Berlin, and Berlin Institute of Health; Geriatrics Research Group, Berlin, Germany.

(Copyright © 2020, JMIR Publications) DOI 10.2196/16131 PMID 32130111

### **Abstract**

**BACKGROUND:** Fall-risk assessment is complex. Based on current scientific evidence, a multifactorial approach, including the analysis of physical performance, gait parameters, and both extrinsic and intrinsic risk factors, is highly recommended. A smartphone-based app was designed to assess the individual risk of falling with a score that combines multiple fall-risk factors into one comprehensive metric using the previously listed determinants.

**OBJECTIVE:** This study provides a descriptive evaluation of the designed fall-risk score as well as an analysis of the app's discriminative ability based on real-world data.

**METHODS:** Anonymous data from 242 seniors was analyzed retrospectively. Data was collected between June 2018 and May 2019 using the fall-risk assessment app. First, we provided a descriptive statistical analysis of the underlying dataset. Subsequently, multiple learning models (Logistic Regression, Gaussian Naive Bayes, Gradient Boosting, Support Vector Classification, and Random Forest Regression) were trained on the dataset to obtain optimal decision boundaries. The receiver operating curve with its corresponding area under the curve (AUC) and sensitivity were the primary performance metrics utilized to assess the fall-risk score's ability to discriminate fallers from nonfallers. For the sake of completeness, specificity, precision, and overall accuracy were also provided for each model.

**RESULTS:** Out of 242 participants with a mean age of 84.6 years old (SD 6.7), 139 (57.4%) reported no previous falls (nonfaller), while 103 (42.5%) reported a previous fall (faller). The average fall risk was 29.5 points (SD 12.4). The performance metrics for the Logistic Regression Model were AUC=0.9, sensitivity=100%, specificity=52%, and accuracy=73%. The performance metrics for the Gaussian Naive Bayes Model were AUC=0.9, sensitivity=100%, specificity=52%, and accuracy=73%. The performance metrics for the Gradient Boosting Model were AUC=0.85, sensitivity=88%, specificity=62%, and accuracy=73%. The performance metrics for the Support Vector Classification Model were AUC=0.84, sensitivity=88%, specificity=67%, and accuracy=76%. The performance metrics for the Random Forest Model were AUC=0.84, sensitivity=88%, specificity=57%, and accuracy=70%.

**CONCLUSIONS:** Descriptive statistics for the dataset were provided as comparison and reference values. The fall-risk score exhibited a high discriminative ability to distinguish fallers from nonfallers, irrespective of the learning model evaluated. The models had an average AUC of 0.86, an average sensitivity of 93%, and an average specificity of 58%. Average overall accuracy was 73%. Thus, the fall-risk app has the potential to support caretakers in easily conducting a valid fall-risk assessment. The fall-risk score's prospective accuracy will be further validated in a prospective trial.

Language: en **Keywords:** app; discriminative ability; fall risk assessment; falls; mHealth; retrospective cohort study; seniors

## Does the presence of cognitive impairment exacerbate the risk of falls in people with peripheral neuropathy? An application of body-worn inertial sensors to measure gait variability

Kang GE, Yang J, Najafi B. *Sensors (Basel)* 2020; 20(5): e1328.

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### Abstract

People with peripheral neuropathy (PN) are at risk of falling. Many people with PN have comorbid cognitive impairment, an independent risk factor of falls, which may further increase the risk of falling in people with PN. However, the negative synergic effect of those factors is yet to be reported. We investigated whether the presence of cognitive impairment exacerbates the risk of falls in people with PN by measuring gait variability during single-task walking and dual-task walking. Forty-four adults with PN were recruited. Based on the Montreal Cognitive Assessment (MoCA) scores, 19 and 25 subjects were cognitively impaired and intact, respectively. We measured coefficients of variation of gait speed, stride length, and stride time using validated body-worn sensors. During single-task walking, no between-group differences were observed (all  $p > 0.05$ ). During dual-task walking, between-group differences were significant for gait variability for gait speed and stride length (51.4% and 71.1%, respectively;  $p = 0.014$  and  $0.011$ , respectively). MoCA scores were significantly correlated with gait variability for gait speed ( $r = 0.319$ ,  $p = 0.035$ ) and stride length ( $r = 0.367$ ,  $p = 0.014$ ) during dual-task walking. Our findings suggest that the presence of cognitive impairment exacerbates the risk of falls in people with PN.

Language: en

### Keywords

Cognitive impairment; body-worn sensors; chemotherapy-induced peripheral neuropathy; diabetic peripheral neuropathy; dual-task walking; gait variability; single-task walking

## Effects of simultaneous cognitive and aerobic exercise training on dual-task walking performance in healthy older adults: results from a pilot randomized controlled trial

Raichlen DA, Bharadwaj PK, Nguyen LA, Franchetti MK, Zigman EK, Solorio AR, Alexander GE. *BMC Geriatr.* 2020; 20(1): e83.

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DOI 10.1186/s12877-020-1484-5 PMID 32122325

### Abstract

**BACKGROUND:** The ability to walk and perform cognitive tasks simultaneously is a key aspect of daily life. Performance declines in these dual-tasks may be associated with early signs of neurodegenerative disease and increased risk of falls. Thus, interventions to improve dual-task walking performance are of great interest for promoting healthy aging. Here, we present results of a pilot randomized controlled trial (RCT) to evaluate the effects of a simultaneous aerobic exercise and cognitive training intervention on dual-task walking performance in healthy older adults.

**METHODS:** Community-dwelling, healthy older adults were recruited to participate in a 12-week RCT. Participants were randomized into one of four groups (n = 74): 1) cognitive training (COG), 2) aerobic exercise (EX), 3) combined aerobic exercise and cognitive training (EXCOG), and 4) video-watching control (CON). The COG and EXCOG groups both used a tablet-based cognitive training program that challenged aspects of executive cognitive function, memory, and processing speed. Performance on a dual-task walking test (DTWT; serial subtraction during two-minute walk) was assessed by researchers blinded to groupings before the intervention, and at 6 and 12 weeks. We included all participants randomized with baseline measurements in an intention to treat analysis using linear mixed effects models.

**RESULTS:** We found a significant group by time interaction for cognitive performance on the DTWT ( $p = 0.039$ ). Specifically, participants in the EXCOG, EX, and COG groups significantly improved on the cognitive aspect of the DTWT following the full 12-week intervention ( $p = 3.5e-7$ ,  $p = 0.048$ ,  $p = 0.048$ , respectively). The improvements in EXCOG were twice as large as in the other groups, and were significant at 6 weeks ( $p = 0.019$ ). The CON group did not show a significant change in cognitive performance on the DTWT, and no group significantly altered dual-task gait measures following the intervention.

**CONCLUSIONS:** A simultaneous aerobic exercise and cognitive training intervention significantly improved cognitive performance during a DTWT in healthy older adults.

Despite no change in DTWT gait measures, significant improvements in cognitive performance indicate that further investigation in a larger RCT is warranted. TRIAL

REGISTRATION: Clinicaltrials.gov, NCT04120792, Retrospectively Registered 08 October 2019.

Language: en

### Keywords

Aging; Cognition; Executive function; Exergame; Physical activity





## Falls in older aged adults in 22 European countries: incidence, mortality and burden of disease from 1990 to 2017

### Citation

Haagsma JA, Olij BF, Majdan M, Van Beeck EF, Vos T, Castle CD, Dingels ZV, Fox JT, Hamilton EB, Liu Z, Roberts NLS, Sylte DO, Aremu O, Bärnighausen TW, Borzi AM, Briggs AM, Carrero JJ, Cooper C, El-Khatib Z, Ellingsen CL, Fereshtehnejad SM, Filip I, Fischer F, Haro JM, Jonas JB, Kiadaliri AA, Koyanagi A, Lunevicius R, Meretoja TJ, Mohammed S, Pathak A, Radfar A, Rawaf S, Rawaf DL, Riera LS, Shiue I, Vasankari TJ, James SL, Polinder S. *Inj. Prev.* 2020; ePub(ePub): ePub.

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(Copyright © 2020, BMJ Publishing Group)

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### Abstract

**INTRODUCTION:** Falls in older aged adults are an important public health problem. Insight into differences in fall-related injury rates between countries can serve as important input for identifying and evaluating prevention strategies. The objectives of this study were to compare Global Burden of Disease (GBD) 2017 estimates on incidence, mortality and disability-adjusted life years (DALYs) due to fall-related injury in older adults across 22 countries in the Western European region and to examine changes over a 28-year period.

**METHODS:** We performed a secondary database descriptive study using the GBD 2017 results on age-standardised fall-related injury in older adults aged 70 years and older in 22 countries from 1990 to 2017.

**RESULTS:** In 2017, in the Western European region, 13 840 per 100 000 (uncertainty interval (UI) 11 837-16 113) older adults sought medical treatment for fall-related injury, ranging from 7594 per 100 000 (UI 6326-9032) in Greece to 19 796 per 100 000 (UI 15 536-24 233) in Norway. Since 1990, fall-related injury DALY rates showed little change for the whole region, but patterns varied widely between countries. Some countries (eg, Belgium and Netherlands) have lost their favourable positions due to an increasing fall-related injury burden of disease since 1990.

**CONCLUSIONS:** From 1990 to 2017, there was considerable variation in fall-related injury incidence, mortality, DALY rates and its composites in the 22 countries in the Western European region. It may be useful to assess which fall prevention measures have been taken in countries that showed continuous low or decreasing incidence, death and DALY rates despite ageing of the population.

Language: en

### Keywords

burden of disease; disability; metanalysis; time series

## **Falls risk and Alzheimer disease: a patient guide**

Kahya M, Sood P, Devos H, Krishnan S, Hirsch MA, Heyn P. Arch. Phys. Med. Rehabil. 2020; ePub(ePub): ePub.

(Copyright © 2020, Elsevier Publishing)

**DOI** 10.1016/j.apmr.2020.01.005 **PMID** 32115098

### **Abstract**

Alzheimer disease is a common brain disorder in older adults that affects memory, thinking, and behavior. The symptoms usually develop slowly but become worse with time and can affect day-to-day activities ...

Language: en

## The relationship between pain, and freezing of gait and falls in Parkinson's disease

Yilmaz NH, Saricaoğlu M, Eser HY, Düz ÖA, Polat B, Özer FF. *Noro Psikiyatrisi* 2020; 57(1): 56-60.

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DOI 10.29399/npa.24716 PMID 32110152

### Abstract

**INTRODUCTION:** To investigate the relationship between pain, freezing of gait (FOG) and falls in Parkinson's Disease (PD).

**METHODS:** The study included 110 PD patients. The Unified PD Rating Scale (UPDRS) and Hoehn and Yahr Scale were used to evaluate disease severity. The patients self-reported occurrence of FOG and falls, and the FOG Questionnaire was administered to evaluate the severity of FOG. A visual analog scale (VAS) was used to measure the severity of pain and pain localization was self-reported by the patients.

**RESULTS:** Fifty-eight of the patients had FOG and 43 experienced falls. Among the patients, 42 had no pain, whereas 35 had lower extremity pain. Higher UPDRS motor and FOG scores, and advanced-stage disease were noted in significantly more of the patients with FOG and falls. VAS scores were not affected by the presence of FOG or falls. There was a positive correlation between the severity of FOG and VAS score in the male patients ( $r=0.308$ ;  $p=0.010$ ). More patients with falls had lower extremity pain than those without falls ( $r=0.308$ ;  $p=0.010$ ).

**DISCUSSION:** Patients with FOG and falls had more severe motor findings. Pain is correlated with both FOG and falls. Further investigations should be done to understand the mechanism of this relationship to prevent the motor complications in advanced PD.

Language: en

### Keywords

Falls; Parkinson's disease; freezing of gait; pain

## **The Tilburg Frailty Indicator (TFI): new evidence for its validity**

Gobbens RJ, Boersma P, Uchmanowicz I, Santiago LM. Clin. Interv. Aging 2020; 15: 265-274.

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**DOI** 10.2147/CIA.S243233 **PMID** 32110005

### **Abstract**

**OBJECTIVE:** The Tilburg Frailty Indicator (TFI) is a self-report user-friendly questionnaire for assessing multidimensional frailty among community-dwelling older people. The main aim of this study is to re-evaluate the validity of the TFI, both cross-sectionally and longitudinally, focusing on the predictive value of the total TFI and its physical, psychological, and social domains for adverse outcomes disability, indicators of healthcare utilization, and falls.

**METHODS:** The validity of the TFI was determined in a sample of 180 Dutch community-dwelling older people aged 70 years and older. The participants completed questionnaires including the TFI, the Groningen Activity Restriction Scale (GARS) for assessing disability, and questions with regard to health care utilization and falls in 2016 and again one year later.

**RESULTS:** The physical and psychological domains of the TFI were significantly correlated as expected with adverse outcomes disability, many indicators of healthcare utilization, and falls. Regression analyses showed that physical frailty was mostly responsible for the effect of frailty on the adverse outcomes. The cross-sectional and longitudinal predictive validity of total frailty with respect to disability and receiving personal care was excellent, evidenced by Areas Under the Curves (AUCs) >0.8. In most cases, using the cut-off point 5 for total frailty ensured the best values for sensitivity and specificity.

**CONCLUSION:** The present study provided new, additional evidence for the validity of the TFI for assessing frailty in Dutch community-dwelling older people aiming to prevent or delay adverse outcomes, including disability.

Language: en

### **Keywords**

Tilburg Frailty Indicator; disability; frailty; older people; validity

## The U-shaped relationship between levels of bouts activity and fall incidence in community-dwelling older adults: a prospective cohort study

Lu Z, Lam FMH, Leung JCS, Kwok TCY. *J. Gerontol. A Biol. Sci. Med. Sci.* 2020; ePub(ePub): ePub.

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DOI 10.1093/gerona/glaa058 PMID 32115656

### Abstract

**BACKGROUND:** It remains uncertain whether the association between physical activity (PA) and falls is U-shaped, and few studies have explored the potential mediation of PA accumulation pattern.

**METHODS:** We measured PA in 671 community-dwelling older adults ( $82.7 \pm 3.8$  years) using wrist-worn accelerometer for 7 days. PA was further classified to bouts PA ( $\geq 10$  min bout length) and sporadic PA ( $< 10$  min bout length) for sub-analysis. Fall incidence in the following 12-month was recorded through tri-monthly telephone interviews. Classification and Regression Tree analysis was used to identify two optimal cutoff values of each PA measurement to predict falls. Participants were then divided into "inactive", "moderately active" and "highly active" groups accordingly. Negative binomial regression models were used to estimate the association between the PA measures and fall incidence.

**RESULTS:** 639 participants completed 12-month follow-up. Ninety-three (14.6%) experienced a total of 118 falls. Inactive and highly active older adults had higher falls per person month relative to the moderately active group (inactive: IRR=2.372, 95%CI=1.317-4.271; highly active: IRR=2.731, 95%CI=1.196-6.232). Sub-analyses found similar significant finding with bouts PA ( $p < 0.001$ ) but not sporadic PA ( $p \geq 0.221$ ). The association between bouts PA and falls remained significant even after adjusting fall incidence for bouts activity time (inactive: IRR=3.636, 95%CI=2.238-5.907; highly active: IRR=1.823, 95%CI=1.072-3.1). Further adjustments for fall-related risk factors did not meaningfully change the results.

**CONCLUSION:** A U-shaped relationship was identified between bouts but not sporadic PA and fall incidence. There is an approximately two-fold increase in fall rate in highly active elderly even after adjusting for activity time.

Language: en

### Keywords

Accelerometer; exercise; falls; physical activity

## **Applying the International Classification of Functioning, Disability and Health framework to determine the predictors of falls and fractures in people with osteoarthritis or at high risk of developing osteoarthritis: data from the Osteoarthritis Initiative**

Soh SE, Barker AL, Morello RT, Ackerman IN. *BMC Musculoskelet. Disord.* 2020; 21(1): e138.

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**DOI** 10.1186/s12891-020-3160-5 **PMID** 32113478

### **Abstract**

**BACKGROUND:** Falls are a major cause of injury and death among older people. Evidence suggests that people with osteoarthritis (OA) are at a higher risk of falls and fall-related injuries including fractures. While studies demonstrate a link between OA and falls, little is known about the pathways that link falls with demographic factors, OA impairments, activity limitations and participation restrictions. The aim of this study was to identify risk factors for falls and fractures among people with OA or at high risk of developing OA using the International Classification of Functioning, Disability and Health (ICF) framework.

**METHODS:** A longitudinal analysis of data from the Osteoarthritis Initiative (OAI) dataset was undertaken. Participants were considered to have OA if they reported they had been diagnosed with knee or hip OA by a medical practitioner. Outcomes were self-reported falls and fractures. Potential predictors were classified using the ICF framework. Poisson regression models were used to determine the risk factors for falls and fractures.

**RESULTS:** Of the 4796 participants, 2270 (47%) were diagnosed with knee and/or hip OA. A higher proportion of participants with OA reported having had falls (72% vs 63%;  $p < 0.0001$ ) and fractures (17% vs 14%;  $p = 0.012$ ) than those without OA. Personal factors were found to be stronger predictors of falls and fractures compared to OA impairments, activity limitations and participation restrictions in this sample of participants. After adjusting for potential covariates, self-reported history of falls was a significant predictor of both increased falls (incidence rate ratio [IRR] 1.50; 95% confidence interval [CI] 1.40, 4.60) and fracture risk (IRR 1.38; 95% CI 1.13, 1.69).

**CONCLUSIONS:** By applying the ICF framework, we have shown that personal factors were more likely to predict falls and fractures rather than OA impairments, environmental factors, activity limitations and participation restrictions in people with OA or at high risk of developing OA. This highlights the importance of questioning patients about their previous falls and past medical history, and using this information to focus our assessment and clinical decision-making processes.

Language: en

**Keywords** Falls; Fractures; Older people; Osteoarthritis

**Better off doing falls prevention "with" our patients rather than "to" them?**

Haines TP, Hill AM. *Jt. Comm. J. Qual. Patient Saf.* 2020; 46(3): 127-128.

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**DOI** 10.1016/j.jcjq.2020.01.004 **PMID** 32111349

**Abstract**

Patient falls have been one of the most common adverse events encountered in hospitals for several decades.<sup>1</sup> Despite this, identification of effective strategies for the prevention of in-hospital falls has been largely elusive. Early trials (pre-2004) seeking to prevent falls focused on single intervention approaches, but small sample sizes limited certainty in the results. Following this, larger trials evaluated the impact of targeted, multifactorial intervention approaches. These results of these trials have been inconsistent—some have reported positive results,<sup>2–6</sup> but other large trials of similar interventions have found no benefits.

Language: en

## Deaths from fall-related traumatic brain injury -- United States, 2008-2017

Peterson AB, Kegler SR. *MMWR Morb. Mortal. Wkly. Rep.* 2020; 69(9): 225-230.

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### Abstract

What is already known about this topic?

Falls can cause serious injuries, including a traumatic brain injury (TBI). Unintentional falls represent the second leading cause of TBI-related death.

What is added by this report?

The national age-adjusted rate of fall-related TBI deaths increased by 17% from 2008 to 2017; rates increased significantly in 29 states and among nearly all groups, most notably persons living in noncore nonmetropolitan counties and those aged  $\geq 75$  years.

What are the implications for public health practice?

Health care providers can educate patients about falls and TBIs, assess fall risk, and encourage participation in evidence-based fall prevention programs. Annual wellness visits might serve as a time to review previously assessed fall risk factors and update personalized prevention plans.

One in 10 U.S. residents aged  $\geq 18$  years reports falling each year (1). Among all age groups, falls can cause serious injury and are the second leading cause of traumatic brain injury (TBI)-related deaths (2). TBI is a head injury caused by a bump, blow, or jolt to the head or body or a penetrating head injury that results in disruption of normal brain function.\* CDC estimated national and state-specific rates and trends for TBI-related deaths (TBI deaths) caused by unintentional falls (fall-related TBI deaths) among U.S. residents during 2008-2017, by selected decedent characteristics. The national age-adjusted rate of fall-related TBI deaths increased by 17% from 2008 to 2017. Rate trends at the national level increased significantly for nearly all decedent characteristics, with the most notable increases observed among persons living in noncore (i.e., most rural), nonmetropolitan counties and those aged  $\geq 75$  years. Analysis of state-specific rate trends determined that rates of fall-related TBI deaths increased significantly in 29 states over the 10-year study period. A fall can happen to anyone of any age, but falls are preventable. Health care providers and the public need to be aware of evidence-based strategies to prevent falls, given that rates of fall-related TBI deaths are increasing. Health care providers can educate patients on fall and TBI prevention, assess their risk for falls, and when needed, encourage participation in appropriate evidence-based fall prevention programs.

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Language: en

## Effectiveness of tai chi on balance improvement in type 2 diabetes patients: a systematic review and meta-analysis

Palermi S, Sacco AM, Belviso I, Marino N, Gambardella F, Loiacono C, Sirico F. J. Aging Phys. Act. 2020; ePub(ePub): ePub.

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### Abstract

Balance impairments are a relevant problem in patients with diabetes, and interventions to manage this issue represent a public health need. This study reviewed the literature about the effectiveness of Tai Chi on balance improvement in patients with type 2 diabetes. Springerlink, MEDLINE, PubMed, CINAHL, Web of Science, Scopus, and Cochrane CENTRAL databases were screened. Randomized and nonrandomized controlled trials assessing balance in patients with type 2 diabetes enrolled in a Tai Chi program were considered eligible. Four studies were included in qualitative synthesis and in quantitative analysis (three randomized controlled trials and one pretest-posttest quasi-experimental study). Evidence supporting Tai Chi to improve balance in patients with type 2 diabetes was found (effect size: 0.52; 95% confidence interval [0.20, 0.84]); however, the analysis relied on a small number of studies, which raises concerns about the risk of bias. In conclusion, the results support the benefits of Tai Chi intervention to improve balance in patients with type 2 diabetes.

Language: en

### Keywords

coordination; exercise; fall; hyperglycemia; prevention

## Enhanced algorithm for the detection of preimpact fall for wearable airbags

Jung H, Koo B, Kim J, Kim T, Nam Y, Kim Y. *Sensors (Basel)* 2020; 20(5): e1277.

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### Abstract

Fall-related injury is a common cause of mortality among the elderly. Hip fractures are especially dangerous and can even be fatal. In this study, a threshold-based preimpact fall detection algorithm was developed for wearable airbags that minimize the impact of falls on the user's body. Acceleration sum vector magnitude (SVM), angular velocity SVM, and vertical angle, calculated using inertial data captured from an inertial measurement unit were used to develop the algorithm. To calculate the vertical angle accurately, a complementary filter with a proportional integral controller was used to minimize integration errors and the effect of external impacts. In total, 30 healthy young men were recruited to simulate 6 types of falls and 14 activities of daily life. The developed algorithm achieved 100% sensitivity, 97.54% specificity, 98.33% accuracy, and an average lead time (i.e., the time between the fall detection and the collision) of  $280.25 \pm 10.29$  ms with our experimental data, whereas it achieved 96.1% sensitivity, 90.5% specificity, and 92.4% accuracy with the SisFall public dataset. This paper demonstrates that the algorithm achieved a high accuracy using our experimental data, which included some highly dynamic motions that had not been tested previously.

Language: en

### Keywords

IMU; airbag; complementary filter; falls; preimpact; threshold-based

## **Incidence, risk and protective factors for unintentional, nonfatal, fall-related injuries at home: a community-based household survey from Ujjain, India**

Pathak A, Agarwal N, Mehra L, Mathur A, Diwan V. *Pediatric Health Med. Ther.* 2020; 11: 65-72.

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### **Abstract**

**BACKGROUND:** Childhood injury is an increasing public health burden and considered a major cause of childhood morbidity and mortality worldwide. In this study, we identified the distribution and risk factors for fall-related child injuries at home in Ujjain, India.

**METHODS:** A community-based, cross-sectional study was conducted in 2017 in Ujjain, India, which included 6308 children up to 18 years of age living in 2518 households. Data were collected using a pretested, semi-structured, proforma from the parents of the included children.

**RESULTS:** The overall incidence of home injury was 7.78% (95% confidence interval [CI]: 7.12-8.84) in the last 1 year, ie, 2015-16. The incidence was significantly higher at 5-10 years of age (odds ratio [OR]: 2.91, 95% CI: 1.75-4.85;  $P < 0.001$ ), followed by 1-5 years (OR: 2.66, 95% CI: 1.59-4.45;  $P < 0.001$ ). The incidence of injuries was higher in boys than in girls (adjusted odds ratio [aOR]: 1.73, 95% CI: 1.43-2.10;  $P < 0.001$ ). Other risk factors associated with unintentional fall injuries at home were residence (rural vs urban; aOR: 1.25, 95% CI: 1.03-1.51;  $P = 0.018$ ), number of family members ( $\leq 4$  vs 5-10 and  $\leq 4$  vs  $> 10$ ; aOR: 0.69, 95% CI: 0.56-0.86;  $P < 0.001$  and aOR: 0.67, CI: 0.48-0.94;  $P < 0.023$ , respectively), cooking area (combined vs separate; aOR: 0.82, 95% CI: 0.68-1.00;  $P = 0.057$ ), and whether mother is alive vs not alive (aOR: 2.09, 95% CI: 1.10-3.94;  $P = 0.023$ ).

**CONCLUSION:** The incidence of fall injuries among children at home in Ujjain, India, was similar to other resource constraint settings. The incidence was higher in rural areas, in the age group of 5-10 years, and in families in which the mother was not alive. By contrast, large and combined families had a lower incidence of falls.

Language: en

### **Keywords**

India; childhood; epidemiology; home injuries; nonfatal injuries