Safety Literature 17th December 2023

Impact of first eye cataract surgery on falls among patients of advanced age: a comparative study

Akbari-Kamrani M, Heidarzadeh H, Naderan M, Gordiz A, Hemmati S, Chaibakhsh S, Mohammadi SS, Farsani MK, Zand A, Abdi F. J. Int. Med. Res. 2023; 51(12): e3000605231216685.

DOI: 10.1177/03000605231216685 **PMID:** 38069864

Abstract

OBJECTIVE: To compare the incidence of falls between patients with visually significant cataracts in both eyes and those who have undergone first-eye cataract surgery.

METHODS: This retrospective case-control study involved patients with a history of cataracts in both eyes who had undergone first-eye cataract surgery within the past 9 to 12 months (pseudophakic group). The control group comprised patients with cataracts in both eyes (cataract group). We assessed best-corrected visual acuity (BCVA), systemic comorbidities and medications (using the Charlson comorbidity index), and independent daily activities (using the Lawton Instrumental Activities of Daily Living scale). The patients were questioned about experiencing two or more falls in the last 6 months

RESULTS: Each group comprised 50 patients. Binocular BCVA was significantly better in the pseudophakic group (0.05 ± 0.06 logMAR) than in the cataract group (0.77 ± 0.34 logMAR). Of all participants, 22% reported experiencing two or more falls in the last 6 months. Multivariate analysis demonstrated significantly better BCVA in participants with less than two falls

CONCLUSIONS: Patients of advanced age with visually significant cataracts in both eyes are at a higher risk of falling. First-eye cataract surgery may mitigate the occurrence of falls by improving binocular BCVA.

Language: en

Keywords: Fall; advanced age; case–control study; cataract; phacoemulsification; visual acuity

NSW Fall Prevention & Healthy Ageing Network

Prevalence and risk factors for falls among community-dwelling adults in Riyadh area

Alenazi AM, Alanazi MF, Elnaggar RK, Alshehri MM, Alqahtani BA, Alhowimel AS, Alhwoaimel NA, Alanazi AD, Alotaibi MA, Almutairi SM, Alghamdi MS, Bindawas SM.
PeerJ 2023; 11: e16478.

DOI: 10.7717/peerj.16478 **PMID:** 38077414 **PMCID:** PMC10710170

Abstract

OBJECTIVES: This study aimed to assess fall prevalence, identify related risk factors, and establish cut-off scores for fall risk measures among community-dwelling adults in Riyadh region of Saudi Arabia.

METHODS: A cross-sectional study was conducted in community, Riyadh city, Saudi Arabia. A sample of 276 Saudi citizens aged ≥40 years who were able to read and write in Arabic. Fall history and number of falls in the past 12 months were determined via self-reports. Variables assessed included demographic information, self-reported chronic diseases, depressive symptoms, and back pain severity.

RESULTS: Participants were classified as either fallers (n = 28, 10.14%) or non-fallers. Fallers were more likely to have arthritis (odds ratio [OR]: 7.60, p = 0.001), back pain (OR: 5.22, p = 0.002), and higher depressive symptom scores (OR: 1.09, p = 0.013) than non-fallers. The number of reported falls was significantly associated with an elevated body mass index (incidence rate ratio [IRR]: 1.09, p = 0.045), arthritis (IRR: 8.74, p < 0.001), back pain (IRR: 4.08, p = 0.005), neurological diseases (IRR: 13.75, p < 0.007), and depressive symptoms (IRR: 1.08, p = 0.005). Cut-off scores predictive of falls associated with back pain and depressive symptoms were 1.5 (sensitivity: 0.61; specificity: 0.79; area under the curve [AUC]: 0.70) and 11.5 score (sensitivity: 0.57; specificity: 0.76; AUC: 0.66), respectively.

CONCLUSIONS: The prevalence of falls was relatively low among the individuals considered in this study. Chronic conditions, back pain severity, and depressive symptoms were determined to be associated with falls among community-dwelling individuals in Saudi Arabia.

Language: en

Keywords: Chronic illness; Falls; Mental health; Depressive symptoms; Elderly; Chronic disease; Falling; Middle aged

Exploring population characteristics and recruitment challenges in older people experiencing falls at home without hospitalization or with an emergency department visit: insights from the RISING-DOM experience

Bouzid W, Tavassoli N, Berbon C, Qassemi S, Vaysset S, Poly M, Bounes V, Shourick J, Nourhashemi F. Clin. Interv. Aging 2023; 18: 1995-2008.

DOI: 10.2147/CIA.S421053 **PMID:** 38058551 **PMCID:** PMC10697010

Abstract

BACKGROUND: An increasing number of falls among community-living older adults are reported in emergency calls. Data on evidence of appropriate fall prevention interventions are limited and challenges in recruiting this population in randomized trials are acknowledged.

PURPOSE: The main aim of this study was to provide demographic data, circumstance and fall-related outcomes of the population in the RISING-DOM study [Impact d'une évaluation des facteurs de RISque de chute et d'une prise en charge personnalisée, sur la mortalité et l'institutionnalisation, après INtervention du SAMU chez la personne âGée à DOMicile], a multicenter, randomized interventional trial involving community-dwelling older adults who have experienced a fall at home and were not hospitalized. Additionally, the challenges of remote recruitment in this population were discussed.

PATIENTS AND METHODS: Participants were identified through the Occitania Emergency Observatory database. Participant recruitment and data collection were performed through telephone interviews (October 2019-March 2022). Additionally, a sample survey of Emergency Medical Services calls was carried out.

RESULTS: Out of the 1151 individuals screened, a total of 951 participants were included in the trial follow-up, resulting in an acceptance rate of 82.62%. The screening delay was extended due to the COVID-19 pandemic. Recruiting difficulties were mainly related to identifying potential participants, unavailable contact information and unreachability. Participants' mean age was 84.1 years, 65.8% were women, and 44.3% lived alone. Pain was the most frequent outcome (53%). In the previous year, 73.5% of participants reported experiencing a fall, with 66.7% of those falls requiring assistance from Emergency Medical Services (EMS). Nearly, 40% did not take proactive steps to prevent future falls and walking aids (79.8%) were the most common preventive action.

CONCLUSION: Indicators of a high-risk group of falls have been identified underscoring the need for appropriate fall interventions in the target population. Challenges of large sampling for randomized fall prevention trials were provided.

TRIAL REGISTRATION: Clinicaltrials.gov identifier: NCT04132544. Registration date: 18/10/2019. https://www.clinicaltrials.gov/ct2/show/NCT04132544?term=rising-dom&draw=2&rank=1.

Language: en

Keywords: descriptive analysis; Emergency Medical Service; fall prevention in community-living older adults; recruitment of older people for fall-related clinical trial

Immediate effects of lower limb sensory simulation using smart socks to stabilize gait in people with Parkinson's disease

Brodie MA, Pelicioni PH, Okubo Y, Chan DY, Carroll V, Toson B, Vigano D, Macagno M, Sternberg S, Schreier G, Lovell NH. Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. 2023; 2023: 1-4.

DOI: 10.1109/EMBC40787.2023.10340604 **PMID:** 38083091

Abstract

People with Parkinson's disease (PD) experience gait impairment that can lead to falls and poor quality of life. Here we investigate the feasibility of using smart socks to stimulate the lower limbs of people with PD to reduce excessive step time variability during walking. We hypothesised that rythmic excitation of lower limb afferents, matched to a participant's comfortable pace, would entrain deficient neuro-muscular signals resulting in improved gait. Five people with mild to moderate PD symptoms (70 ± 9 years) were tested on medication before and after a 30-minute familierization session. Paired t-tests and Cohen's d were used to assess gait changes and report effect sizes. Participant experiences were recorded through structured interviews. Lower limb stimulation resulted in an acute 15% increase in gait speed ($p=0.006$, $d=0.62$), an 11% increase in step length ($p=0.04$, $d=0.35$), a 44% reduction in step time variability ($p=0.03$, $d=0.91$), a 22% increase in perceived gait quality ($p=0.04$, $d=1.17$), a 24% reduction in mental effort to walk ($p=0.02$, $d=0.79$) and no statistical difference for cadence ($p=0.16$). Participants commented positively on the benefit of stimulation during training but found that stimulation could be distracting when not walking and the socks hard to put on. While the large effects for step time variability and percieved gait quality (Cohen's $d > 0.8$) are promising, limitations regarding sample size, potential placebo effects and translation to the home environment should be addressed by future studies.Clinical Relevance- This study demonstrates the feasibility of using smart stimulating socks to reduce excessive step time variability in people with PD. As step time variability is a risk factor for falls, the use of smart textiles to augment future rehabilitation programs warrants further investigation.

Language: en

Feasibility, safety, and effects of a Nintendo Ring Fit Adventure™ balance and strengthening exercise program in community-dwelling older adults with a history of falls: a feasibility randomized controlled trial

Chan WLS, Chan CWL, Lam FMH, Chan HHW, Chan KCK, Chan JSK, Chan OLW, Cheung DSK. Geriatr. Gerontol. Int. 2023; ePub(ePub): ePub.

DOI: 10.1111/ggi.14771 **PMID:** 38088479

Abstract

AIM: This pilot study examined the feasibility, safety, and effects of a Nintendo Ring Fit Adventure™-based exercise program to enhance balance and lower limb muscle strength in community-dwelling older adults with a history of falls.

METHODS: In total, 42 older adults who experienced at least one fall in the past year were randomly assigned to an experimental or control group. Participants in the experimental group performed 60-min sessions of the exercise program twice per week for 8 weeks. The control group received usual care. We assessed the feasibility (retention and adherence to the exercise program), safety (number of adverse events), and clinical outcomes: (1) balance (Mini-BESTest); (2) functional lower limb muscle strength (Five-Time Sit-to-Stand test); (3) mobility (Timed-Up and Go test); (4) dual-task ability (Timed-Up and Go test - Dual Task); (5) fear of falling (Icon-FES); and (6) executive function (Color Trails Test).

RESULTS: Thirty-one participants (74%) completed the 8-week assessment. No adverse event associated with the exercise program was reported. There was a significant interaction in the anticipatory domain score of the Mini-BESTest between the experimental and control groups over the 8 weeks ($P = 0.019$).

CONCLUSIONS: The Nintendo Ring Fit Adventure™-based exercise program was feasible, safe, and potentially effective in improving anticipatory balance in community-dwelling older fallers. Geriatr Gerontol Int 2023; ••: ••-••.

Language: en

Keywords: gerontechnology; falls; exergaming; rehabilitation

A precise hip protection system with multi-scale fall warning algorithm based on offset displacement

Chen Q, Diao Y, Wang Y, Chen Y, Ning Y, Li G, Zhao G. Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. 2023; 2023: 1-6.

DOI: 10.1109/EMBC40787.2023.10339954 **PMID:** 38082866

Abstract

Falls occur frequently in daily life and the damage to the body is irreversible. Therefore, it is crucial to implement timely and effective warning and protection systems for falls to minimize the damage caused by falls. Currently, the fall warning algorithm has shortcomings such as low recognition rates for falls and fall-risk movements and insufficient lead-time, the time before the subject impacts the floor, making it difficult for falling protection devices to function effectively. In this study, a multi-scale falls warning algorithm based on offset displacement is built, and a hip protection system is designed. The performance of the algorithm and the system is validated using 150 falling and 500 fall-risk actions from 10 volunteers. The results showed that the recognition accuracy for falling actions is 98.7% and the recognition accuracy for fall-risk actions is 99.4%, with an average lead-time of 402ms. The protection rate for falling movements reached 98.7%. This proposed algorithm and hip protection system have the potential to be applied in elderly communities, hospitals, and homes to reduce the damage caused by falls.Clinical Relevance- This study provides important reference for clinicians in analyzing fall behaviors to patients at risk of falls in clinical settings, offering valuable technical support for ensuring the safety of patients in danger of falling. It also contributes to further promoting the development of falling-prevention medical devices.

Language: en

A gaming app developed for vestibular rehabilitation improves the accuracy of performance and engagement with exercises

D'Silva LJ, Phongsavath T, Partington K, Pickle NT, Marschner K, Zehnbauer TP, Rossi M, Skop K, Roos PE. Front. Med. (Lausanne) 2023; 10: e1269874.

DOI: 10.3389/fmed.2023.1269874 **PMID:** 38076248 **PMCID:** PMC10704144

Abstract

INTRODUCTION: Vestibular hypofunction is associated with dizziness, imbalance, and blurred vision with head movement. Vestibular rehabilitation is the gold standard recommendation to decrease symptoms and improve postural stability. The Clinical Practice Guidelines for vestibular hypofunction suggest home exercises 3-5 times daily, but patient adherence is a problem, with compliance rates often below 50%.

METHODS: An app was developed to increase engagement with home exercises by providing exercises as games. This study compared the accuracy of exercise performance in a one-time session using the app versus no-app and gathered participant feedback on using the app for vestibulo-ocular reflex (VOR) and balance exercises. The app was tested with 40 adults (20 women), mean age of 67 ± 5.7 years, with symptomatic unilateral or bilateral vestibular hypofunction. Participants completed VOR exercises in pitch and yaw planes, weight-shift, and single-leg balance exercises using an inertial motion unit to move the character on the tablet screen. Participants were randomly assigned to begin the exercises with or without the app.

RESULTS: Results show that during VOR exercises, participants achieved the prescribed frequency of head motion for the yaw plane ($p \leq 0.001$) and reduced variability of head movement frequency in both the yaw ($p \leq 0.001$) and pitch plane ($p \leq 0.001$) in the app compared to the no-app condition. During weight-shifting exercises, a larger range of body motion was noted in the anteroposterior and mediolateral directions in the app compared to the no-app condition ($p < 0.05$). During single-leg balance exercises, pelvic motion was lower in the app versus no-app condition ($p = 0.02$). Participants modified their exercise performance and corrected their mistakes to a greater extent when they used the app during the VOR exercises. Participants agreed that they felt motivated while playing the games (97%) and felt motivated by the trophies (92%). They agreed that the app would help them perform the exercises at home (95%), improve their rehab performance (95%) and that it was fun to do the exercises using the app (93%).

DISCUSSION: The results of this study show that technology that is interactive and provides feedback can be used to increase accuracy and engagement with exercises.

Language: en

Keywords: older adults; engagement; motivation; rehabilitation games; vestibular hypofunction

Smart Lacelock sensor for the balance assessment of community-dwelling older people

Haque MR, Islam MR, Choma E, Hayes S, McMahon S, Sazonov E, Shen X. Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. 2023; 2023: 1-4.

DOI: 0.1109/EMBC40787.2023.10340165 **PMID:** 38083186

Abstract

This paper introduces a novel wearable shoe sensor named the Smart Lacelock Sensor. The sensor can be securely attached to the top of a shoe with laces and incorporates a loadcell to measure the force applied by the shoelace, providing valuable information related to ankle movement and foot loading. As the first step towards the automated balance assessment, this paper investigates the correlations between various levels of physical performance measured by the wearable Smart Lacelock Sensor and the SPPB clinical method in community-living older persons. 19 adults (age 76.84 ± 3.45 years), including those with and without recent fall history and SPPB score ranging from 4 to 12, participated in the study. The Smart Lacelock Sensor was attached to both shoes of each participant by skilled research staff, who then led them through the SPPB evaluation. The data obtained from the Smart Lacelock Sensors after the SPPB assessment were used to evaluate the deviation between the SPPB scores assigned by the research staff and the signals generated by the sensors for various participants.

RESULTS demonstrate that the standard deviation of the Smart Lacelock Sensor's loadcell response (both feet) for the side-by-side balance testing is significantly correlated (R(2) = 0.68) with the SPPB score, demonstrating the capability of the Smart Lacelock Sensor in balance assessment.

Language: en

Development and validation of a machine learning-based fall-related injury risk prediction model using nationwide claims database in Korean community-dwelling older population

Heo KN, Seok JY, Ah YM, Kim KI, Lee SB, Lee JY. BMC Geriatr. 2023; 23(1): e830.

DOI: 10.1186/s12877-023-04523-8 **PMID:** 38082380 **PMCID:** PMC10712099

Abstract

BACKGROUND: Falls impact over 25% of older adults annually, making fall prevention a critical public health focus. We aimed to develop and validate a machine learning-based prediction model for serious fall-related injuries (FRIs) among community-dwelling older adults, incorporating various medication factors.

METHODS: Utilizing annual national patient sample data, we segmented outpatient older adults without FRIs in the preceding three months into development and validation cohorts based on data from 2018 and 2019, respectively. The outcome of interest was serious FRIs, which we defined operationally as incidents necessitating an emergency department visit or hospital admission, identified by the diagnostic codes of injuries that are likely associated with falls. We developed four machine-learning models (light gradient boosting machine, Catboost, eXtreme Gradient Boosting, and Random forest), along with a logistic regression model as a reference.

RESULTS: In both cohorts, FRIs leading to hospitalization/emergency department visits occurred in approximately 2% of patients. After selecting features from initial set of 187, we retained 26, with 15 of them being medication-related. Catboost emerged as the top model, with area under the receiver operating characteristic of 0.700, along with sensitivity and specificity rates around 65%. The high-risk group showed more than threefold greater risk of FRIs than the low-risk group, and model interpretations aligned with clinical intuition.

CONCLUSION: We developed and validated an explainable machine-learning model for predicting serious FRIs in community-dwelling older adults. With prospective validation, this model could facilitate targeted fall prevention strategies in primary care or community-pharmacy settings.

Language: en

Keywords: Older adults; Fall; Claims data; Fall-related injury; Machine-learning; Prediction model

The effect of tread patterns on slip resistance of footwear outsoles based on composite materials in icy conditions

Islam S, Gide K, Dutta T, Bagheri ZS. J. Saf. Res. 2023; 87: 453-464.

DOI: 10.1016/j.jsr.2023.08.017 **PMID:** 38081717

Abstract

INTRODUCTION: Falls on icy surfaces are the leading cause of injuries for outdoor workers. Footwear outsole material and geometrical design parameters are the most significant factors affecting slips-and-falls. Recently, composite materials have been incorporated into outsoles to improve traction, yet the best design parameters are not fully understood.

METHOD: In this effort, based on Taguchi orthogonal array design, 27 outsole prototypes were fabricated with different tread pattern features using our patented composites and tested in a simulated winter condition.

RESULTS: An analysis of variance (ANOVA) showed that surface area ($p = 0.041$, Contribution = 15.63%) was the only factor significantly affecting the slip-resistance of our prototypes. The best performance was observed for the maximized surface area covered by our composite material with circular and half circular plugs laid obliquely, mostly in the forefoot area. PRACTICAL APPLICATIONS: These findings suggest that some tread design features of composite-based footwear have a great role in affecting slip-resistance properties of composite-based footwear.

Language: en

Keywords: Falls; Icy conditions; Slip-resistant footwear outsole; Slips; Taguchi method

Development and internal validation of a prognostic model for loss of balance and falls in mid- to late-stage Parkinson's disease

Juwara L, Cressatti M, Galindez JM, Drammeh PS, Velly AM, Schipper HM. Neurol. Sci. 2023; ePub(ePub): ePub.

DOI: 10.1007/s10072-023-07220-x **PMID:** 38060035

Abstract

BACKGROUND: Mid- to late-stage Parkinson's disease (PD) is often linked with worsened and significant impairment of motor activities, but existing prognostic markers do not adequately capture the risk of loss of balance in PD patients. This study aims to develop a risk prognostic model for mid- to late-stage PD and identify prognostic factors that are indicative of impending loss of balance and falls.

METHODS: The study included 307 participants of which 75 were diagnosed with idiopathic PD and 232 were neurological or non-neurological controls. Among the PD group, 46 were early-stage (Hoehn and Yahr [H&Y] = 1,2) with no significant loss of balance while 29 were mid- to late-stage (H&Y = 3,4,5) which is characterized by loss of balance and falls. Multivariable logistic regression (MLR) was used to develop a prognostic model for mid- to late-stage PD. Model discrimination was assessed by ROC curves. The model was internally validated through bootstrapping and calibration plots.

RESULTS: The relevant factors identified and included in the final MLR model were shortness of breath, age, swollen joints, heme oxygenase-1 (HO-1) protein, and total salivary protein. The model had an AUC of 0.82 (95% CI = 0.71-0.92) and was well calibrated (calibration slope = 0.77, intercept = 0.03). The likelihood of shortness of breath (OR = 7.91, 95% CI = 1.63-45.12) was significantly higher among mid- to late-stage PD than early-stage. Age and total salivary protein were also significantly higher among mid- to late-stage PD.

CONCLUSION: The MLR prognostic model for mid- to late-stage PD may assist physicians in identifying patients at high risk for loss of balance and falls.

Language: en

Keywords: Balance/falls; Marker; Neurodegenerative conditions; Parkinson’s disease; Prognosis

Balance strategies for recovery from perturbed overground walking

Karabin MJ, Smith RW, Sparto PJ, Furman JM, Redfern MS. J. Biomech. 2023; 162: e111898.

DOI: 10.1016/j.jbiomech.2023.11189 **PMID:** 38070294

Abstract

Bipedal locomotion is naturally unstable and requires active control. Walking is believed to be primarily stabilized through the selection of foot placements; however, other strategies are available, including regulation of ankle inversion/eversion, ankle push-off, and angular momentum through trunk postural adjustments. The roles of these strategies in maintaining overall stability are often masked by the dominant foot placement strategy. The objectives of this study were to describe how the four strategies are used to respond to medial or lateral ground perturbations during overground walking in healthy individuals and determine reliance on each strategy. Fifteen healthy adults walked with and without perturbations applied to the right foot at heel strike while body kinematics and surface electromyographic activity were measured. Medial perturbations resulted in decreased step width on the first step after the perturbation, increased ankle inversion, increased ankle push-off, and rightward trunk sway. Lateral perturbations resulted in increased step width, decreased ankle inversion, no change in ankle push-off, and leftward trunk sway. EMG activity was consistent with the observed strategies (e.g. increased peroneus longus EMG activity during ankle eversion) with the exception of increased bilateral erector spinae activity for all perturbations. Foot placement was the dominant strategy in response to perturbations, with other strategies showing reduced, yet significant, roles. This work demonstrates that multiple strategies are recruited to improve the balance response in addition to foot placement alone. These results can serve as a reference for future studies of populations with impaired balance to identify potential deficits in strategy selection.

Language: en

Keywords: Walking; Stability; Perturbations; Stability strategies

Walking speed and risk of falling patients operated for selected malignant tumors

Latajka A, Stefańska M, Woźniewski M, Malicka I. Healthcare (Basel) 2023; 11(23).

DOI: 10.3390/healthcare11233069 **PMID:** 38063637 **PMCID:** PMC10706285

Abstract

BACKGROUND: A literature review reveals that studies on walking and fall occurrences in the context of cancer have predominantly centered on geriatric patients. Nonetheless, cancer patients of all ages are susceptible to such risks. Both cancer and its treatments contribute to significant risk factors for disturbances in walking and falls, encompassing muscle weakness, impaired balance, reduced proprioception, cognitive impairment, and functional limitations.

AIM: to assess walking speed and the risk of falls among patients undergoing surgery for the most common malignancies: breast (BU), lung (P), colorectal (DS), and reproductive organs (G). MATERIAL AND METHODS: An observational study was conducted using a cohort design. A total of 176 individuals participated in the study, including 139 cancer patients, who were divided into four groups: BU (N = 30), P (N = 35), DS (N = 35), and G (N = 39), as well as 37 healthy volunteers in the control group (C, N = 37). All participants underwent an assessment of walking speed using BTS G-WALK(®) and an evaluation of the number of falls and the risk of falling using a Fall Control Card.

RESULTS: There was a significant decrease in walking speed after surgery compared to the time before surgery, from 2.7% in the BU group, through 9.3% in the P group, and 19.2% in the DS group, to 30.0% in the G group. At the same time, for groups G and DS, the average walking speed fell below 1.0 m/s, amounting to 0.84 m/s and 0.97 m/s, respectively, in the measurement after the surgery and 0.95 m/s and 1.0 m/s in the follow-up measurement. Falling occurred in all the groups except for the BU group. The created logistic regression model showed that increasing the walking speed measured after the procedure (study 2) by 1 m/s reduces the risk of falling by approximately 500 times (OR = 0.002). Limitations in daily activity were observed in the follow-up examination (study 3) in 75% of patients.

CONCLUSIONS: Surgical intervention has an impact on walking speed, and being part of the study group influences the risk of falling. Further research is needed to determine the precise risk of falls in cancer patients.

Language: en

Keywords: fall risk; cancer; walking speed; surgical treatment

Stakeholder development of an implementation strategy for fall prevention in Norwegian home care - a qualitative co-creation approach

Linnerud S, Kvael LAH, Graverholt B, Idland G, Taraldsen K, Brovold T. BMC Health Serv. Res. 2023; 23(1): e1390.

DOI: 10.1186/s12913-023-10394-x **PMID:** 38082278

Abstract

BACKGROUND: The uptake of fall prevention evidence has been slow and limited in home care services. Involving stakeholders in the implementation process is suggested as a method to successfully tailor implementation strategies. The aim of this study was to develop an implementation strategy for fall prevention, targeting healthcare providers working in home care services.

METHODS: This study used an explorative qualitative approach in a five-step co-creation process to involve researchers, service users, and healthcare providers. The first two steps consisted of workshops. This was followed by focus group interviews and individual interviews with key informants as steps three and four. Data from the first four steps were analyzed using reflexive thematic analysis. The fifth and final step was a workshop finalizing a strategy for implementing fall prevention evidence in home health services.

RESULTS: Overall, our findings, resulted in an implementation strategy for fall prevention with four components: (1) Empower leaders to facilitate implementation, operationalized through what managers pay attention to regularly, resource priorities, and time spent on fall prevention, (2) Establish implementation teams, consisting of multidisciplinary healthcare providers from different levels of the organization, with formalized responsibility for implementation, (3) Tailor dual competence improvement, reflecting the need for knowledge and skills for fall prevention and implementation among healthcare providers and users, and (4) Provide implementation support, representing guidance through the implementation process.

CONCLUSIONS: This study advances our understanding of implementation in home care services. Implementation of fall prevention requires an implementation strategy involving a blend of essential components targeting leaders, competent healthcare providers and users, and establishing structures enhancing the implementation process.

Language: en

Keywords: Implementation; Older adults; Co-creation; Fall prevention; Home care services; Implementation strategy; Stakeholder engagement; Uptake of evidence

An unobtrusive fall detection system using ceiling-mounted ultra-wideband radar

Lu W, Kumar S, Sandhu M, Zhang Q. Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. 2023; 2023: 1-5.

DOI: 10.1109/EMBC40787.2023.10341081 **PMID:** 38083299

Abstract

Falls are among the most devastating events that can happen to an older person. Automatic fall detection systems aim to solve this problem by alerting carers and family the moment a fall occurs. This paper presents the development of an unobtrusive fall detection system using ultra-wideband (UWB) radar. The proposed system employed a ceiling-mounted UWB radar to avoid object occlusion and allow for flexible implementation. An innovative pre-processing method was developed to effectively enhance motion and reduce noise from raw UWB data. We designed a trial protocol composed of common types of falls in older population and activities of daily living (ADL). A fall detection algorithm based on convolutional neural networks was developed with simulated falls and ADLs obtained from ten participants following the trial protocol in a clear and cluttered living environment. The fall detection system achieved an accuracy of 93.97%, with a sensitivity of 95.58% and specificity of 92.68%.

Language: en

Fall risk prediction in older adults using free-text nursing notes and medications in electronic health records

Mishra AK, Chappell MJ, Emerson S, Skubic M. Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. 2023; 2023: 1-4.

DOI: 10.1109/EMBC40787.2023.10341127 **PMID:** 38082830

Abstract

Nursing notes in Electronic Health Records (EHR) contain critical health information, including fall risk factors. However, an exploration of fall risk prediction using nursing notes is not well examined. In this study, we explored deep learning architectures to predict fall risk in older adults using text in nursing notes and medications in the EHR. EHR predictor data and fall events outcome data were obtained from 162 older adults living at TigerPlace, a senior living facility located in Columbia, MO. We used pre-trained BioWordVec embeddings to represent the words in the clinical notes and medications and trained multiple recurrent neural network-based natural language processing models to predict future fall events. Our final model predicted falls with an accuracy of 0.81, a sensitivity of 0.75, a specificity of 0.83, and an F1 score of 0.82. This preliminary exploratory analysis provides supporting evidence that fall risk can be predicted from clinical notes and medications. Future studies will utilize additional data modalities available in the EHR to potentially improve fall risk prediction from EHR data.

Language: en

Inertial measurement and heart-rate sensor-based dataset for geriatric fall detection using custom built wrist-worn device

Nandi P, Anupama KR, Agarwal H, Patel K, Bang V, Bharat M, Guru MV. Data Brief 2024; 52: e109812.

DOI: 10.1016/j.dib.2023.109812 **PMID:** 38076473 **PMCID:** PMC10709028

Abstract

This paper describes a dataset acquired from 41 volunteers performing 16 Activities of daily livings (ADLs) and 8 Falls repeated 5 times. This data was collected using a custom wrist-worn end device. The dataset has data collected from Inertial measurement unit (IMU) and heart-rate sensors. The end device is built using Qualcomm Snapdragon 820c System on Chip (SoC) interfaced to the sensors via Interconnect Integrated Circuit (I2C) protocol. The data was sampled for every activity at a rate of 20 Hz for the motion sensors and at a rate of 1 Hz for the heart-rate sensor. The motion sensor comprised of a triaxial accelerometer, triaxial gyroscope, triaxial magnetometer and a linear accelerometer. The heart-rate sensor was medical grade and all sensors were calibrated for the wrist -worn position. The dataset is available on this website https://shamanx86.github.io/fall_detection_data/ and https://doi.org/10.5281/zenodo.10013090.

Language: en

Keywords: Dataset; Fall detection; Geriatric; System on Chip; Wearable

Medication and the risk of falls: an analysis of adverse drug reactions reported to the Portuguese pharmacovigilance system

Rodrigues D, Silvestre S, Monteiro C, Duarte AP. J. Clin. Med. 2023; 12(23): e7268.

DOI: 10.3390/jcm12237268 **PMID:** 38068320

Abstract

Falls are not always considered direct adverse drug reactions (ADRs). However, due to their mechanism of action, certain drugs increase the risk of falls. This retrospective study aimed to evaluate the association between drugs and the risk of falls. An analysis of ADR reports submitted to a national pharmacovigilance database from 1992 to 2021 was performed using terms from the MedDRA dictionary. This included the word "fall" and terms related to conditions potentially predisposing patients to falls. The analysis involved examining the sex and age distribution of the population. Reports were assessed for seriousness, the class of the suspected drug, and the characterisation of fall events when they occurred. Over this period, 2217 cases were reported, with the majority occurring among females (60.71%) and the age group of 18-64 years old (38.43%). Most reports were classified as serious across all age groups, and immunomodulators (16.78%) were the most frequently reported pharmacotherapeutic class of suspected drugs. Falls were reported as ADRs in 343 cases, with fractures being the most commonly reported injuries (24.45%). In conclusion, falls can pose a significant health problem. Therefore, continuously monitoring drugs is crucial to minimise fall-associated risk factors.

Language: en

Keywords: safety; falls; adverse drug reactions; Portuguese pharmacovigilance system

Classification of fall risk across the lifespan using gait derived features from a wearable device

Sasso G, Mou L, Hernandez ME. Annu. Int. Conf. IEEE Eng. Med. Biol. Soc. 2023; 2023: 1-4.

DOI: 10.1109/EMBC40787.2023.10340146 **PMID:** 38083240

Abstract

Falls are one of the leading factors of injury and fatality in older adults. Given the importance of early detection of adults at higher risk of falls, we evaluated the ability of machine learning to classify fall risk in adults across the lifespan using wearable sensors embedded in a smartshirt. We evaluated the classification performance of binary and multiclass fall risk classifier models using SciKit Digital Health in adults across the lifespan. Using a k-fold and group k-fold cross-validation strategy, we demonstrate the feasibility of fall risk classification using accelerometer data from 10 second epochs of treadmill walking data from adults across the lifespan. We achieved an 88% accuracy in a binary clasifier of fallers vs. non-fallers, and an 86% accuracy in a multiclass classifier comparing non-fallers, fallers, and recurrent fallers using retrospective fall histories. Comparing group k-fold vs. k-fold cross-validation strategies, we find a 22-27% drop-off in accuracy performance. Furthering the evaluation framework presented in this study would be valuable to the development of more robust and clinically relevant models used in the prediction of fall risk. These models could one day be applied in clinical settings to help better diagnose and monitor fall risk among older adults, improving the care of at-risk individuals and reducing the injury and associated cost of falls.

Language: en

Evaluation of a concise fall risk stratification among older adults with cataracts in day surgery settings: a historically controlled study

Wang YP, Dai C, Ou-Yang P, Zhao YH, Xu D. Jpn. J. Nurs. Sci. 2023; ePub(ePub): ePub.

DOI: 10.1111/jjns.12579 **PMID:** 38058225

Abstract

AIM: This study aimed to evaluate the use of a concise fall risk stratification in assessing and predicting falls compared with the Morse Falls Scale among older adults with cataracts in day surgery settings.

METHODS: A historically controlled study conducted from July 2020 to June 2022 was used in a municipal ophthalmic hospital in China. The concise fall risk stratification which directly graded fall risk by multifactorial judgment was used during the intervention period, while the Morse Falls Scale which graded fall risk by scale scores was used during the control period. The fall risk levels, fall assessment time, fall rates, fall-related injuries, predictive validity, and patient satisfaction with day surgery care were extracted. Propensity score matching was performed to balance baselines.

RESULTS: After matching, 4132 patients were included in the final analysis. Compared with the control group, the intervention group had significantly higher assessment results for fall risk level, a significantly shorter (by 48.15%) fall assessment time, and higher patient satisfaction. There were no differences in fall rates and fall-related injuries. Compared with the Morse Falls Scale, the concise fall risk stratification had higher sensitivity and negative predictive validity, and lower specificity and positive predictive validity, while the area under curve did not differ significantly.

CONCLUSION: The use of the concise fall risk stratification reduced fall assessment time, improved patient satisfaction, and is unlikely to impact falls with an overall predictive performance comparable to that of the Morse Falls Scale for older cataract adults in day surgery settings.

Language: en

Keywords: cataract; day surgery; falls; older adults; risk assessment

The 6-minute walk test and fall risk in patients with heart failure: a cross-sectional study

Yakut Ozdemir H, Bozdemir Ozel C, Dural M, Yalvac HE, Al A, Murat S, Mert GO, Cavusoglu Y. Heart Lung 2023; 64: 80-85.

DOI: 10.1016/j.hrtlng.2023.11.012 **PMID:** 38065041

Abstract

BACKGROUND: Given the increased risk of falls in patients with heart failure (HF), there is limited information in the literature about the possible relationship between fall risk and functional capacity.

OBJECTIVE: To investigate the relationship between functional capacity and fall risk in patients with HF and to determine whether there are differences in clinical parameters between patients with and without fall risk.

METHODS: The study included 64 patients with HF. The Activity-Specific Balance Confidence Scale (ABC) determined the fall risk. Functional capacity was assessed with the 6-minute walk test (6MWT). The Berg Balance Scale (BBS), the timed up-and-go test (TUG), and the five times sit-to-stand (5-STS) test were used to evaluate functional balance and mobility. Comorbidities and dyspnea perception were assessed with the Charlson Comorbidity Index (CCI) and modified Medical Research Council (mMRC), respectively.

RESULTS: The 6MWT was associated with fall risk in logistic regression with an odds ratio of 0.979 (0.970-0.989, $p < 0.001$). Furthermore, the 6MWT had a discriminative value for increased fall risk in patients with HF, with a cutoff value of 248 m. Patients with increased fall risk had lower 6MWT distance, BBS, and gait speed, and higher CCI and mMRC, number of falls, duration of TUG and 5STS compared to patients with no increased fall risk ($p < 0.05$).

CONCLUSIONS: The study results demonstrated that 6MWT may be a clinically useful tool in quickly identifying potential balance problems and increased fall risk by providing insight into fall risk/balance confidence in addition to assessing functional capacity.

Language: en

Keywords: Falls; Balance; Functional capacity; Heart failure

The relationship of depression level and physical activity with postural control in geriatric individuals

Yerlikaya T, Bağkur M, Taş S, Öniz A, Özgören M. Noro Psikiyatr Ars 2023; 60(4): 356-362.

DOI: 10.29399/npa.28217 **PMID:** 38077843 **PMCID:** PMC10709698

Abstract

INTRODUCTION: The aim of this study was to investigate the relationships between functional performance, physical activity level, and depression level with postural control in older adults.

METHODS: Data were collected from 48 community-dwelling subjects aged ≥65 years. As measurement parameters, Sway mobile balance application for postural control, Sit - Stand Test for lower extremity muscle strength, SenseWear armband for physical activity level, Mini-Mental Test for mental status and Beck Depression Inventory (BDI) for depression level were used.

RESULTS: Sway score was positively correlated with total energy expenditure (TEE) (r=0.28, p=0.04) and number of steps (r=0.30, p=0.03) and negatively correlated with BDI (r=-0.33, p=0.03). The BDI score was negatively correlated with all physical activity parameters. While lower extremity strength, which indicates functional performance, showed moderate-good correlation with physical activity parameters, it showed moderate negative correlation with BDI (r=-0.63, p<0.001). Body mass index value positively correlated with TEE (r=0.34, p=0.01).

CONCLUSIONS: The results of this study showed a significant correlation between postural control, physical activity, and depression level. A sufficient level of physical activity is important for the maintenance and improvement of depression level and postural control system. The relationship between physical activity, depression level and postural control should not be ignored in healthy aging.

Language: en

Keywords: physical activity; depression; fall risk; postural control; Healthy aging

Physical exercise habits are related with reduced prevalence of falling among elderly women in China

Zhao C, Wang T, Yu D, Li W. BMC Womens Health 2023; 23(1): e653.

DOI: 10.1186/s12905-023-02808-z **PMID:** 38066469

Abstract

BACKGROUND: Although some studies have examined the association between exercise and falls, most have focused on specific exercises, and the results have been inconsistent. In addition, there is a lack of evidence on elderly Chinese women who have different living and exercise habits compared to those in other countries. Therefore, this study aimed to investigate whether physical exercise is associated with falls in elderly Chinese women.

METHODS: This cross-sectional study included 1429 elderly Chinese women with a mean age of 69.2 years. Information on physical exercise habits and fall experiences was collected using a self-report questionnaire. Logistic regression models were used to analyze the association between physical exercise habits and falls.

RESULTS: The results showed that 15% participants had a fall in the past year. After adjusting for confounding factors, the odd ratios (ORs) and 95% Confidence Intervals (CIs) for fall experiences across categories of exercise frequency were as follow: 1 (reference) for no exercise behavior, 0.50 (0.29, 0.85) for exercise 1 to 5 times a week, and 0.37 (0.25, 0.55) for exercise more than 6 times a week. Furthermore, the ORs (95% CIs) across categories of exercise insistence were 1 (reference) for less than 1 year, 0.78 (0.37, 1.65) for 1 to 3 years, and 0.38 (0.20, 0.74) for more than 3 years. In terms of exercise duration, the ORs (95% CIs) for < 1 h/day, 1-2 h/day, and > 2 h/day were 1 (reference), 0.85 (0.53, 1.36), and 2.80 (1.30, 6.05). Unlike other variables, longer exercise duration was associated unfavorably with falls.

CONCLUSION: Physical exercise habits were associated with falls in elderly Chinese women. Keeping a proper exercise habit may contribute to lower risk of falling in elderly women.

Language: en

Keywords: Accidental falls; Cross-sectional study; Aged female; Exercise habits