

Safety Literature 5th January 2020

A randomised controlled trial of an exercise intervention promoting activity, independence and stability in older adults with mild cognitive impairment and early dementia (PrAISED) - A Protocol

Bajwa RK, Goldberg SE, van der Wardt V, Burgon C, Di Lorito C, Godfrey M, Dunlop M, Logan P, Masud T, Gladman J, Smith H, Hood-Moore V, Booth V, das Nair R, Pollock K, Vedhara K, Edwards RT, Jones C, Hoare Z, Brand A, Harwood RH. *Trials* 2020; 20(1): e815.

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Abstract

BACKGROUND: People with dementia progressively lose cognitive and functional abilities. Interventions promoting exercise and activity may slow decline. We developed a novel intervention to promote activity and independence and prevent falls in people with mild cognitive impairment (MCI) or early dementia. We successfully undertook a feasibility randomised controlled trial (RCT) to refine the intervention and research delivery. We are now delivering a multi-centred RCT to evaluate its clinical and cost-effectiveness.

METHODS: We will recruit 368 people with MCI or early dementia (Montreal Cognitive Assessment score 13-25) and a family member or carer from memory assessment clinics, other community health or social care venues or an online register (the National Institute for Health Research Join Dementia Research). Participants will be randomised to an individually tailored activity and exercise programme delivered using motivational theory to promote adherence and continued engagement, with up to 50 supervised sessions over one year, or a brief falls prevention assessment (control). The intervention will be delivered in participants' homes by trained physiotherapists, occupational therapists and therapy assistants. We will measure disabilities in activities of daily living, physical activity, balance, cognition, mood, quality of life, falls, carer strain and healthcare and social care use. We will use a mixed methods approach to conduct a process evaluation to assess staff training and delivery of the intervention, and to identify individual- and context-level mechanisms affecting intervention engagement and activity maintenance. We will undertake a health economic evaluation to determine if the intervention is cost-effective.

DISCUSSION: We describe the protocol for a multi-centre RCT that will evaluate the clinical and cost-effectiveness of a therapy programme designed to promote activity and independence amongst people living with dementia. **TRIAL REGISTRATION:** ISRCTN, ISRCTN15320670. Registered on 4 September 2018.

Language: en

Keywords Activities of daily living; Balance training; Cognitive impairment; Dementia; Dual-task training; Falls prevention; Occupational therapy; Physiotherapy; Strength training; Tailoring

Falls and risk factors of falls for urban and rural community-dwelling older adults in China

Zhang L, Ding Z, Qiu L, Li A. BMC Geriatr. 2019; 19(1): e379.

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Abstract

BACKGROUND: Falls among older people have become a public health concern due to serious health consequences. Despite abundant literature on falls in older people, little is known about the rural-urban differentials in falls among older people in China. This research fills the voids of prior literature by investigating falls and the associated risk factors among Chinese seniors, with a particular focus on the rural-urban differences.

METHODS: Data are from the 2010 wave of Chinese Longitudinal Survey on Urban and Rural Elderly. The analysis includes 16,393 respondents aged 65 and over, with 8440 and 7953 of them living in urban and rural areas, respectively. Descriptive analyses are performed to examine incidence, locations, circumstances and consequences of falls in older people. Regression analysis is used to investigate the effects of risk factors on falls among older people in urban and rural China.

RESULTS: The incidence of falls is higher among rural than urban older people. In both settings, older people are more likely to fell outside of home. But common outdoor falls among rural and urban older people differ in terms of locations and circumstances. Urban older people are more likely to report falling on the road whereas their rural counterparts have experienced more falls in the yard. Falls occurring within homes or immediate home surroundings are also common; but few falls occurred in public areas. The rate of hospitalization of urban seniors after falling is higher than that of rural ones. Most risk factors of falls show similar than different effects on rural and urban elders' risks of falling.

CONCLUSIONS: Incidence, locations, circumstances and consequences of falls vary among Chinese rural and urban older people. But most risk factors for falls show similar effects on rural and urban elders' odds of falling. Implications drawn from this research provide suggestions for the government and local agencies to develop suitable fall prevention strategies which may well be applicable to other countries.

Language: en

Keywords

China; Fall; Older people; Risk factors; Rural-urban difference

Neuroticism predicts fear of falling after hip fracture

Bower ES, Wetherell JL, Petkus AJ, Lenze EJ. *Int. J. Geriatr. Psychiatry* 2020; ePub(ePub): ePub.

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Abstract

OBJECTIVES: Fear of Falling (FoF) is common and associated with poorer functional outcomes after hip fracture. We sought to differentiate patterns of FoF at 4 and 12 weeks after surgical repair for hip fracture and examine predictors of FoF.

METHODS/DESIGN: Secondary analysis of existing data from a 52-week prospective study examining recovery after hip fracture. Participants (N=263) were aged 60 and older with recent hip fracture recruited from eight hospitals. FoF was measured 4 and 12 weeks post-fracture with the Short Falls Efficacy Scale-International. Latent class mixed models were constructed to identify distinct patterns of FoF from 4 to 12 weeks post-fracture, and predictors of FoF. Predictors examined included age, gender, neuroticism, depression, negative affect, perceived social support, medical comorbidity, functional ability, cognition, and pain.

RESULTS: Three latent classes of FoF were identified: a group with minimal FoF at weeks 4 and 12 (72%), a group with high FoF that decreased (17%), and a group with high FoF that increased from week 4 to 12 (11%). In a multivariate model, higher neuroticism was associated with greater risk for high FoF (increasing or decreasing) whereas higher premorbid medical comorbidity was associated with increasing FoF, poorer premorbid functional ability was associated with decreasing FoF, and social support was not significantly associated.

CONCLUSIONS: Older adults with higher neuroticism are more likely to have FoF in the first 12 weeks after a hip fracture. Screening for neuroticism in health care settings might identify individuals who would benefit from interventions to improve outcomes during recovery. This article is protected by copyright. All rights reserved.

Language: en

Keywords

Falls Efficacy Scale International; falls; fear of Falling; femoral fractures; hip fracture; intertrochanteric fractures; neuroticism; personality

Post-stroke patients with moderate function have the greatest risk of falls: a National Cohort Study

Wei WE, De Silva DA, Chang HM, Yao J, Matchar DB, Young SHY, See SJ, Lim GH, Wong TH, Venketasubramanian N. *BMC Geriatr.* 2020; 19(1): e373.

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Abstract

BACKGROUND: Stroke patients have increased risks of falls. We examined national registry data to evaluate the association between post-stroke functional level and the risk of low falls among post-stroke patients.

METHODS: This retrospective cohort study analyzed data from national registries to examine the risk factors for post-stroke falls. Data for patients who suffered ischemic strokes and survived the index hospital admission was obtained from the Singapore National Stroke Registry and matched to the National Trauma Registry, from 2011 to 2015. The primary outcome measure was a low fall (fall height ≤ 0.5 m). Competing risk analysis was performed to examine the association between functional level (by modified Rankin score [mRS] at discharge) and the risk of subsequent low falls.

RESULTS: In all, 2255 patients who suffered ischemic strokes had recorded mRS. The mean age was 66.6 years and 58.5% were men. By the end of 2015, 54 (2.39%) had a low fall while 93 (4.12%) died. After adjusting for potential confounders, mRS was associated with fall risk with an inverted U-shaped relationship. Compared to patients with a score of zero, the sub-distribution hazard ratio (SHR) increased to a maximum of 3.42 (95%CI:1.21-9.65, $p = 0.020$) for patients with a score of 2. The SHR then declined to 2.45 (95%CI:0.85-7.12, $p = 0.098$), 2.86 (95%CI:0.95-8.61, $p = 0.062$) and 1.93 (95%CI:0.44-8.52, $p = 0.38$) for patients with scores of 3, 4 and 5 respectively.

CONCLUSIONS: An inverted U-shaped relationship between functional status and fall risk was observed. This is consistent with the complex interplay between decreasing mobility (hence decreased opportunity to fall) and increasing susceptibility to falls. Fall prevention intervention could be targeted accordingly. (263 words).

Language: en

Keywords

Falls; Function; Modified Rankin scale; Stroke

A cross-dataset deep learning-based classifier for people fall detection and identification

Delgado-Escañó R, Castro FM, Cózar JR, Marín-Jiménez MJ, Guil N, Casilari E. *Comput. Methods Programs Biomed.* 2019; 184: e105265.

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Abstract

BACKGROUND AND OBJECTIVE: Fall detection is an important problem for vulnerable sectors of the population such as elderly people, who frequently live alone. Note that a fall can be very dangerous for them if they cannot ask for help. Hence, in those situations, an automatic system that detected and informed to emergency services about the fall and subject identity could help to save lives. This way, they would know not only when but also who to help. Thus, our objective is to develop a new approach, based on deep learning, for fall detection and people identification that can be used in different datasets without any fine-tuning of the model parameters.

METHODS: We present a dataset-independent deep learning-based model that, by employing a multi-task learning approach, uses raw inertial information as input to solve simultaneously two tasks: fall detection and subject identification. By this way, our approach is able to automatically learn the best representations without any constraint introduced by the pre-processed features.

RESULTS: Our cross-dataset classifier is able to detect falls with more than a 98% of accuracy in four datasets recorded under different conditions (i.e. accelerometer device, sampling rate, sequence length, age of the subjects, etc.). Moreover, the number of false positives is very low - on average less than 1.6% - establishing a new state-of-the-art. Finally, our classifier is also capable of correctly identifying people with an average accuracy of 79.6%.

CONCLUSIONS: The presented approach performs both tasks (fall detection and people identification) by using a single model and achieving real-time execution. The obtained results allow us to assert that a single model can be used for both fall detection and people identification under different conditions, easing its real implementation, as it is not necessary to train the model for new subjects.

Language: en

Keywords

Activities of daily living; Convolutional neural network; Fall detection; Inertial sensors; Long short-term memory; Multi-task

A dataset build using wearable inertial measurement and ECG sensors for activity recognition, fall detection and basic heart anomaly detection system

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Abstract

This paper defines two major data sets 1) from wearable inertial measurement sensors and 2) wearable ECG SHIMMER™ sensors. The first dataset is devised to benchmark techniques dealing with human behavior analysis based on multimodal inertial measurement wearable SHIMMER™ sensors unit during research studies "Fall Detection System for the Elderly Based on the Classification of Shimmer Sensor Prototype Data" [2] and "A novel fall detection algorithm for elderly using SHIMMER wearable sensors" [3]. The SHIMMER inertial sensor is a lightweight sensing device, incorporated with tri-axial accelerometer, a tri-axial gyroscope and tri-axial magnetometer, mounted on the waist of the subjects. The second dataset is developed to assess the feasibility of using SHIMMER™ wearable third generation ECG sensors for identification of basic heart anomalies by remote ECG analysis. The experimental protocol was carried out according to the Timed Up and Go (TUG) test [1], which is mainly used in fall detection and fall risk assessment systems specially designed for elderly. Three daily life activities such as standing still, walking and sitting on chair and getup were performed along with fall activity in controlled environment. This dataset is available on Data in Brief Dataverse [4] and a data repository [5].

Language: en

Keywords

Daily life activities; ECG analysis; ECG sensor; Fall detection systems; Inertial sensors; SHIMMERTM; TUG test

Development of a smartphone-based balance assessment system for subjects with stroke

Hou YR, Chiu YL, Chiang SL, Chen HY, Sung WH. *Sensors (Basel)* 2020; 20(1): s20010088.

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Abstract

Stroke is a cerebral artery disease that negatively affects activities of daily living (ADLs) and quality of life (QoL). Smartphones have demonstrated strong potential in assessing balance performance. However, such smartphone-based tools have thus far not been applied to stroke survivors. The purpose of this study was to develop a smartphone-based balance assessment system for subjects who have experienced strokes and evaluate the system feasibility. The smartphone-based balance assessment application was developed with Android Studio, and reliability and validity tests were conducted. The smartphone was used to record data using a built-in accelerometer and gyroscope, and increased changes represented greater instability. Six postures were tested for 30 s each. Ten healthy adults were recruited in the reliability test, and the intraclass correlation coefficient (ICC) was used to analyze the within-day and between-day reliabilities. Eight subjects with chronic stroke and eight healthy adults were recruited for the validity test, in which balance performance was compared to represent the application validity. The ICC values of the reliability tests were at least 0.76 ($p = 0.00$). The acceleration data exhibited no difference between individuals who have experienced stroke and healthy subjects; however, all six postures were found to differ significantly between the two groups in the gyroscope data. The study demonstrates that the smartphone application provides a convenient, reliable, and valid tool for the balance assessments of subjects who have experienced chronic stroke.

Language: en

Keywords

balance; smartphone; stroke

Effect of induced hyperopia on fall risk and Fourier transformation of postural sway

Moon BY, Choi JH, Yu DS, Kim SY. PeerJ 2019; 7: e8329.

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Abstract

BACKGROUND AND PURPOSE: Fall accidents are a social challenge in Korea and elsewhere. Most previous studies have focused on the effects of reduced visual acuity due to myopia on falls and body balance. The objective of this study was to investigate whether uncorrected hyperopia was a major risk factor for falls and to establish whether the risk of falls was absolutely correlated with visual acuity.

METHODS: Fifty-one young subjects with a mean age of 22.75 ± 2.13 years were enrolled in this study. To induce hyperopic and myopic refractive errors, spherical lenses of ± 1.0 - 6.0 D (1.0 D stepwise) were used. Under each induced condition, fall risk index and sway power were assessed via Fourier transformation of postural sway using a TETRAX system.

RESULTS: The fall risk index for eyes-closed was significantly greater than that of eyes-open with full correction ($t = -5.876$, $p < 0.05$). The fall risk index increased significantly from hyperopia induced with -4.0 D lenses (with visual acuity of 0.69 ± 0.32) compared to eyes-open with full correction ($F = 3.213$, $p < 0.05$). However, there was no significant change in the induced myopia conditions, despite a drastic decline in decimal visual acuity. Sway power increased significantly in the low-to-medium frequency band derived from the peripheral vestibular system when hyperopia was induced. A significant difference was detected in hyperopia induced with -6.0 D lenses compared to eyes-open with full correction ($F = 4.981$, $p = 0.017$).

CONCLUSION: An uncorrected hyperopia rather than myopia may increase the risk of falls, although eyes may show normal visual acuity due to the inherent accommodation mechanism. Our findings suggest that the corrected state of refractive errors is more important than the level of visual acuity as the criteria for appropriate visual input, which contributes to stable posture. Therefore, clinicians should consider the refractive condition, especially the characteristics of hyperopia, when analyzing body balance, and appropriate correction of uncorrected hyperopia to prevent falls.

Language: en

Keywords

Fall risk index; Fourier spectrum of postural sway; Hyperopia; Sway power

Forward functional stability indicator (FFSI) as a reliable measure of limits of stability

Słomka KJ, Michalska J, Marszałek W, Bacik B, Juras G. *MethodsX* 2020; 7: 10-16.

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Abstract

Functional stability has been studied in diverse populations, yet the possibility to compare the results across them and the knowledge about actual performance referenced to the maximum capacity is limited. Our aim was to improve the functional limits of stability testing and introduced Forward Functional Stability Indicator (FFSI) as a reliable measure of functional stability. The study participants were not able to cross the projected forward anatomical stability limit (FASL). It is located at the level of first metatarsophalangeal joints and should be considered a mechanical limit of the maximal voluntary centre of foot pressure (COP) excursion (MVE). It was only true when the whole feet were in contact with the ground. There were statistically significant differences in limits of stability (LOS) test results in the conditions when the heels were raised and the toes muscles were contracted isometrically. The proposed forward functional stability indicator (FFSI) is a highly reliable measure of functional stability, which provides information about the actual performance with reference to maximum capacity and is easy to compare across normal and clinical populations. •The proposed forward functional stability indicator (FFSI) is a highly reliable measure of functional stability. •FFSI provides information about the actual performance with reference to maximum capacity and is easy to compare across normal and clinical populations. •The forward anatomical stability limit (FASL) is located at the level of first metatarsophalangeal joints and should be considered a mechanical limit of the maximal voluntary centre of pressure (COP) excursion when certain measurement criteria are met.

Language: en

Keywords

Balance; Foot antropometry; Forward Functional Stability Indicator (FFSI); Forward anatomical stability limit

Incidence of falls among adults with cerebral palsy: a cohort study using primary care data

Ryan JM, Cameron MH, Liverani S, Smith KJ, O'connell N, Peterson MD, Anokye N, Victor C, Boland F. *Dev. Med. Child Neurol.* 2019; ePub(ePub): ePub.

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DOI 10.1111/dmcn.14444 **PMID** 31879951

Abstract

AIM: To compare the rate of falls between adults with and without cerebral palsy (CP).

METHOD: We used primary care data on 1705 adults with CP and 5115 adults without CP matched for age, sex, and general practice attended. We compared odds of experiencing a fall between adults with and without CP using conditional logistic regression. We compared the rate of falls using a negative binomial model.

RESULTS: Participants were 3628 males (53%) and 3192 females (47%) (median age 29y, interquartile range 20-42y) at the start of follow-up. Follow-up was 14 617 person-years for adults with CP and 56 816 person-years for adults without CP. Of adults with CP, 15.3% experienced at least one fall compared to 5.7% of adults without CP. Adults with CP had 3.64 times (95% confidence interval [CI] 2.98-4.45) the odds of experiencing a fall compared to adults without CP. The rate of falls was 30.5 per 1000 person-years and 6.7 per 1000 person-years for adults with and without CP respectively (rate ratio 5.83, 95% CI 4.84-7.02)

INTERPRETATION: Adults with CP are more likely to fall, and fall more often, than adults without CP. The causes and consequences of falls in adults with CP need examination.

Language: en

Individuals with peripheral vestibulopathy and poor quality of sleep are at a higher risk for falls

Andrade Junior MC, Stefanini R, Gazzola JM, Haddad FLM, Ganança FF. Rev. Bras. Otorrinolaringol. 2019; ePub(ePub): ePub.

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Abstract

INTRODUCTION: There is a lack of scientific studies on the assessment of patients with vestibular disorders associated with sleep quality disorders and its impact on the balance and overall quality of life.

OBJECTIVES: to assess the impact of the sleep quality on the balance and quality of life of individuals with peripheral vestibulopathies.

METHODS: 52 individuals with peripheral vestibulopathies underwent sleep quality assessment through the Pittsburgh sleep quality index, neurotological examination through dizziness handicap inventory and Tetrax posturography (Sunlight Medical Ltd.) in eight sensory conditions. Thirty-two healthy individuals (G3) participated as the control group.

RESULTS: Fourteen individuals with vestibulopathy had good quality of sleep (G1) and 38 showed poor quality of sleep (G2) as demonstrated by the Pittsburgh sleep quality index global scores ($p=0.001$). The dizziness handicap inventory showed worse impact of the dizziness on the quality of life in G2 when compared to G1 ($p=0.045$). The G2 showed higher risk of falling in posturography when compared to G3 ($p=0.012$) and higher index of postural instability in five sensory conditions in comparison with G3. In the vestibulopathy groups, the worse the sleep quality, the higher the risk of falling ($r=0.352$) and the worse the quality of life ($r=0.327$).

CONCLUSION: Individuals with peripheral vestibulopathies and poor quality of sleep demonstrate worse balance evidenced by increased postural instability, higher risk of falls and worse perceived quality of life. The quality of sleep is a predictive factor for worse perceived quality of life and for higher risk of falls in individuals with peripheral vestibulopathies.

Language: en

Keywords

Distúrbios do sono; Distúrbios vestibulares; Equilíbrio postural; Postural balance; Qualidade de vida; Quality of life; Sleep disorders; Vestibular disorders