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Brain activation changes during balance- and attention-demanding tasks in middle- and older-aged adults with multiple sclerosis

Hernandez ME, O'Donnell E, Chaparro G, Holtzer R, Izzetoglu M, Sandroff BM, Motl RW. *Motor Control* 2019; ePub(ePub): ePub.

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PMID

30987505

Abstract

Functional near-infrared spectroscopy was used to evaluate prefrontal cortex activation differences between older adults with multiple sclerosis (MS) and healthy older adults (HOA) during the performance of a balance- and attention-demanding motor task. Ten older adults with MS and 12 HOA underwent functional near-infrared spectroscopy recording while talking, virtual beam walking, or virtual beam walking while talking on a self-paced treadmill. The MS group demonstrated smaller increases in prefrontal cortex oxygenation levels than HOA during virtual beam walking while talking than talking tasks. These findings indicate a decreased ability to allocate additional attentional resources in challenging walking conditions among MS compared with HOA. This study is the first to investigate brain activation dynamics during the performance of balance- and attention-demanding motor tasks in persons with MS.

Language: en

Keywords

cognitive control; divided attention; gait

Effects of pilates on fall risk factors in community-dwelling elderly women: a randomized, controlled trial

Aibar-Almazán A, Martínez-Amat A, Cruz-Díaz D, De la Torre-Cruz MJ, Jiménez-García JD, Zagalaz-Anula N, Pérez-Herrezuelo I, Hita-Contreras F. *Eur. J. Sport Sci.* 2019; ePub(ePub): ePub.

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PMID

30990762

Abstract

OBJECTIVE: the main objective was to analyze the effects that an exercise programme based on the Pilates method would have on balance confidence, fear of falling, and postural control among women ≥ 60 years old.

METHODS: a total of 110 women (69.15 ± 8.94 years) participated in this randomized, controlled trial that took place in Jaén (Spain). The participants were randomly assigned to either a control group ($n = 55$), which received no intervention, or to a Pilates group ($n = 55$), which carried out an exercise programme based on the Pilates method in 60-minute sessions for 12 weeks. The Falls Efficacy Scale-International and the activity-specific balance confidence scale were respectively used to assess fear of falling and balance confidence in performing activities of daily living. Postural control was evaluated using a stabilometric platform.

RESULTS: Regarding balance confidence, the Pilates group showed higher values compared to the control group (77.52 ± 18.27 vs 72.35 ± 16.39 , Cohen's $d = 0.030$). Women in the Pilates group showed lower fear of falling, compared to those of the control group (22.07 ± 5.73 vs 27.9 ± 6.95 , Cohen's $d = 0.041$). Finally, concerning static balance, participants of the Pilates group experienced statistically significant improvements on the velocity and anteroposterior movements of the centre of pressure with eyes open and closed respectively (Cohen's $d = 0.44$ and 0.35 respectively).

CONCLUSION: A 12-week Pilates training programme has beneficial effects on balance confidence, fear of falling and postural stability, in elderly women.

Language: en

Keywords

Menopause; Pilates; falls; fear of falling; postural balance

Factors associated with impairment in gait speed in older people with clinically normal gait. A cross-sectional study

Caballero-Mora MA, Rodríguez Mañas L, Valdés-Aragónés M, García-Sánchez I, Alonso-Bouzon C, Castro Rodríguez M, Nuñez-Jimenez L, Esteban A, Rodríguez-Laso A. *Aging Clin. Exp. Res.* 2019; ePub(ePub): ePub.

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30989508

Abstract

BACKGROUND: Health professionals commonly use gait speed in the evaluation of functional status in older people. However, only a limited number of studies have assessed gait speed in the absence of disorders of gait, using confounding factors and exclusion criteria coming from studies conducted in younger people. Our study aims to analyse which factors are associated with gait speed in older people with normal clinical gait.

METHODS: An observational cross-sectional study was conducted in 119 community-dwelling residents without relevant comorbidities (Charlson index < 2), preserved function (Barthel > 85) and normal gait by visual exploration. Exclusion criteria included suffering from any illness that could modify the characteristics of gait, terminal status or the presence of an acute medical illness in the past 3 months. We used a stepwise linear regression of several variables (sociodemographic characteristics, cognition, body composition, drugs, falls, sarcopenia, frailty and physical activity) on 6-metre gait speed.

RESULTS: The mean age was 78 years (range 70-96 years) and 71.4% were women. Variables that remained associated with gait speed in the multivariate final model were age (B = - 0.020, p < 0.001); gender (B = - 0.184, p < 0.001); waist-to-height ratio (B = - 0.834, p = 0.002); number of falls (B = - 0.049, p = 0.003) and the number of Fried's frailty criteria (B = - 0.064, p = 0.019).

CONCLUSION: Falls, frailty and the waist-to-height ratio modify gait speed in older people with normal gait. Studies analysing the potential effect of several factors on gait speed should consider them as confounding factors.

Language: en

Keywords

Confounding factors; Falls; Frailty; Gait speed; Older people; Waist-to-height ratio

Falls Sensei: a serious 3D exploration game to enable the detection of extrinsic home fall hazards for older adults

Money AG, Atwal A, Boyce E, Gaber S, Windeatt S, Alexandrou K. *BMC Med. Inform. Decis. Mak.* 2019; 19(1): e85.

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Abstract

BACKGROUND: Falls are the main cause of death and injury for older adults in the UK. Many of these falls occur within the home as a result of extrinsic falls risk factors such as poor lighting, loose/uneven flooring, and clutter. Falls education plays an important role in self-management education about extrinsic hazards and is typically delivered via information leaflets, falls apps, and educational booklets. Serious games have the potential of delivering an engaging and informative alternative to traditional methods but almost exclusively, these are currently delivered as exergaming applications that focus solely on intrinsic falls risk factors. This study presents 'Falls Sensei' a first-person 3D exploration game that aims to educate older adults about extrinsic falls risk factors within the home environment. After presenting Falls Sensei, game usability and older adults' perceptions and attitudes towards using the game in practice are explored.

METHODS: This study involved 15 community dwelling older adults. After playing the Falls Sensei game, participants completed a Systems Usability Scale (SUS) questionnaire and post task interview, and follow-up interviews three weeks later. Inductive and deductive thematic template analysis, informed by the Unified Theory of Acceptance and Use of Technology model, was used to analyse the think-aloud, post-task and follow-up interview transcripts. Descriptive statistical analysis and one-sampled t-tests were used to analyse log-file data and SUS responses.

RESULTS: Three high-level themes emerged from the analysis of transcriptions: Performance Expectancy; Effort Expectancy; Social Influence. The SUS score was 77.5/100 which indicates 'Good' levels of usability. Interestingly, reported usability of the game increased with participant age. Participants were positive about the usability of the game ($p \leq 0.05$ for 9/10 items). The most memorable fall hazards were those most commonly encountered in the game or those most challenging to participants.

CONCLUSIONS: The results support the use of serious games as an engaging tool for educating older adults about extrinsic falls risk factors. Awareness of home hazard detection was raised by the game, and some older adults became more aware for the need to adapt their own homes after gameplay. Further research would be needed to draw comparisons with established interventions.

Keywords

3D; Falls prevention; Game-based learning; Health education; Occupational therapy; Older adults; Serious games; Virtual reality

Gait impairments in Parkinson's disease

Mirelman A, Bonato P, Camicioli R, Ellis TD, Giladi N, Hamilton JL, Hass CJ, Hausdorff JM, Pelosin E, Almeida QJ. *Lancet Neurol*. 2019; ePub(ePub): ePub.

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30975519

Abstract

Gait impairments are among the most common and disabling symptoms of Parkinson's disease. Nonetheless, gait is not routinely assessed quantitatively but is described in general terms that are not sensitive to changes ensuing with disease progression. Quantifying multiple gait features (eg, speed, variability, and asymmetry) under natural and more challenging conditions (eg, dual-tasking, turning, and daily living) enhanced sensitivity of gait quantification. Studies of neural connectivity and structural network topology have provided information on the mechanisms of gait impairment. Advances in the understanding of the multifactorial origins of gait changes in patients with Parkinson's disease promoted the development of new intervention strategies, such as neurostimulation and virtual reality, aimed at alleviating gait impairments and enhancing functional mobility. For clinical applicability, it is important to establish clear links between specific gait impairments, their underlying mechanisms, and disease progression to foster the acceptance and usability of quantitative gait measures as outcomes in future disease-modifying clinical trials.

Language: en

Involvement of cortical dysfunction in frequent falls in patients with Parkinson's disease

Otomune H, Mihara M, Hattori N, Fujimoto H, Kajiyama Y, Konaka K, Mitani Y, Watanabe Y, Mochizuki H. *Parkinsonism Relat. Disord.*2019; ePub(ePub): ePub.

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30992233

Abstract

INTRODUCTION: Gait and balance disorders are common clinical features of Parkinson's disease (PD). Although falls significantly affect the activities of daily living (ADL) and quality of life (QOL) of patients with PD, the underlying neural mechanisms associated with frequent falls in PD patients are still unclear.

METHODS: Hypothesizing that the cerebral cortex would contribute to frequent falls in PD, we obtained 3D T1-weighted images from 91 non-dementia patients with PD and performed voxel-based morphometric analysis (VBM). Gray matter volume was compared between patients with and without frequent falls to investigate the structural basis for frequent falls in PD. As an ancillary analysis, we also performed resting-state functional magnetic resonance analysis using data from 58 patients.

RESULTS: Among the 91 patients, 36 had experienced frequent falls. Gray matter volume in the right superior temporal gyrus (STG) and the right inferior parietal lobule (IPL) of these patients was significantly lower than that of the non-frequent fallers. There was also a significant correlation between fall frequency and gray matter volume in these two regions. Additionally, resting-state functional analysis revealed lower connectivity in the right posterior perisylvian region, including in the IPL and STG, in frequent fallers than in non-frequent fallers.

CONCLUSION: Frequent falls in PD are associated with structural and functional abnormality of the cerebral cortex including the right IPL and STG.

Language: en

Keywords

Accidental falls; Cerebral cortex; Gray matter; Parkinson disease

Predicting incident falls: relationship between postural sway and limits of stability in older adults

Johansson J, Jarocka E, Westling G, Nordström A, Nordström P. *Hum. Mov. Sci.* 2019; 66: 117-123.

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30981147

Abstract

BACKGROUND: We have previously shown that objective measurements of postural sway predicts fall risk, although it is currently unknown how limits of stability (LOS) might influence these results. **RESEARCH QUESTION:** How integrated postural sway and LOS measurements predict the risk of incident falls in a population-based sample of older adults.

METHODS: The sample for this prospective observational study was drawn from the Healthy Ageing Initiative cohort and included data collected between June 2012 and December 2016 for 2396 men and women, all 70 years of age. LOS was compared to postural sway with measurements during eyes-open (EO) and eyes-closed (EC) trials, using the previously validated Wii Force Plate. Fall history was assessed during baseline examination and incident falls were collected during follow-up at 6 and 12 months. Independent predictors of incident falls and additional covariates were investigated using multiple logistic regression models.

RESULTS: During follow-up, 337 out of 2396 participants (14%) had experienced a fall. Unadjusted regression models from the EO trial revealed increased fall risk by 6% (OR 1.06, 95% CI 1.02-1.11) per each centimeter squared increase in sway area and by 16% (OR 1.16, 95% CI 1.07-1.25) per 1-unit increase in Sway-Area-to-LOS ratio. Odds ratios were generally lower when analyzing EC trials and only slightly attenuated in fully adjusted models. **SIGNIFICANCE:** Integrating postural sway and LOS parameters provides valid fall risk prediction and a holistic analysis of postural stability. Future work should establish normative values and evaluate clinical utility of these measures.

Language: en

Keywords

Cohort study; Incident falls; LOS; Objective measures; Postural sway

Prediction of freezing of gait in Parkinson's disease using statistical inference and lower-limb acceleration data

Naghavi N, Wade E. [IEEE Trans. Neural Syst. Rehabil. Eng.](#) 2019; ePub(ePub): ePub.

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PMID

30990186

Abstract

Freezing of gait (FoG) is a common type of motor dysfunction in advanced Parkinson's disease (PD) associated with falls. Over the last decade, a significant amount of studies has been focused on detecting FoG episodes in clinical and home environments. Yet, there remains a paucity of techniques regarding real-time prediction of FoG before its occurrence. In this study a new algorithm was employed to define the best combination of sensor position, axis, sampling window length and features to predict FoG. We hypothesized that gait deterioration before FoG onsets can be discriminated from normal gait using statistical analysis of features from successive windows of data collected from lower-limb accelerometers. We defined a new performance measure, "predictivity", to compare the number of correctly predicted FoG events among different combinations. We characterized the system performance using data from 10 PD patients who experienced FoG while performing several walking tasks in a lab environment. The analysis of 120 different combinations revealed that prediction of FoG can be realized by using an individual shank sensor and sample entropy calculated from the horizontal forward axis with window length of 2s (88.8%, 92.5% and 89.0% for average predictivity, sensitivity and specificity, respectively).

Language: en

Prevalence, severity, and risk of future falls in community-dwelling older adults living in a rural community: the Atahualpa Project

Del Brutto OH, Mera RM, Peinado CD, Sedler MJ. *J. Community Health* 2019; ePub(ePub): ePub.

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30989455

Abstract

Accidental falls are a leading cause of disability and death in older adults living in urban centers. However, little is known about the consequences of falls in rural communities. We aimed to assess characteristics and risk of falls in community-dwellers aged ≥ 60 years living in rural Ecuador. Of 463 older adults enrolled in the Atahualpa Project, 327 (71%) were included. Multivariate logistic regression models were fitted to assess factors associated with history of falls and risk of future falls. Sensitivity analysis was conducted to determine which component of the Downton fall risk index (DFRI) better predicts risk of future falls. A history of falls was reported by 173 (53%) individuals. Most were related to stumbling due to uneven (non-paved) streets. Only three individuals had bone fractures after the fall. Previous falls were not associated with any of the investigated covariables. The DFRI was positive in 87 (27%) participants, and was associated with age ($p < 0.001$) and history of stroke ($p < 0.001$). None of the subjects were taking tranquilizers/sedatives. The most reliable component of the DFRI was the presence of sensory/motor deficits. History of falls in our population is similar to that reported elsewhere. However, the risk of future falls is lower. Such discrepancies are probably because the DFRI does not take into account environmental factors resulting in falls. There were almost no severe complications from falls, which could be partly related to the lack of use of tranquilizers/sedatives.

Language: en

Keywords

Downton fall risk index; Falls; Older adults; Population study; Rural communities

Prognostic factors that modify outcomes of vestibular rehabilitation in elderly patients with falls

Rossi-Izquierdo M, Gayoso-Diz P, Santos-Pérez S, Del-Río-Valeiras M, Faraldo-García A, Vaamonde-Sánchez-Andrade I, Lirola-Delgado A, Soto-Varela A. *Aging Clin. Exp. Res.* 2019; ePub(ePub): ePub.

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PMID

30977081

Abstract

BACKGROUND: Our previous study has shown that vestibular rehabilitation (VR) is an effective technique to reduce falls in elderly patients. It would be interesting to establish patients' clinical characteristics in which vestibular rehabilitation is expected to be more effective. **AIMS:** Evaluate factors that could modify rehabilitation outcomes in elderly patients with previous falls.

METHODS: Fifty-seven patients randomized to one of the intervention group (computerized dynamic posturography-CDP-training, optokinetic stimulus or exercise at home) and with previous falls were analyzed. Patients were assessed with objective outcome measures (sensorial organization test and limits of stability-LOS-of CDP, modified timed up and go test-TUG-and number of falls) and with subjective outcome measures (dizziness handicap inventory and Short falls efficacy scale-international-Short FES-I) during a 12-month follow-up period.

RESULTS: In the logistic regression model, a worse score in the maximum excursion (MXM), and a shorter time in the TUG significantly associated with a reduction > 50% of falls. Also, association with a higher score in the Short FES-I was close to a statistical significance. There was no statistical significance association with other covariables.

DISCUSSION: In patients with reduced limits of stability, VR seems to be more effective and they should be encouraged to perform it. But on the other hand, patients with longer time in the TUG show worse outcomes and may benefit more with gait training.

CONCLUSIONS: VR in elderly people with previous falls is effective regardless of their age and gender.

Language: en

Keywords

Elderly; Falls; Outcomes; Prognostic factor; Vestibular rehabilitation

Sarcopenia and its association with falls and fractures in older adults: a systematic review and meta-analysis

Yeung SSY, Reijnierse EM, Pham VK, Trappenburg MC, Lim WK, Meskers CGM, Maier AB. *J. Cachexia Sarcopenia Muscle* 2019; ePub(ePub): ePub.

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30993881

Abstract

Sarcopenia is a potentially modifiable risk factor for falls and fractures in older adults, but the strength of the association between sarcopenia, falls, and fractures is unclear. This study aims to systematically assess the literature and perform a meta-analysis of the association between sarcopenia with falls and fractures among older adults. A literature search was performed using MEDLINE, EMBASE, Cochrane, and CINAHL from inception to May 2018. Inclusion criteria were the following: published in English, mean/median age ≥ 65 years, sarcopenia diagnosis (based on definitions used by the original studies' authors), falls and/or fractures outcomes, and any study population. Pooled analyses were conducted of the associations of sarcopenia with falls and fractures, expressed in odds ratios (OR) and 95% confidence intervals (CIs). Subgroup analyses were performed by study design, population, sex, sarcopenia definition, continent, and study quality. Heterogeneity was assessed using the I^2 statistics. The search identified 2771 studies. Thirty-six studies (52 838 individuals, 48.8% females, and mean age of the study populations ranging from 65.0 to 86.7 years) were included in the systematic review. Four studies reported on both falls and fractures. Ten out of 22 studies reported a significantly higher risk of falls in sarcopenic compared with non-sarcopenic individuals; 11 out of 19 studies showed a significant positive association with fractures. Thirty-three studies (45 926 individuals) were included in the meta-analysis. Sarcopenic individuals had a significant higher risk of falls (cross-sectional studies: OR 1.60; 95% CI 1.37-1.86, $P < 0.001$, $I^2 = 34\%$; prospective studies: OR 1.89; 95% CI 1.33-2.68, $P < 0.001$, $I^2 = 37\%$) and fractures (cross-sectional studies: OR 1.84; 95% CI 1.30-2.62, $P = 0.001$, $I^2 = 91\%$; prospective studies: OR 1.71; 95% CI 1.44-2.03, $P = 0.011$, $I^2 = 0\%$) compared with non-sarcopenic individuals. This was independent of study design, population, sex, sarcopenia definition, continent, and study quality. The positive association between sarcopenia with falls and fractures in older adults strengthens the need to invest in sarcopenia prevention and interventions to evaluate its effect on falls and fractures.

Language: en

Keywords

Falls; Fractures; Meta-analysis; Sarcopenia

Unintentional falls mortality in China, 2006-2016

Cheng P, Wang L, Ning P, Yin P, Schwebel DC, Liu J, Qi J, Hu G, Zhou M. [J. Glob. Health](#) 2019; 9(1): e010603.

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30992985

PMCID

[PMC6445498](https://pubmed.ncbi.nlm.nih.gov/30992985/)

Abstract

BACKGROUND: To examine trends in unintentional falls mortality from 2006 to 2016 in China by location (urban/rural), sex, age group and mechanism.

METHODS: Mortality data were retrieved from the National Disease Surveillance Points system (DSPs) of China, a nationally representative data source. Percent change in mortality between 2006 and 2016 was calculated as "mortality rate ratio - 1" based on a negative binomial regression model.

RESULTS: The crude unintentional falls mortality was 9.55 per 100 000 population in 2016. From 2006 to 2016, the age-adjusted unintentional falls mortality increased by 5% (95% confidence interval (CI) = 1%-9%), rising from 7.65 to 8.03 per 100 000 population. Males, rural residents and older age groups consistently had higher falls mortality rates than females, urban residents and younger age groups. Falls on the same level from slipping, tripping and stumbling (W01) was the most common mechanisms of falls mortality, accounting for 29% of total mortality.

CONCLUSIONS: Unintentional falls continued to be a major cause of death in China from 2006 to 2016. Empirically-supported interventions should be implemented to reduce unintentional falls mortality.

Language: en

What enables older people to continue with their falls prevention exercises? A qualitative systematic review

Finnegan S, Bruce J, Seers K. [BMJ Open](#) 2019; 9(4): e026074.

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PMID

30992291

Abstract

OBJECTIVES: To review the qualitative literature that explores the barriers and facilitators to continued participation in falls prevention exercise after completion of a structured exercise programme.

DESIGN: A systematic literature review with thematic synthesis of qualitative studies exploring older adults' experiences of continued participation in falls prevention exercise.

DATA SOURCES: Comprehensive searches were conducted in MEDLINE, PSYCHinfo, AMED, ASSIA, CINAHL and EMBASE from inception until November 2017. Additional studies were identified via searches of reference lists and citation tracking of relevant studies.

ELIGIBILITY CRITERIA: Qualitative or mixed methods studies exploring experiences of community-dwelling older adults (65 years and over) participation in a falls prevention exercise programme including their experience of ongoing participation in exercise after the completion of a structured exercise programme. **DATA EXTRACTION AND SYNTHESIS:**

Key characteristics including aim, participant characteristics, method of data collection, underpinning qualitative methodology and analytical approach were extracted and independently checked. Thematic synthesis was used to integrate findings.

RESULTS: From 14 studies involving 425 participants, we identified three descriptive themes: identity, motivators/deterrents and nature of the intervention and one overarching analytical theme: agency.

CONCLUSIONS: Older people have their own individual and meaningful rationale for either continuing or stopping exercise after completion of a structured falls prevention exercise programme. Exploring these barriers and facilitators to continued exercise is key during the intervention phase. It is important that health care professionals get to know the older person's rationale and offer the best evidence-based practice and support to individuals, to ensure a smooth transition from their structured intervention towards longer-term exercise-related behaviour. **PROSPERO REGISTRATION NUMBER:** CRD42017082637.

Language: en

Keywords

exercise; falls prevention; long-term participation; qualitative research