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Accuracy of a wavelet-based fall detection approach using an accelerometer and a barometric pressure sensor

Ejupi A, Galang C, Aziz O, Park EJ, Robinovitch S.

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(Copyright © 2017, IEEE (Institute of Electrical and Electronics Engineers))

DOI 10.1109/EMBC.2017.8037280 PMID 29060322

Abstract

GOAL: Falls are a major source of morbidity in older adults, and 50% of older adults who fall cannot rise independently after falling. Wearable sensor-based fall detection devices may assist in preventing long lies after falls. The goal of this study was to determine the accuracy of a novel wavelet-based approach to automatically detect falls based on accelerometer and barometric pressure sensor data.

METHODS: Participants (n=15) mimicked a range of falls, near falls, and activities of daily living (ADLs) while wearing accelerometer and barometric pressure sensors on the lower back, chest, wrists and thighs. The wavelet transform using pattern adapted wavelets was applied to detect falls from the sensor data.

RESULTS: In total, 525 trials (194 falls, 105 near-falls and 226 ADLs) were included in our analysis. When we applied the wavelet-based method on only accelerometer data, classification accuracies ranged from 82% to 96%, with the chest sensor providing the highest accuracy. Accuracy improved by 3.4% on average ($p=0.041$; $SD=3.0\%$) when we also included the barometric pressure sensor data. The highest classification accuracies (of 98%) were achieved when we combined wavelet-based features and traditional statistical features in a multiphase fall detection model using machine learning.

CONCLUSION: We show that the wavelet-based approach accurately distinguishes falls from near-falls and ADLs, and that it can be applied on wearable sensor data generated from various body locations. Additionally, we show that the accuracy of a wavelet-based fall detection system can be further improved by combining accelerometer and barometric pressure sensor data, and by incorporating wavelet and statistical features in a machine learning classification algorithm.

PDF Y Endnote Y

An elderly fall detection using a wrist-worn accelerometer and barometer

Jatesiktat P, Wei

Tech Ang. Conf. Proc. IEEE Eng. Med. Biol. Soc. 2017; 2017: 125-130.

(Copyright © 2017, IEEE (Institute of Electrical and Electronics Engineers))

DOI 10.1109/EMBC.2017.8036778 PMID 29059826

Abstract

As the world population is growing toward an aging society, elderly fall becomes a serious problem. Automatic fall detection and alert systems could shorten their waiting time after a fall and mitigate its physical and mental negative consequences. This work proposes a method that integrates a 3-axis accelerometer and a barometer on a wrist-worn device for the fall detection task. The method focuses on the use of noisy signals from a barometer in both pre-processing steps and feature extractions. A use of free falling events to address the lack of training data in a learning process is also explored. An evaluation using simulated falls and various activities shows a high classification performance except for a few false alarms occurring when sitting on the floor from a standing pose.

PDF Y Endnote Y**Analysis of gait pattern during stair walk for improvement of gait training robot**

Sang-Eun Park, Ye Ji Ho, Youngjin Moon, Jaesoon Choi.

Conf. Proc. IEEE Eng. Med. Biol. Soc. 2017; 2017: 1905-1908.

(Copyright © 2017, IEEE (Institute of Electrical and Electronics Engineers))

DOI 10.1109/EMBC.2017.8037220 **PMID** 29060264

Abstract

This paper seeks stair gait patterns which can improve effectiveness of gait training by applying to robotic locomotion therapy system. To get applicable data for stair walking function of the system, the stair walk of five subjects were measured by a motion capture system. From the acquired data, trajectories of each joint angle and relative change of the joints were calculated in the anatomical sagittal plane. Also, we were attempt to create more natural stair gait pattern by analyzing the movement of hip on the transverse plane.

PDF Y Endnote Y**Anticoagulated trauma patients: a Level I trauma center's response to a growing geriatric population**

Mason MD, Spilman SK, Fuchsen EA, Olson SD, Sidwell RA, Swegle JR, Sahr SM.

J. Emerg. Med. 2017; 53(4): 458-466.

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(Copyright © 2017, Elsevier Publishing)

DOI 10.1016/j.jemermed.2017.05.023 **PMID** 29079066

Abstract

BACKGROUND: Injured older adults often receive delayed care in the emergency department (ED) because they do not meet criteria for trauma team activation (TTA). This is particularly dangerous for the increasing number of patients taking anticoagulant or antiplatelet (AC/AP) medication at the time of injury.

OBJECTIVES: The present study examined improvements in processes of care and triage accuracy when TTA criteria include an escalated response for older anticoagulated patients.

METHODS: A retrospective study was performed at a Level I trauma center. The study population (referred to as A55) included patients aged 55 years or older who were taking an AC/AP medication at the time of injury. Study periods included 11 months prior to the criteria change (Phase 1: July 2013-May 2014; n = 107) and 11 months after the change (Phase 2: July 2014-May 2015; n = 211). Differences were assessed with Kruskal-Wallis and chi-squared tests.

RESULTS: More A55 patients received a full or limited TTA after criteria were revised (70% vs. 26%, p < 0.001). Undertriage was reduced from 13% to 2% (p < 0.001). The trauma center significantly decreased time to first laboratory result, time to first computed tomography scan, and total time in ED prior to admission for A55 patients arriving from the scene of injury or by private vehicle.

CONCLUSION: Criteria that escalated the trauma response for A55 patients led to reductions in undertriage for anticoagulated older adults, as well as more timely mobilization of important clinical resources.

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PDF Y Endnote Y

Association between chronic or acute use of antihypertensive class of medications and falls in older adults. A systematic review and meta-analysis

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Am. J. Hypertens. 2017; ePub(ePub): ePub.

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(Copyright © 2017, Elsevier Publishing)

DOI 10.1093/ajh/hpx189 **PMID** 29087440

Abstract

BACKGROUND: Evaluating effect of acute or chronic use of antihypertensives on risk of falls in older adults.

METHODS: DATA SOURCES Systematic search of primary research articles in CINAHL, Cochrane, EBM, EMBASE and MEDLINE databases from 1.1.2007 to 1.6.2017. STUDY SELECTION Research studies of cohort, case-control, case-crossover, cross-sectional or RCT design examining association between antihypertensives and falls in people older than 60 years were evaluated. DATA SYNTHESIS 29 studies (N=1,234,667 participants) were included. Study quality was assessed using the Newcastle-Ottawa Scale (NOS).1 PRISMA2 and MOOSE3 guidelines were used for abstracting data and random-effects inverse-variance (REIV) meta-analysis was conducted on 26 articles examining chronic antihypertensives use, with odds ratios and hazard ratios analysed separately. Time-risk analysis was performed on five articles examining acute use of antihypertensives. OUTCOMES Pooled odds ratios (OR) and hazards ratios (HR) were calculated to determine the association between chronic antihypertensives use and falls. For time-risk analysis, OR was plotted with respect to number of days since antihypertensives commencement, change or dose increase.

RESULTS: There was no significant association between risk of falling and chronic antihypertensive medication use (OR=0.97, 95%CI 0.93-1.01, I²=64.1%, P=0.000; and HR=0.96, 95%CI 0.92-1.00, I²=0.0%, P=0.706). The time-risk analysis demonstrated a significantly elevated risk of falling 0-24 hours after antihypertensives initiation, change or dose increase. When diuretics were used, the risk remained significantly elevated till day 21.

CONCLUSIONS: There is no significant association between chronic use of antihypertensives and falls in older adults. Risk of falls is highest on day zero for all antihypertensive medications.

PDF Y Endnote Y

Biomechanical and human behavior assessment using virtual reality to challenge balance and posture for the elderly and patients with Parkinson's disease

Muhla F, Clanché F, Rose C, Cosson A, Gauchard G.

Comput. Methods Biomech. Biomed. Eng. 2017; 20(sup1): 141-142.

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DOI 10.1080/10255842.2017.1382901 **PMID** 29088656

Abstract [Abstract unavailable]

PDF Y Endnote Y

Comment on tai chi for risk of falls. A meta-analysis

Schoene D, Kiesswetter E, Lord SR.

J. Am. Geriatr. Soc. 2017; ePub(ePub): ePub.

Affiliation: Falls and Balance Research Group, Neuroscience Research Australia, Randwick, New South Wales, Australia.

(Copyright © 2017, John Wiley and Sons)

DOI 10.1111/jgs.15103 **PMID** 29080347

Abstract Letter to the Editor [Abstract unavailable]

PDF Y Endnote Y

Coordination impairments are associated with falling among older adults

James EG, Leveille SG, Hausdorff JM, Barton B, Cote S, Karabulut M, Conatser P, Kennedy DN, Tucker KL, Al Snih S, Markides KS, Bean JF.

Exp. Aging Res. 2017; ePub(ePub): ePub.

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(Copyright © 2017, Informa - Taylor and Francis Group)

DOI 10.1080/0361073X.2017.1369634 **PMID** 29072539

Abstract

BACKGROUND/STUDY CONTEXT: Approximately one third of older adults over the age of 65, and over 40% of those over 80 years, fall each year, leading to fractures, morbidity, and mortality. Annual direct medical costs due to falls in the United States are approximately \$19.2 billion. The identification of new treatable risk factors for falls has the potential to advance their prevention and rehabilitation.

METHODS: A cross-sectional study of 127 community-dwelling adults aged 67-99 years was conducted. An electronic gait walkway was used to assess gait coordination, measured as the Phase Coordination Index during normal speed walking. A motion capture system was used to assess rhythmic interlimb antiphase ankle coordination, measured as the standard deviation of ankle relative phase. Having fallen in the previous year was self-reported retrospectively. Odds ratios for falling as a function of coordination quartiles were determined using multivariable logistic regression.

RESULTS: Adjusting for age, sex, body mass index, number of chronic conditions, Mini-Mental State Examination score, gait speed, and the variability of step length, time, and width, the odds ratios for falling based upon being in the 4th (the poorest) quartiles of gait or ankle coordination were 5.5 (95% confidence interval [CI]: 1.2-24.7) and 8.2 (95% CI: 2.2-31.3), respectively, and 3.7 (95% CI: 1.0-13.8) for the 3rd quartile of gait coordination, compared with the best (the 1st) coordination quartiles. Similar results were found in regression without adjustment for gait characteristics.

CONCLUSION: The results support the hypothesis that impaired gait and rhythmic interlimb ankle coordination are associated with a history of falls in the past year. Prospective longitudinal research is needed to determine the possible direction of causality between falls and impaired coordination.

PDF Y Endnote Y

Effect of multimorbidity on gait speed in well-functioning older people: a population-based study in Peru

Ortiz PJ, Tello T, Aliaga EG, Casas PM, Peinado JE, Miranda JJ, Varela LF.

Geriatr. Gerontol. Int. 2017; ePub(ePub): ePub.

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(Copyright © 2017, Japan Geriatrics Society, Publisher John Wiley and Sons)

DOI 10.1111/ggi.13182 **PMID** 29076226

Abstract

AIM: To determine the association between multimorbidity and gait speed in a population-based sample of older people without functional dependency.

METHODS: Data were obtained from a previously made cross-sectional population-based study of individuals aged >60 years carried out in San Martin de Porres, the second most populous district in Lima, Peru. We included well-functioning, independent older people. Exclusion criteria emphasized removing conditions that would impair gait. The exposure of interest was non-communicable chronic disease multimorbidity, and the outcome was gait speed determined by the time required for the participant to walk a distance of 8 m out of a total distance of 10 m. Generalized linear models were used to estimate adjusted gait speed by multimorbidity status.

RESULTS: Data from 265 older adults with a median age of 68 years (IQR 63-75 years) and 54% women were analyzed. The median gait speed was 1.06 m/s (SD 0.27) and the mean number of chronic conditions per adult was 1.1 (SD ±1). The difference in mean gait speed between older adults without a chronic condition and those with ≥3 chronic conditions was 0.24 m/s. In crude models, coefficients decreased by a significant exponential factor for every increase in the number of chronic conditions. Further adjustment attenuated these estimates.

CONCLUSIONS: Slower speed gaits are observed across the spectrum of multimorbidity in older adults without functional dependency. The role of gait speed as a simple indicator to evaluate and monitor general health status in older populations is expanded to include older adults without dependency.

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PDF Y Endnote Y

Effect of somatosensory and neurofeedback training on balance in older healthy adults: a preliminary investigation

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Aging Clin. Exp. Res. 2017; ePub(ePub): ePub.

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(Copyright © 2017, Editrice Kurtis)

DOI 10.1007/s40520-017-0835-3 **PMID** 29063490

Abstract

The aim of this study was to assess the effectiveness of balance training with somatosensory and neurofeedback training on dynamic and static balance in healthy, elderly adults. The sample group consisted of 45 healthy adults randomly assigned to one of the three test groups: somatosensory, neurofeedback, and a control. Individualization of the balance program started with pre-tests for static and dynamic balances. Each group had 15- and 30-min training sessions. All groups were tested for static (postural stability) and dynamic balances (Berg Balance Scale) in acquisition and

transfer tests (fall risk of stability and timed up and go). Improvements in static and dynamic balances were assessed by somatosensory and neurofeedback groups and then compared with the control group.

RESULTS indicated significant improvements in static and dynamic balances in both test groups in the acquisition test.

RESULTS revealed a significant improvement in the transfer test in the neurofeedback and somatosensory groups, in static and dynamic conditions, respectively. The findings suggest that these methods of balance training had a significant influence on balance. Both the methods are appropriate to prevent falling in adults. Neurofeedback training helped the participants to learn static balance, while somatosensory training was effective on dynamic balance learning. Further research is needed to assess the effects of longer and discontinuous stimulation with somatosensory and neurofeedback training on balance in elderly adults.

PDF Y Endnote Y

Evidence-based practice guideline: fall prevention for older adults

Kruschke C, Butcher HK.

J. Gerontol. Nurs. 2017; 43(11): 15-21.

(Copyright © 2017, Healio)

DOI 10.3928/00989134-20171016-01 PMID 29065212

Abstract

Falls are a major cause of injury and death annually for millions of individuals 65 and older. Older adults are at risk for falls for a variety of reasons regardless of where they live. Falls are defined as any sudden drop from one surface to a lower surface. The purpose of this fall prevention evidence-based practice guideline is to describe strategies that can identify individuals at risk for falls. A 10-step protocol including screening for falls, comprehensive fall assessment, gait and balance screening when necessary, and an individualized fall intervention program addressing specific fall risks is presented. Reassessing fall risk and fall prevention programs will ensure a proactive approach to reducing falls in the aging population. [Journal of Gerontological Nursing, 43(11), 15-21.].

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Factors associated with the setting of function-related goals among community-dwelling older people

Oliveira JS, Hassett L, Sherrington C, Ramsay E, Kirkham C, Manning S, Tiedemann A.

J. Aging Phys. Act. 2017; ePub(ePub): ePub.

Affiliation: Sydney Medical School, University of Sydney, Sydney, Australia.

(Copyright © 2017, Human Kinetics Publishers)

DOI 10.1123/japa.2017-0172 PMID 29091515

Abstract

This study aimed to summarise the function-related goals set by older people and to explore gender differences in goal selection, and associations between balance-related goals and fall history, self-rated balance and fear of falling. We included community-dwelling people aged 60+ participating in two randomised controlled trials. Participants nominated two function-related goals, which were summarised into components of the International Classification of Functioning, Disability and Health (ICF). Chi-square analyses were used to explore associations between goal types and participant

characteristics. Goals related to recreation and leisure, and walking were the most common function-related goals selected. Men and women set similar goals. Participants who had poor/fair self-reported balance were more likely to set a balance-related goal than people with good self-rated balance. In contrast, fallers and participants who had fear of falling were not more likely to select a balance-related goal than non-fallers and participants who had no fear of falling, respectively.

PDF Y Endnote Y

Fall detection using smart floor sensor and supervised learning

Minvielle L, Atiq M, Serra R, Mougeot M, Vayatis N.

Conf. Proc. IEEE Eng. Med. Biol. Soc. 2017; 2017: 3445-3448.

(Copyright © 2017, IEEE (Institute of Electrical and Electronics Engineers))

DOI 10.1109/EMBC.2017.8037597 PMID 29060638

Abstract

Falls are a major risk for elderly people's health and independence. Fast and reliable fall detection systems can improve chances of surviving the accident and coping with its physical and psychological consequences. Recent research has come up with various solutions, all suffering from significant drawbacks, one of them being the intrusiveness into patient's life. This paper proposes a novel fall detection monitoring system based on a sensitive floor sensor made out of a piezoelectric material and a machine learning approach. The detection is done by a combination between a supervised Random Forest and an aggregation of its output over time. The database was made using acquisitions from 28 volunteers simulating falls and other behaviours. Unlike existent fall detection systems, our solution offers the advantages of having a passive sensor (no power supply is needed) and being completely unobtrusive since the sensor comes with the floor.

RESULTS are compared with state-of-the-art classification algorithms. On our database, good performance of fall detection was obtained with a True Positive Rate of 94.4% and a False Positive Rate of 2.4%.

PDF Y Endnote Y

Falls and fall-prevention in older persons: geriatrics meets spaceflight!

Goswami N.

Front. Physiol. 2017; 8: e603.

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(Copyright © 2017, Frontiers Research Foundation)

DOI 10.3389/fphys.2017.00603 PMID 29075195 PMCID PMC5641583

Abstract

This paper provides a general overview of key physiological consequences of microgravity experienced during spaceflight and of important parallels and connections to the physiology of aging. Microgravity during spaceflight influences cardiovascular function, cerebral autoregulation, musculoskeletal, and sensorimotor system performance. A great deal of research has been carried out to understand these influences and to provide countermeasures to reduce the observed negative consequences of microgravity on physiological function. Such research can inform and be informed by research related to physiological changes and the deterioration of physiological function due to aging. For example, head-down bedrest is used as a model to study effects of spaceflight deconditioning due to reduced gravity. As hospitalized older persons spend up to 80% of

their time in bed, the deconditioning effects of bedrest confinement on physiological functions and parallels with spaceflight deconditioning can be exploited to understand and combat both variations of deconditioning. Deconditioning due to bed confinement in older persons can contribute to a downward spiral of increasing frailty, orthostatic intolerance, falls, and fall-related injury. As astronauts in space spend substantial amounts of time carrying out exercise training to counteract the microgravity-induced deconditioning and to counteract orthostatic intolerance on return to Earth, it is logical to suggest some of these interventions for bed-confined older persons. Synthesizing knowledge regarding deconditioning due to reduced gravitational stress in space and deconditioning during bed confinement allows for a more comprehensive approach that can incorporate aspects such as (mal-) nutrition, muscle strength and function, cardiovascular (de-) conditioning, and cardio-postural interactions. The impact of such integration can provide new insights and lead to methods of value for both space medicine and geriatrics (Geriatrics meets spaceflight!). In particular, such integration can lead to procedures that address the morbidity and the mortality associated with bedrest immobilization and in the rising health care costs associated with an aging population demographic.

PDF Y Endnote Y

Falls and the rise of the GP contract: an EMIS web protocol and template to help identify frail patients

Chapman S, Thomas S.

Br. J. Community Nurs. 2017; 22(11): 554-556.

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(Copyright © 2017, Mark Allen Publishing)

DOI 10.12968/bjcn.2017.22.11.554 **PMID** 29091506

Abstract [Abstract unavailable]

PDF Will get ILL Endnote Y

Feasibility, safety, acceptability, and functional outcomes of playing Nintendo Wii Fit Plus™ for frail elderly: study protocol for a feasibility trial

Gomes GCV, Bacha JMR, do Socorro Simões M, Lin SM, Viveiro LAP, Varise EM, Filho WJ, Pompeu JE. *Pilot Feasibility Stud.* 2017; 3: 41.

Affiliation: Department of Physical Therapy, Speech Therapy, and Occupational Therapy, School of Medicine, University of Sao Paulo, 51th Cipotânea Street, University City, Sao Paulo, 05360-000 Brazil.

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DOI 10.1186/s40814-017-0184-1 **PMID** 29085661 **PMCID** PMC5654058

Abstract

BACKGROUND: Frailty can be defined as a medical syndrome with multiple causes and contributors, characterized by diminished strength and endurance and reduced physiological function that increases the vulnerability to develop functional dependency and/or death. Studies have shown that the most commonly studied exercise protocol for frail older adults is the multimodal training. Interactive video games (IVGs) involve tasks in virtual environments that combine physical and cognitive demands in an attractive and challenging way. The aim of this study will be to evaluate the feasibility, safety, acceptability, and functional outcomes of playing Nintendo Wii Fit Plus(TM)

(NWFP) for frail older adults.

METHODS/DESIGN: The study is a randomized controlled, parallel group, feasibility trial. Participants will be randomly assigned to the experimental group (EG) and control group (CG). The EG will participate in 14 training sessions, each lasting 50 min, twice a week. In each training session, the participants will play five games, with three attempts at each game. The first attempt will be performed with the assistance of a physical therapist to correct the movements and posture of the patients and subsequent attempts will be performed independently. Scores achieved in the games will be recorded. The participants will be evaluated by a blinded physical therapist at three moments: before and after intervention and 30 days after the end of the intervention (follow-up). We will assess the feasibility, acceptability, safety, and clinical outcomes (postural control, gait, cognition, quality of life, mood, and fear of falling).

DISCUSSION: Due to the deficiencies in multiple systems, studies have shown that multimodal interventions including motor-cognitive stimulation can improve the mobility of frail elderly adults. IVGs, among them the NWFP, are considered as a multimodal motor-cognitive intervention that can potentially improve motor and cognitive functions in the frail elderly. However, there is still no evidence in the literature that proves the feasibility, safety, acceptability, and functional outcomes of this intervention in frail elderly individuals. **TRIAL REGISTRATION:** Brazilian Registry of Clinical Trials (RBR-823rst). World Health Organization Trial Registration Data Set (Additional file 1).

PDF Y Endnote Y

Inter-rater reliability, standard error of measurement and minimal detectable change of the 12-item WHODAS 2.0 and four performance tests in institutionalized ambulatory older adults

Silva AG, Cerqueira M, Raquel Santos A, Ferreira C, Alvarelhão J, Queirós A.

Disabil. Rehabil. 2017; ePub(ePub): 1-8.

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(Copyright © 2017, Informa - Taylor and Francis Group)

DOI 10.1080/09638288.2017.1393112 **PMID** 29065719

Abstract

PURPOSE: Self-reported and performance-based instruments are both necessary for a comprehensive view of the functioning of institutionalized older adults. Our aim was to assess the reliability and measurement error of the 12-item World Health Organization Disability assessment Schedule and compare these indexes against performance-based tests.

MATERIALS AND METHODS: One hundred participants from Nursing Homes and Day Care Centers were assessed twice (two days to one week apart) by two independent assessors. Reliability and measurement error indexes were calculated.

RESULTS: Reliability of the World Health Organization Disability assessment Schedule total score, and of three performance tests was appropriate for individual comparisons ($ICC \geq 0.92$). Reliability for the five times seat to stand test was appropriate for group comparisons only ($ICC = 0.84$). The high measurement error of the timed up and go test ($SEM = 4.25$; $MDC = 11.78$) and of the five times seat to stand test ($SEM = 3.47$; $MDC = 9.62$) and the number of participants unable to perform them (TUG: $n = 11$; FTSST: $n = 41$) suggest that these tests are less suitable to monitor individual changes.

CONCLUSIONS: The 12-item World Health Organization Disability Assessment Schedule total score, the gait speed and hand grip tests could be used to monitor changes at both the individual and

group level in a population with decreased functioning. Implications for Rehabilitation The 12-item World Health Organization Disability assessment Schedule, could be used to monitor changes in perceived functioning both at the individual and group level in institutionalized ambulatory older adults. The gait speed and hand grip tests could be used to monitor changes in performance both at the individual and group level in institutionalized ambulatory older adults' functioning. The utility of the time up and go and of the five times seat to stand test might be of limited value when aiming to monitor changes in institutionalized older adults' functioning.

PDF Y Endnote Y

Muscle contributions to the acceleration of the whole body centre of mass during recovery from forward loss of balance by stepping in young and older adults

Graham DF, Carty CP, Lloyd DG, Barrett RS.

PLoS One 2017; 12(10): e0185564.

Affiliation: Menzies Health Institute Queensland, Griffith University, Queensland, Australia.

(Copyright © 2017, Public Library of Science)

DOI 10.1371/journal.pone.0185564 **PMID** 29069097

Abstract

The purpose of this study was to determine the muscular contributions to the acceleration of the whole body centre of mass (COM) of older compared to younger adults that were able to recover from forward loss of balance with a single step. Forward loss of balance was achieved by releasing participants (14 older adults and 6 younger adults) from a static whole-body forward lean angle of approximately 18 degrees. 10 older adults and 6 younger adults were able to recover with a single step and included in subsequent analysis. A scalable anatomical model consisting of 36 degrees-of-freedom was used to compute kinematics and joint moments from motion capture and force plate data. Forces for 92 muscle actuators were computed using Static Optimisation and Induced Acceleration Analysis was used to compute individual muscle contributions to the three-dimensional acceleration of the whole body COM. There were no significant differences between older and younger adults in step length, step time, 3D COM accelerations or muscle contributions to 3D COM accelerations. The stance and stepping leg Gastrocnemius and Soleus muscles were primarily responsible for the vertical acceleration experienced by the COM. The Gastrocnemius and Soleus from the stance side leg together with bilateral Hamstrings accelerated the COM forwards throughout balance recovery while the Vasti and Soleus of the stepping side leg provided the majority of braking accelerations following foot contact. The Hip Abductor muscles provided the greatest contribution to medial-lateral accelerations of the COM. Deficits in the neuromuscular control of the Gastrocnemius, Soleus, Vasti and Hip Abductors in particular could adversely influence balance recovery and may be important targets in interventions to improve balance recovery performance.

PDF Y Endnote Y

Prevalence of household falls in long-lived adults and association with extrinsic factors

Pereira SG, Santos CBD, Doring M, Portella MR.

Rev. Lat. Am. Enfermagem 2017; 25: e2900.

Affiliation: PhD, Professor, Universidade de Passo Fundo, Passo Fundo, RS, Brazil.

(Copyright © 2017, Escola de Enfermagem de Ribeirao Preto, Universidade de Sao Paulo)

DOI 10.1590/1518-8345.1646.2900 **PMID** 29069267

Abstract

OBJECTIVE: to identify the prevalence of falls among older adults and the extrinsic factors associated with them.

METHOD: population-based cross-sectional study with 350 older adults. A household survey was conducted using a questionnaire addressing socio-demographic, clinical, and environmental characteristics. Data were analyzed using Stata Software V.10. Pearson's chi-square test and logistic regression analysis were used with stepwise criteria for selection of variables in the model, with measures of effect expressed in Prevalence Ratio. For input into the multiple model, the variables with $p \leq 0.20$ were considered. All ethical care regarding research on human beings has been observed and respected.

RESULTS: the prevalence of falls was 46.9%. The extrinsic factors associated with falls were: stairs, uneven floor and pets in the main entrance, lack of anti-slip loose throw rugs and slippery floor in the kitchen, lack of anti-slip loose throw rugs and objects on the floor in the room, lack of grab bars in the shower, lack of grab bars in the toilet and switch away from the bathroom door ($p < 0.05$).

CONCLUSION: falls are frequent in long-lived adults. The identification of the extrinsic factors associated with the occurrence of this event can help in its prevention.

PDF Y Endnote Y

Reply to: Comment on tai chi for risk of falls. A meta-analysis

Lomas-Vega R, Obrero-Gaitán E, Molina-Ortega FJ, Del-Pino-Casado R.

J. Am. Geriatr. Soc. 2017; ePub(ePub): ePub.

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(Copyright © 2017, John Wiley and Sons)

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Abstract Letter to Editor [Abstract unavailable]

PDF Y Endnote Y

The incidence of depression among residents of assisted living: prevalence and related risk factors

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Clin. Interv. Aging 2017; 12: 1645-1653.

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(Copyright © 2017, Dove Medical Press)

DOI 10.2147/CIA.S147436 **PMID** 29070943 **PMCID** PMC5640406

Abstract

AIM: This study aims to recognize and estimate the prevalence of depression and its risk factors among residents of assisted living facilities (ALs) in Jordan.

BACKGROUND: Depression is commonly experienced by residents of ALs. The condition is, however, often misunderstood as a part of normal aging and may be overlooked by health care professionals. Little is known about the extent of depression and its risk factors among AL residents in Jordan.

SUBJECTS AND METHODS: A national representative sample of 221 residents selected from all AL units across Jordan was recruited to the study. Data on expected risk factors for depression were collected, including sociodemographics; smoking status; number of roommates; number of family members; assessments for cognitive functioning, for lower limb functioning, for hand, shoulder, and arm impairments; and oral health status. Levels of depression among the sample respondents were

also assessed.

RESULTS: The study found that around 60% of the participants reported depressive manifestations, with 48.0% of AL residents exhibiting impaired cognitive functions, one-third (33.2%) having >50% upper limb disability, two-thirds (63.2%) being at moderate risk of falls, and 69.7% having fair to poor oral health status. Being female, and having a higher level of education, disability of the upper limbs, and impairment of cognitive functions were found to be independent risk factors for depression in participants.

CONCLUSION: Depression is relatively common among residents of AL units in Jordan. Health care professionals, nurses, physiotherapists, and dentists working in these facilities need to work cooperatively to identify the manifestations of depression in residents and collaboratively implement the best practice in the treatment of depression and circumvent its long-term impacts on the health of residents.

PDF Y Endnote Y

The role of conscious control in maintaining stable posture

Uiga L, Capio CM, Ryu D, Wilson MR, Masters RSW.

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Abstract

This study aimed to examine the relationship between conscious control of movements, as defined by the Theory of Reinvestment (Masters & Maxwell, 2008; Masters, Polman, & Hammond, 1993), and both traditional and complexity-based COP measures. Fifty-three young adults (mean age=20.93±2.53years), 39 older adults with a history of falling (mean age=69.23±3.84years) and 39 older adults without a history of falling (mean age=69.00±3.72years) were asked to perform quiet standing balance in single- and dual-task conditions. The results showed that higher scores on the Movement Specific Reinvestment Scale (MSRS; Masters, Eves, & Maxwell, 2005; Masters & Maxwell, 2008), a psychometric measure of the propensity for conscious involvement in movement, were associated with larger sway amplitude and a more constrained (less complex) mode of balancing in the medial-lateral direction for young adults only. Scores on MSRS explained approximately 10% of total variation in the medial-lateral sway measures. This association was not apparent under dual-task conditions, during which a secondary task was used to limit the amount of cognitive resources available for conscious processing. No relationship between postural control and score on the MSRS was found for either older adult fallers or non-fallers. Possible explanations for these results are discussed.

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The role of previous falls in major osteoporotic fracture prediction in conjunction with FRAX in older Chinese men and women: the Mr. OS and Ms. OS cohort study in Hong Kong

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Abstract

Falls are a major concern in terms of fracture risk. Although awareness rising for the absence of falls in the FRAX algorithm, our study only identified the independent predictive role of previous recurrent falls and their better conjunction use with FRAX for major osteoporotic fracture prediction in older Chinese men.

INTRODUCTION: Although the association of falls with fracture has been widely explored, the impact of previous falls is not included in the FRAX algorithm currently. Our aim was to examine the FRAX-independent associations between falls in the previous year and subsequent fracture risk, as well as the conjunctive use of falls and the FRAX score for major osteoporotic fracture (MOF) prediction in older Chinese people.

METHODS: Four thousand community older men and women aged 65 years or older were followed up for 9.9 ± 2.7 and 8.8 ± 1.5 years, respectively. The associations between falls in the previous 1 year and MOF risk by follow-up years were evaluated using the Fine and Gray model. New prediction scores were calculated by incorporating the falls and FRAX scores using the Fine and Gray model, or developed by adjusting the FRAX scores by 30% increased risk for each fall in the previous year. The predictive powers for MOF risk between the new scores and FRAX scores were evaluated by the area under the curve (AUC) and category-based net reclassification improvement index (NRI).

RESULTS: During the follow-up period, 139 (7.0%) men and 236 (11.8%) women had at least one incident MOF. One previous fall significantly predicted the first year incident MOF in men [hazard ratio (HR) (95%CI), 3.47 (1.02, 11.80)]. Previous recurrent falls significantly predicted a 10-year incident MOF in men [HR (95%CI), 2.42 (1.30, 4.51)]. In men, the fall-adjusting FRAX scores showed significant improvement on total net reclassification of fracture (3-6%). No improved predictive accuracy shown in women.

CONCLUSION: Falls in the previous year are likely to provide some predictive power to FRAX for MOF risk assessment in older Chinese men, but not women.

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The use of shear thickening polymer as a hip protector

Taeyong Lee, Dong-Gyu Hwang, Ogihara N, Ito K.

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Abstract

External hip protectors are used by the elderly in preventing hip fracture due to sideway falls. There are some commercial hip protectors which has both energy absorbing and energy shunting properties. In this study, a novel hip protector using shear thickening polymer (STP) is studied. The purpose of this work is to determine the optimal thickness of STP needed for maximum force

attenuation. A mechanical test rig to simulate a person falling with sufficient impact energy to fracture the greater trochanter if unprotected was used together with biofidelic femur model which simulates the layer of flesh with skin. 8mm of STP together with 5mm foam gives the best force attenuation. When comparing the overall thickness with commercial hip protectors, STP hip protectors tested have much less thickness. Reduced thickness increases the compliance and comfort of STP hip protectors.

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Two-year follow-up of fall prediction among older adults in an independent-living community

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Adv. Exp. Med. Biol. 2017; ePub(ePub): ePub.

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Abstract

Adults over the age of 70 are at risk of falls. Early detection of risk of falls can suggest early interventions. In this study, we attempted to determine valid clinical tests that can differentiate older individuals who are at risk of falling. Older adults from an independent-living community volunteered to participate in this descriptive, cohort study. They were administered the Berg Balance Scale (BBS), Zur Balance Scale (ZBS); Head Shaking Nystagmus Head Impulse Test, Dynamic Visual Acuity, and the Hallpike maneuver for evaluating benign paroxysmal positional vertigo (BPPV); a questionnaire including sociodemographics and a health characteristics survey. Multivariate analysis indicated that a ZBS score < 51, previous fall, and number of medications strongly predict falls in older adults. ZBS score, BBS score, Hallpike maneuver, number of medications, deficit of vestibular ocular reflex, along with positive ZBS score and past fall differentiate between fallers and non-fallers. ZBS <51, taking >6 medications, and history of falls were a benchmark for high-risk of falling.

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Z-drugs and risk for falls and fractures in older adults-a systematic review and meta-analysis

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Age Ageing 2017; ePub(ePub): ePub.

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Abstract

OBJECTIVE: zolpidem, zopiclone, eszopiclone and zaleplon, also known as 'Z-drugs', are commonly used as alternatives to benzodiazepines (BZDs) to treat insomnia. Z-drugs are often perceived as safer than BZDs. We conducted a systematic review and meta-analysis evaluating the association between Z-drugs and fractures, falls and injuries.

METHODS: a systematic review was performed using MEDLINE, EMBASE and ClinicalTrials.gov. Pooled effect-sizes were calculated comparing Z-drugs users with non-users, using fixed and random-effect models with corresponding 95% confidence of intervals (CI).

RESULTS: we identified 14 eligible studies reporting on the association between Z-drugs and outcomes of interest. Z-Drugs were associated with a statistically significant increased risk for fractures, with evidence of considerable heterogeneity (OR = 1.63; 95% CI: 1.42-1.87; I² = 90%; n = 830,877). Likewise, there was a trend suggesting a 2-fold increase in the odds for falls, however, this result was not statistically significant and there was evidence of considerable heterogeneity (OR = 2.40; 95% CI: 0.92-6.27; I² = 95%; n = 19,505). In an analysis assessing the risk for injuries following exposure to zolpidem we found a statistically significant increased risk of injuries, with no evidence of heterogeneity (OR = 2.05; CI 95%: 1.95-2.15; I² = 0; n = 160,502).

RESULTS were similar in sensitivity analyses, including analyses restricted to studies of high-quality, studies with control groups suffering from insomnia, and with specific Z-drugs.

CONCLUSION: our results indicate that Z-drugs are associated with an increased risk for fractures, and suggest a possible increased risk for falls and injuries as well. However, studies included were observational and susceptible to confounding. Physicians should consider these potential risks before prescribing these medications in older adults.

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A new fall-inducing technology platform: Development and assessment of a programmable split-belt treadmill

Beom-Chan Lee, Martin BJ, Thrasher TA, Layne CS.

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Abstract

Typical technologies for fall reduction/prevention training incorporate mechanical obstacles or cables/pulleys to induce trip or slip perturbations. This paper proposes a technology platform that uses a split-belt treadmill equipped with one force plate underneath each belt and a real-time gait phase detection algorithm. A proof-of-concept study validates the method for inducing trip perturbations in healthy young adults (n=10) by using kinematic measures from a full body motion capture system to characterize the effects of the perturbations. Preliminary results show that the proposed method successfully induces a trip and its congruent postural responses. The major findings have implications for designing intervention programs to reduce or prevent falls by individuals with a high risk of falls.

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A prospective study of falls in relation to freezing of gait and response fluctuations in Parkinson's disease

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Parkinsonism Relat. Disord. 2017; ePub(ePub): ePub.

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Abstract

INTRODUCTION: Falls are a disabling feature of Parkinson's disease (PD). In this prospective study we investigated: (1) in which motor state patients with PD fall most often; and (2) whether freezing of gait (FOG) and dyskinesias contribute to falls.

METHODS: Patients with PD who had fallen at least once in the previous year and had wearing-off were recruited. During six months, patients complete a standardized fall report. We analyzed data regarding fall circumstances and motor state at the time of each first 10 falls.

RESULTS: We included 36 patients with PD (34 freezers), with mean \pm SD age of 67.5 ± 6.3 years and disease duration of 12.4 ± 4.1 years. 50% had Hoehn & Yahr (HY) 2 at ON-state and 56% had a HY 4 at OFF. All 36 patients fell at least once during the follow-up period (total number of falls: 252; mean \pm SD: 19.03 ± 33.9). Falls at ON were 50% of the total falls, followed by Transition (30%) and OFF (20%). Overall, 69% of falls were related to FOG, 28% were unrelated to FOG and 3% were related to dyskinesia. There was a significant relationship between motor state and circumstances ($\chi^2(2) = 31.496, p < 0.001$), showing that FOG-related falls happened mostly at OFF-state.

CONCLUSION: This study showed that patients with PD fall mostly at ON. Additionally, FOG is an important contributor to falls in patients with PD. This information may assist clinicians in optimizing medication to prevent further falls.

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Fall prevention shoes using camera-based line-laser obstacle detection system

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(Copyright © 2017, Multi-Science)

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Abstract

Fall prevention is an important issue particularly for the elderly. This paper proposes a camera-based line-laser obstacle detection system to prevent falls in the indoor environment. When obstacles are detected, the system will emit alarm messages to catch the attention of the user. Because the elderly spend a lot of their time at home, the proposed line-laser obstacle detection system is designed mainly for indoor applications. Our obstacle detection system casts a laser line, which passes through a horizontal plane and has a specific height to the ground. A camera, whose optical axis has a specific inclined angle to the plane, will observe the laser pattern to obtain the potential obstacles. Based on this configuration, the distance between the obstacles and the system can be further determined by a perspective transformation called homography. After conducting the experiments, critical parameters of the algorithms can be determined, and the detected obstacles can be classified into different levels of danger, causing the system to send different alarm messages.

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Falls in Parkinson's disease: a complex and evolving picture

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Abstract

Falls are a major determinant of poor quality of life, immobilization, and reduced life expectancy in people affected by Parkinson's disease (PD) and in older adults more generally. Although many questions remain, recent research has advanced the understanding of this complex problem. The goal of this review is to condense new knowledge of falls in PD from prodromal to advanced disease, taking into account risk factors, assessment, and classification as well as treatment. The fundamental steps of clinical and research-based approaches to falls are described, namely, the identification of fall risk factors, clinical and instrumental methods to evaluate and classify fall risk, and the latest evidence to reduce or delay falls in PD. We summarize recent developments, the direction in which the field should be heading, and what can be recommended at this stage. We also provide a practical algorithm for clinicians. © 2017 International Parkinson and Movement Disorder Society.

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Real-time gait analysis with accelerometer-based smart shoes

Delgado-Gonzalo R, Hubbard J, Renevey P, Lemkaddem A, Vellinga Q, Ashby D, Willardson J, Bertschi M.

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Abstract

In this paper, we present the evaluation of a new smart shoe capable of performing gait analysis in real time. The system is exclusively based on accelerometers which minimizes the power consumption. The estimated parameters are activity class (rest/walk/run), step cadence, ground contact time, foot impact (zone, strength, and balance), forward distance, and speed. The different parameters have been validated with a customized database of 26 subjects on a treadmill and video data labeled manually. Key measures for running analysis such as the cadence is retrieved with a maximum error of 2%, and the ground contact time with an average error of 3.25%. The classification of the foot impact zone achieves a precision between 72% and 91% depending of the running style. The presented algorithm has been licensed to ICON Health & Fitness Inc. for their line of wearables under the brand iFit.

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Video analysis of "YouTube funnies" to aid the study of human gait and falls - preliminary results and proof of concept

Taati B, Lohia P, Mansfield A, Ashraf AB.

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Abstract

Because falls are funny, YouTube and other video sharing sites contain a large repository of real-life falls. We propose extracting gait and balance information from these videos to help us better understand some of the factors that contribute to falls. Proof-of-concept is explored in a single video

containing multiple ($n=14$) falls/non-falls in the presence of an unexpected obstacle. The analysis explores: computing spatiotemporal parameters of gait in a video captured from an arbitrary viewpoint; the relationship between parameters of gait from the last few steps before the obstacle and falling vs. not falling; and the predictive capacity of a multivariate model in predicting a fall in the presence of an unexpected obstacle. Homography transformations correct the perspective projection distortion and allow for the consistent tracking of gait parameters as an individual walks in an arbitrary direction in the scene. A synthetic top view allows for computing the average stride length and a synthetic side view allows for measuring up and down motions of the head. In leave-one-out cross-validation, we were able to correctly predict whether a person would fall or not in 11 out of the 14 cases (78.6%), just by looking at the average stride length and the range of vertical head motion during the 1-4 most recent steps prior to reaching the obstacle.

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