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Addition of a non-immersive virtual reality component to treadmill training to reduce fall risk in older adults (V-TIME): a randomised controlled trial

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Abstract

BACKGROUND: Age-associated motor and cognitive deficits increase the risk of falls, a major cause of morbidity and mortality. Because of the significant ramifications of falls, many interventions have been proposed, but few have aimed to prevent falls via an integrated approach targeting both motor and cognitive function. We aimed to test the hypothesis that an intervention combining treadmill training with non-immersive virtual reality (VR) to target both cognitive aspects of safe ambulation and mobility would lead to fewer falls than would treadmill training alone.

METHODS: We carried out this randomised controlled trial at five clinical centres across five countries (Belgium, Israel, Italy, the Netherlands, and the UK). Adults aged 60-90 years with a high risk of falls based on a history of two or more falls in the 6 months before the study and with varied motor and cognitive deficits were randomly assigned by use of computer-based allocation to receive 6 weeks of either treadmill training plus VR or treadmill training alone. Randomisation was stratified by subgroups of patients (those with a history of idiopathic falls, those with mild cognitive impairment, and those with Parkinson's disease) and sex, with stratification per clinical site. Group allocation was done by a third party not involved in onsite study procedures. Both groups aimed to train three times per week for 6 weeks, with each session lasting about 45 min and structured training progression individualised to the participant's level of performance. The VR system consisted of a motion-capture camera and a computer-generated simulation projected on to a large screen, which was specifically designed to reduce fall risk in older adults by including real-life challenges such as obstacles, multiple pathways, and distracters that required continual adjustment of steps. The primary outcome was the incident rate of falls during the 6 months after the end of training, which was assessed in a modified intention-to-treat population. Safety was assessed in all patients who were assigned a treatment. This study is registered with ClinicalTrials.gov, NCT01732653.

FINDINGS: Between Jan 6, 2013, and April 3, 2015, 302 adults were randomly assigned to either the treadmill training plus VR group (n=154) or treadmill training alone group (n=148). Data from 282 (93%) participants were included in the prespecified, modified intention-to-treat analysis. Before training, the incident rate of falls was similar in both groups (10·7 [SD 35·6] falls per 6 months for treadmill training alone vs 11·9 [39·5] falls per 6 months for treadmill training plus VR). In the 6 months after training, the incident rate was significantly lower in the treadmill training plus VR group than it had been before training (6·00 [95% CI 4·36-8·25] falls per 6 months; p<0·0001 vs before training), whereas the incident rate did not decrease significantly in the treadmill training alone group (8·27 [5·55-12·31] falls per 6 months; p=0·49). 6 months after the end of training, the incident

rate of falls was also significantly lower in the treadmill training plus VR group than in the treadmill training group (incident rate ratio 0.58, 95% CI 0.36-0.96; $p=0.033$). No serious training-related adverse events occurred.

INTERPRETATION: In a diverse group of older adults at high risk for falls, treadmill training plus VR led to reduced fall rates compared with treadmill training alone. FUNDING: European Commission.

PDF Y Endnote Y

Virtual reality and the prevention of falls in the real world

Lord SR. *Lancet* 2016; ePub(ePub): ePub.

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Abstract Comment on Mirelman et al 2016 above[Abstract unavailable]

PDF Y Endnote Y

Aging of the human vestibular system

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Abstract

Aging affects every sensory system in the body, including the vestibular system. Although its impact is often difficult to quantify, the deleterious impact of aging on the vestibular system is serious both medically and economically. The deterioration of the vestibular sensory end organs has been known since the 1970s; however, the measurable impact from these anatomical changes remains elusive. Tests of vestibular function either fall short in their ability to quantify such anatomical deterioration, or they are insensitive to the associated physiologic decline and/or central compensatory mechanisms that accompany the vestibular aging process. When compared with healthy younger individuals, a paucity of subtle differences in test results has been reported in the healthy older population, and those differences are often observed only in response to nontraditional and/or more robust stimuli. In addition, the reported differences are often clinically insignificant inasmuch that the recorded physiologic responses from the elderly often fall within the wide normative response ranges identified for normal healthy adults. The damaging economic impact of such vestibular sensory decline manifests itself in an exponential increase in geriatric dizziness and a subsequent higher prevalence of injurious falls. An estimated \$10 to \$20 billion dollar annual cost has been reported to be associated with falls-related injuries and is the sixth leading cause of death in the elderly population, with a 20% mortality rate. With an estimated 115% increase in the geriatric population over 65 years of age by the year 2050, the number of balanced-disordered patients with a declining vestibular system is certain to reach near epidemic proportions. An understanding of the effects of age on the vestibular system is imperative if clinicians are to better manage elderly patients with balance disorders, dizziness, and vestibular disease.

PDF Endnote Y

An interprofessional approach to reducing the risk of falls through enhanced collaborative practice

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Abstract

Falls are the leading cause of accidental deaths in older adults and are a growing public health concern. The American Geriatrics Society (AGS) and British Geriatrics Society (BGS) published guidelines for falls screening and risk reduction, yet few primary care providers report following any guidelines for falls prevention. This article describes a project that engaged an interprofessional teaching team to support interprofessional clinical teams to reduce fall risk in older adults by implementing the AGS/BGS guidelines. Twenty-five interprofessional clinical teams with representatives from medicine, nursing, pharmacy, and social work were recruited from ambulatory, long-term care, hospital, and home health settings for a structured intervention: a 4-hour training workshop plus coaching for implementation for 1 year. The workshop focused on evidence-based strategies to decrease the risk of falls, including screening for falls; assessing gait, balance, orthostatic blood pressure, and other medical conditions; exercise including tai chi; vitamin D supplementation; medication review and reduction; and environmental assessment. Quantitative and qualitative data were collected using chart reviews, coaching plans and field notes, and postintervention structured interviews of participants. Site visits and coaching field notes confirmed uptake of the strategies. Chart reviews showed significant improvement in adoption of all falls prevention strategies except vitamin D supplementation. Long-term care facilities were more likely to address environmental concerns and add tai chi classes, and ambulatory settings were more likely to initiate falls screening. The intervention demonstrated that interprofessional practice change to target falls prevention can be incorporated into primary care and long-term care settings.

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Can a single lower trunk body-fixed sensor differentiate between level-walking and stair descent and ascent in older adults? Preliminary findings

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Med. Eng. Phys. 2016; ePub(ePub): ePub.

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Abstract

Stair ascent and descent are common forms of ambulation that may be challenging to detect. Here, we propose the first step towards differentiating between stair negotiation and level-walking using a single body-fixed sensor. Seventeen healthy older adults (age: 79.3±4.2 years, 47% women) wore a body-fixed sensor on the lower-back while performing level-walking and stair negotiation. Measures derived from the 3D acceleration and angular-velocity signals included medians, ranges, step

duration, step and stride regularity, filtered vertical to horizontal acceleration ratio (VAF/HAF), and wavelet-based features. Friedman's and Wilcoxon tests compared between conditions. Stepwise-binary logistic-regression evaluated classification accuracy. During level-walking, yaw range was lowest and anterior-posterior and vertical step and stride regularity were highest ($p \leq 0.007$). Anterior-posterior step regularity ($p=0.003$), VAF/HAF ($p=0.094$), and yaw range ($p=0.105$) identified level-walking (92.2% accuracy). During stair ascent, roll range, median anterior-posterior acceleration and anterior-posterior wavelet-coefficient were lowest ($p \leq 0.006$), while VAF/HAF was highest ($p=0.0029$). Anterior posterior wavelet coefficient ($p=0.038$) and VAF/HAF ($p=0.018$) identified stair ascent (94.3% accuracy). During stair descent, vertical and medio-lateral ranges were highest and medio-lateral stride regularity and VAF/HAF were lowest ($p \leq 0.006$). VAF/HAF ($p=0.01$), medio-lateral acceleration range ($p=0.069$), and medio-lateral stride regularity ($p=0.072$) identified stair descent (90.2% accuracy). These findings suggest that a single worn body-fixed sensor can be used to differentiate between level-walking and stair negotiation.

PDF Y Endnote Y

Diabetes mellitus and risk of falls in older adults: a systematic review and meta-analysis

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Age Ageing 2016; ePub(ePub): ePub.

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Abstract

BACKGROUND: intensive or very loose glycemic control may contribute to the risk of falls in diabetic patients. However, studies on diabetes mellitus and the risk of falls have yielded conflicting results. Our objective was to investigate the effect of diabetes mellitus on the risk of falls in older adults by conducting a systematic review and meta-analysis.

METHODS: the PubMed and Embase databases were searched for relevant studies published until November 2015. Only prospective cohort studies reporting at least age-adjusted risk estimate of falls compared diabetic to non-diabetic individuals were selected. Diabetes mellitus was ascertained by a combination of medical history and laboratory tests or use of anti-diabetic drugs.

RESULTS: a total of six studies involving 14,685 participants were identified. The number of falls in diabetic and non-diabetic individuals was 423 of 1,692 (25.0%) and 2,368 of 13,011 (18.2%), respectively. Diabetes mellitus was associated with an increased risk of falls (risk ratio [RR] = 1.64; 95% confidence intervals [CI] 1.27-2.11) in a random-effects model. Subgroup analyses showed that the risk of falls seemed more pronounced among both gender groups (RR = 1.81; 95% CI 1.19-2.76) than among women (RR = 1.52; 95% CI 1.04-2.21). Diabetes increased 94% (RR = 1.94; 95% CI 1.42-2.63) and 27% (RR = 1.27; 95% CI 1.06-1.52) risk of falls in insulin-treated and no-insulin-treated patients, respectively.

CONCLUSIONS: this meta-analysis reveals that older adults with diabetes mellitus are associated with greater risk of falls, and this association is more pronounced in insulin-treated patients.

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Elderly Taiwanese's intrinsic risk factors for fall-related injuries

Li IF, Hsiung Y, Hsing HF, Lee MY, Chang TH, Huang MY.

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Abstract

BACKGROUND: As a vital issue in geriatric research, risk factors for falls were concluded to be multifactorial, and prevention has been mostly aimed at decreasing situational and environmental risks that cause and aggravate fall-related injuries, particularly within the institutions. While knowledge is limited about older patients' intrinsic determinants, the purpose of this study was to explore elderly Taiwanese's intrinsic risk factors associated with severe fall-related injuries.

METHODS: Between April 2011 and December 2013, medical records related to in-ward elderly patients' falls were retrieved from two teaching hospitals in the northern Taiwan area. A total of 244 elderly hospitalized patients' fall-related assessments were reviewed from the national hospital safety reporting system. Chi-square statistics and odds ratio calculations were performed to ascertain significant associations between risk factors and the severity of after-fall injuries.

RESULTS: Major risk factors resulting in fall-related injuries were found to be intrinsic and not situational or environment-related. Vertigo and weakness of the legs were both significant physical and behavioral determinants, and elderly cancer patients staying in oncological wards were more likely to have severe injuries after incidents of falls, compared with those in medical and surgical wards. Female gender was not discovered as a significant factor to affect the severity of falls.

CONCLUSION: Elderly Taiwanese inpatients with existing intrinsic conditions of cancer, vertigo, and lower leg weakness were at high risk of falling, resulting in severe injuries. Additional research including controlled trials is necessary to further identify treatable, causal intrinsic risk factors for this elderly group.

PDF Endnote Y

Fall detection using adaptive neuro-fuzzy inference system

Rashidpour M, Fathi A, Abdali-Mohammadi F.

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Abstract

A factor seriously endangers the people health is falling, particularly for patients and the elderly. Fall detection systems contribute in preventing the consequences of the late medical aid and injuries endangering the people health. The main problem within fall detection systems is how to correctly distinguish between a fall and the other daily activities. There are various types of fall detection systems each of which has different advantages and disadvantages. Wireless motion-sensor based systems such as accelerometer and gyroscope provide higher efficiency with lower limits. This study introduces a new fall detection method employing motion sensors in smart phones to collect data due to the ease of access and application. To provide high efficiency for people with various ages and conditions, this method also takes advantages of adaptive-fuzzy neural networks for learning and inference. These methods correctly detect all 4 types of fall from 9 main daily activity groups.

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Inertial sensor based analysis of lie-to-stand transfers in younger and older adults

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Sensors (Basel) 2016; 16(8): ePub.

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Abstract

Many older adults lack the capacity to stand up again after a fall. Therefore, to analyse falls it is relevant to understand recovery patterns, including successful and failed attempts to get up from the floor in general. This study analysed different kinematic features of standing up from the floor. We used inertial sensors to describe the kinematics of lie-to-stand transfer patterns of younger and healthy older adults. Fourteen younger (20-50 years of age, 50% men) and 10 healthy older community dwellers (≥ 60 years; 50% men) conducted four lie-to-stand transfers from different initial lying postures. The analysed temporal, kinematic, and elliptic fitting complexity measures of transfer performance were significantly different between younger and older subjects (i.e., transfer duration, angular velocity (RMS), maximum vertical acceleration, maximum vertical velocity, smoothness, fluency, ellipse width, angle between ellipses). These results show the feasibility and potential of analysing kinematic features to describe the lie-to-stand transfer performance, to help design interventions and detection approaches to prevent long lies after falls. It is possible to describe age-related differences in lie-to-stand transfer performance using inertial sensors. The kinematic analysis remains to be tested on patterns after real-world falls.

PDF Y Endnote Y

Injury profile and outcomes of elderly nursing home residents admitted to an Australian major trauma centre

Sotade O, Dinh M, Bein K.

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Abstract

BACKGROUND: Trauma outcomes in elderly nursing home patients are not well described. The objectives of the study were to examine injury profile and in-hospital outcomes in a population of elderly nursing home residents admitted after a fall. The study aims to determine predictors of increased length of stay and the association of anticoagulant use to trauma.

METHODS: Retrospective analysis of trauma registry data, of all nursing home residents aged 65 or over, admitted to hospital after a ground level fall between January 2013 and December 2013.

Results: Two hundred and fifteen cases were analysed. The most common injuries sustained were head injury (n=82) and lower limb injury (n=51). Patients who used anticoagulants prior to hospital admission had a higher proportion of major trauma (36% versus 9% $p < 0.001$) and severe head injury (23% versus 7% $p=0.015$) compared to patients who did not use pre-study anticoagulants. The median length of stay for admitted patients was 7 days (Interquartile Range 3-10 days). The only predictor of increased length of stay including transfer to rehabilitation after adjusting for age, injury severity, and co-morbidities was the presence of lower limb injuries (OR 5.2 95%CI 1.5, 18.0 $p=0.01$).

CONCLUSION: Head injuries are the most commonly injured body region. Our data suggest there is

an association between anticoagulant use and greater severity of injury. Lower limb injuries were associated with longer length of stay in hospital.

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Investigating community perspectives on falls prevention information seeking and delivery: older person perceptions regarding preferences for falls prevention education using a world cafe approach

Bulsara C, Khong L, Hill K, Hill AM.

J. Community Psychol. 2016; 44(7): 937-944.

(Copyright © 2016, John Wiley and Sons)

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Abstract

Falls among older people are a significant global socioeconomic problem, and older adults have low levels of self-perceived risk and a lack of willingness to take up existing falls prevention strategies. We believe that given the challenges of delivering falls prevention information, meaningful engagement of community members would create solutions based on an understanding of what would work best for that community. A World Cafe community forum sought the opinions of 70 community-dwelling older people about their preferences on how they would best receive and seek falls prevention information that could prevent falls within their age group. Participants evaluated the café as a highly positive experience and felt that learning occurred by way of interaction and "sharing of ideas." Local communities could develop this participatory approach to engage older people in leading the translation of falls prevention evidence into practice.

PDF Y Endnote Y

Obesity and falls in a prospective study of older men: the Osteoporotic Fractures in Men Study

Hooker ER, Shrestha S, Lee CG, Cawthon PM, Abrahamson M, Ensrud K, Stefanick ML, Dam TT, Marshall LM, Orwoll ES, Nielson CM.

J. Aging Health 2016; ePub(ePub): ePub.

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Abstract

OBJECTIVE: The aim of this study is to evaluate fall rates across body mass index (BMI) categories by age group, considering physical performance and comorbidities.

METHOD: In the Osteoporotic Fractures in Men (MrOS) study, 5,834 men aged ≥ 65 reported falls every 4 months over 4.8 (± 0.8) years. Adjusted associations between BMI and an incident fall were tested using mixed-effects models.

RESULTS: The fall rate (0.66/man-year overall, 95% confidence interval [CI] = [0.65, 0.67]) was lowest in the youngest, normal weight men (0.44/man-year, 95% CI = [0.41, 0.47]) and greatest in the oldest, highest BMI men (1.47 falls/man-year, 95% CI = [1.22, 1.76]). Obesity was associated with a 24% to 92% increased fall risk in men below 80 (ptrend $\leq .0001$, p for interaction by age = .03). Only adjustment for dynamic balance test altered the BMI-falls association substantially.

DISCUSSION: Obesity was independently associated with higher fall rates in men 65 to 80 years old. Narrow walk time, a measure of gait stability, may mediate the association.

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Objective drivers of subjective well-being in geriatric inpatients: mobility function and level of education are general predictors of self-evaluated health, feeling of loneliness, and severity of depression symptoms

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Abstract

PURPOSE: Identification of optimal predictors for different indicators of subjective well-being (SWB) in geriatric inpatients: (1) self-evaluated health status (SEH), (2) feeling of loneliness (FoL), and (3) severity of depression symptoms (SoDS). Investigation of the relationship between response categories of the SWB indicators and their predictors.

METHODS: The data were collected retrospectively from hospital records. All 555 geriatric inpatients underwent a comprehensive geriatric assessment, including the Timed Up and Go (TUG) test. The Bayesian information criterion was applied in ordinal logistic regression models to identify optimal predictors of SEH, FoL, and SoDS among different objective factors.

RESULTS: After controlling for high-stress situations in the recent past, motor slowness measured with the TUG test, and a level of education were jointly selected as the best predictors of all three SWB indicators. The speed of performing the TUG test improved SEH (OR = 2.08) and decreased both FoL (OR = 0.41) and SoDS (OR = 0.41). A higher level of education improved SEH (OR = 1.05) and alleviated both FoL (OR = 0.96) and SoDS (OR = 0.92). Additionally, a higher level of SEH was positively correlated with a lower BMI, improved instrumental activities of daily living (I-ADL), and higher hemoglobin level. FoL was reinforced by the level of comorbidity, and SoDS was increased by impaired basic ADL.

CONCLUSION: Although SWB in geriatric inpatients can be explained by objective comorbidities and disabilities, the good motor function (i.e., a TUG test outcome of less than about 20 s) and a higher level of education were the general predictors that exert an independent beneficial impact on all three SWB indicators.

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Older age results in differential gene expression after mild traumatic brain injury and is linked to imaging differences at acute follow-up

Cho YE, Latour LL, Kim H, Turtzo LC, Olivera A, Livingston WS, Wang D, Martin C, Lai C, Cashion A, Gill J. *Front. Aging Neurosci.* 2016; 8: e168.

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Abstract

Older age consistently relates to a lesser ability to fully recover from a traumatic brain injury (TBI); however, there is limited data to explicate the nature of age-related risks. This study was undertaken to determine the relationship of age on gene-activity following a TBI, and how this biomarker relates to changes in neuroimaging findings. A young group (between the ages of 19 and 35 years), and an

old group (between the ages of 60 and 89 years) were compared on global gene-activity within 48 h following a TBI, and then at follow-up within 1-week. At each time-point, gene expression profiles, and imaging findings from both magnetic resonance imaging (MRI) and computed tomography were obtained and compared. The young group was found to have greater gene expression of inflammatory regulatory genes at 48 h and 1-week in genes such as basic leucine zipper transcription factor 2 (BACH2), leucine-rich repeat neuronal 3 (LRRN3), and lymphoid enhancer-binding factor 1 (LEF1) compared to the old group. In the old group, there was increased activity in genes within S100 family, including calcium binding protein P (S100P) and S100 calcium binding protein A8 (S100A8), which previous studies have linked to poor recovery from TBI. The old group also had reduced activity of the noggin (NOG) gene, which is a member of the transforming growth factor- β superfamily and is linked to neurorecovery and neuroregeneration compared to the young group. We link these gene expression findings that were validated to neuroimaging, reporting that in the old group with a MRI finding of TBI-related damage, there was a lesser likelihood to then have a negative MRI finding at follow-up compared to the young group. Together, these data indicate that age impacts gene activity following a TBI, and suggest that this differential activity related to immune regulation and neurorecovery contributes to a lesser likelihood of neuronal recovery in older patients as indicated through neuroimaging.

PDF Y Endnote Y

Pain increases the risk of developing frailty in older adults with osteoarthritis

Veronese N, Maggi S, Trevisan C, Noale M, Rui MD, Bolzetta F, Zambon S, Musacchio E, Sartori L, Perissinotto E, Stubbs B, Crepaldi G, Manzato E, Sergi G.

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Abstract

OBJECTIVE: While osteoarthritis (OA)-related pain increases the risk of physical inactivity, disability, and falls, less is known about whether pain increases the risk of frailty. We investigated if people with OA reporting pain are more likely to develop frailty than people with OA without pain. **Design.** Population-based prospective cohort study with a follow-up of 4.4 years. **Setting.** Community. **Subjects.** The subjects were 1,775 older men and women with osteoarthritis, enrolled in the Progetto Veneto Anziani.

METHODS: Pain was ascertained according to medical records, symptoms/signs, and use of analgesics. Participants were considered frail if they met three out of five criteria of Fried's Index.

RESULTS: Cross-sectional analysis at baseline demonstrated that after adjusting for potential confounders (age, gender, anthropometric and demographic data, comorbidities), people with OA and pain ($n = 568$) were significantly more likely to have frailty compared with those with OA without pain ($n = 1,207$; hand OA, OR = 1.86, 95% CI = 1.65-2.09; hip OA, OR = 1.62, 95% CI = 1.44-1.83; knee OA, OR = 1.42, 95% CI = 1.26-1.60; all $p < 0.0001$). Prospective analysis of 1,152 nonfrail subjects at baseline demonstrated that 19.9% developed incident frailty. A fully-adjusted logistic regression analysis demonstrated that lower limb OA-related pain was associated with an increased risk of developing frailty compared with people with OA and no pain.

CONCLUSIONS: Pain related to OA might be an important factor influencing the relationship between OA and the development of frailty.

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Physical behavior in older persons during daily life: insights from instrumented shoes

Moufawad El Achkar C, Lenoble-Hoskovec C, Paraschiv-Ionescu A, Major K, Büla C, Aminian K. *Sensors* (Basel) 2016; 16(8): s16081225.

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Abstract

Activity level and gait parameters during daily life are important indicators for clinicians because they can provide critical insights into modifications of mobility and function over time. Wearable activity monitoring has been gaining momentum in daily life health assessment. Consequently, this study seeks to validate an algorithm for the classification of daily life activities and to provide a detailed gait analysis in older adults. A system consisting of an inertial sensor combined with a pressure sensing insole has been developed. Using an algorithm that we previously validated during a semi structured protocol, activities in 10 healthy elderly participants were recorded and compared to a wearable reference system over a 4 h recording period at home. Detailed gait parameters were calculated from inertial sensors. Dynamics of physical behavior were characterized using barcodes that express the measure of behavioral complexity. Activity classification based on the algorithm led to a 93% accuracy in classifying basic activities of daily life, i.e., sitting, standing, and walking. Gait analysis emphasizes the importance of metrics such as foot clearance in daily life assessment. RESULTS also underline that measures of physical behavior and gait performance are complementary, especially since gait parameters were not correlated to complexity. Participants gave positive feedback regarding the use of the instrumented shoes. These results extend previous observations in showing the concurrent validity of the instrumented shoes compared to a body-worn reference system for daily-life physical behavior monitoring in older adults.

PDF Y Endnote y

The association between different levels of alcohol use and gait under single and dual task in community-dwelling older persons aged 65 to 70 years

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Curr. Gerontol. Geriatr. Res. 2016; 2016: e2018507.

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Abstract

OBJECTIVE: This study aimed to describe the cross-sectional and longitudinal association between alcohol intake and gait parameters in older persons.

METHODS: Community-dwelling persons aged 65-70 years (N = 807). Information on health, functional status, and alcohol use was self-reported at baseline and at 3-year follow-up, whereas gait speed and stride-to-stride variability were measured while walking only (single task) and under dual tasking (counting backwards).

RESULTS: Compared to light-to-moderate drinking, heavy drinking was associated with slower gait

speed in single task (adj. coeff.: -.040, 95% CI: -.078 to -.002, $p = .035$). No significant association was observed between heavy drinking and gait speed variability. Nondrinkers walked significantly slower than light-to-moderate drinkers in dual task and had significantly higher gait speed variability in both single and dual task, but these associations disappeared after adjustment for comorbidity. At follow-up, 35.2% and 34.1% of the participants walked significantly slower in single and dual task, respectively. This proportion varied a little across drinking categories.

CONCLUSION: At baseline, heavy alcohol consumption was significantly associated with slower gait speed in single task. Selective survival of the fittest heavy drinkers probably explains why this association faded in longitudinal analyses. The trend of poorer gait performance in nondrinkers disappeared after adjustment for comorbidity, suggesting confounding by a worse health status.

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What becomes of people admitted to acute old age psychiatry wards? An exploration of factors affecting length of stay, delayed discharge and discharge destination

Tucker S, Hargreaves C, Wilberforce M, Brand C, Challis D.

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Abstract

OBJECTIVES: The study sought to identify the variables associated with increased length of stay on old age psychiatry inpatient wards. It also explored the factors related to delayed discharge and the likelihood of patients admitted from home returning there.

METHODS: Data were collected on the sociodemographic, clinical and service receipt characteristics of a 6-month series of admissions to seven wards in England in 2010/2011. The cohort was followed for a 9- to 11-month period. The relationship between patients' status on admission and the specified outcome variables was explored.

RESULTS: Information was collected on 216 admissions, of whom 165 were discharged in the study period. Mean length of stay was 64 days. Female gender, higher dependency, greater challenging behaviour and locality predicted extended stay. Forty per cent of cases experienced delayed discharge. Better physical health, more cognitive impairment, receipt of social care and locality were associated with delayed discharge. The vast majority of patients admitted from home returned there. Younger patients and patients with less dependency, cognitive impairment and challenging behaviour had a higher likelihood of returning home. Patients receiving social care or admitted because of carer stress, a risk of self-neglect, accidental self-harm or abuse/exploitation were less likely to return home.

CONCLUSIONS: The study provides a useful starting point for identifying cases on which future efforts to improve inpatient outcomes might centre and suggests local rather than national responses may be needed. It also highlights an urgent need for a national focus on the scope, purpose and effectiveness of acute inpatient care. Copyright © 2016 John Wiley & Sons, Ltd.

PDF Y Endnote Y

A novel robot for imposing perturbations during overground walking: mechanism, control and normative stepping responses

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DOI 10.1186/s12984-016-0160-7 **PMID** 27287551 **PMCID** PMC4903006

Abstract

BACKGROUND: The most common approach to studying dynamic balance during walking is by applying perturbations. Previous studies that investigated dynamic balance responses predominantly focused on applying perturbations in frontal plane while walking on treadmill. The goal of our work was to develop balance assessment robot (BAR) that can be used during overground walking and to assess normative balance responses to perturbations in transversal plane in a group of neurologically healthy individuals.

METHODS: BAR provides three passive degrees of freedom (DoF) and three actuated DoF in pelvis that are admittance-controlled in such a way that the natural movement of pelvis is not significantly affected. In this study BAR was used to assess normative balance responses in neurologically healthy individuals by applying linear perturbations in frontal and sagittal planes and angular perturbations in transversal plane of pelvis. One way repeated measure ANOVA was used to statistically evaluate the effect of selected perturbations on stepping responses.

RESULTS: Standard deviations of assessed responses were similar in unperturbed and perturbed walking. Perturbations in frontal direction evoked substantial pelvis displacement and caused statistically significant effect on step length, step width and step time. Likewise, perturbations in sagittal plane also caused statistically significant effect on step length, step width and step time but with less explicit impact on pelvis movement in frontal plane. On the other hand, except from substantial pelvis rotation angular perturbations did not have substantial effect on pelvis movement in frontal and sagittal planes while statistically significant effect was noted only in step length and step width after perturbation in clockwise direction.

CONCLUSIONS: Results indicate that the proposed device can repeatedly reproduce similar experimental conditions.

RESULTS also suggest that "stepping strategy" is the dominant strategy for coping with perturbations in frontal plane, perturbations in sagittal plane are to greater extent handled by "ankle strategy" while angular perturbations in transversal plane do not pose substantial challenge for balance.

RESULTS also show that specific perturbation in general elicits responses that extend also to other planes of movement that are not directly associated with plane of perturbation as well as to spatio temporal parameters of gait.

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Conflicting and non-conflicting visual cues lead to error in gait initiation and gait inhibition in individuals with freezing of gait

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Abstract

INTRODUCTION: We asked whether conflicting visual cues influences gait initiation, gait inhibition and postural control in Parkinson's disease (PD) between freezers, non-freezers and healthy older adults.

METHODS: Twenty-five PD participants on dopaminergic medication and 17 healthy older adults were asked to initiate or refrain gait depending on visual cues: green GO (GG), green STOP (GS), red GO (RG), red STOP (RS). Center of pressure (CoP) displacement, variability and mean velocity (VCoP) in the anterior-posterior (AP) and medial-lateral (ML) directions and movement time (MT) were measured.

RESULTS: Gait initiation: Both freezers and non-freezers were different from controls in GG and GS. In GS, freezers had smaller CoP displacement and velocity in both directions ($p < 0.01$), while non-freezers had smaller VCoP in AP and ML ($p < 0.01$). AP CoP displacement in GS was smaller in freezers compared to non-freezers ($p < 0.05$). Freezers had longer MT compared to controls in GG and compared to both groups in GS ($p < 0.01$). Gait inhibition: Controls and freezers had larger CoP displacement variability ($p < 0.05$) and velocity ($p < 0.01$) in both directions in RG compared to RS. No differences were seen in non-freezers. Three freezers initiated walking during the RG or RS conditions.

CONCLUSION: Freezers were in general slower at initiating gait, displayed a more restrictive postural strategy and were more affected by the conflicting conditions compared to both controls and non-freezers. In freezers, the conflicting visual cues may have increased the cognitive load enough to provoke delays in processing the visual information and implementing the appropriate motor program.

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Exploring the feasibility and acceptability of sensor monitoring of gait and falls in the homes of persons with multiple sclerosis

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Abstract

Gait parameters variability and falls are problems for persons with MS and have not been adequately captured in the home. Our goal was to explore the feasibility and acceptability of monitoring of gait and falls in the homes of persons with MS over a period of 30 days. To test the feasibility of measuring gait and falls for 30 days in the home of persons with MS, spatiotemporal gait parameters stride length, stride time, and gait speed were compared. A 3D infrared depth imaging system has been developed to objectively measure gait and falls in the home environment. Participants also completed a 16-foot GaitRite electronic pathway walk to validate spatiotemporal parameters of gait (gait speed (cm/s), stride length (cm), and gait cycle time(s)) during the timed 25 foot walking test (T25FWT). We also documented barriers to feasibility of installing the in-home sensors for these participants. The results of the study suggest that the Kinect sensor may be used as an alternative device to measure gait for persons with MS, depending on the desired accuracy level. Ultimately, using in-home sensors to analyze gait parameters in real time is feasible and could lead to better analysis of gait in persons with MS.

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Gait characteristics, balance performance and falls in ambulant adults with cerebral palsy: an observational study

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Abstract

The relationship between spatiotemporal gait parameters, balance performance and falls history was investigated in ambulant adults with cerebral palsy (CP). Participants completed a single assessment of gait using an instrumented walkway at preferred and fast speeds, balance testing (Balance Evaluation Systems Test; BESTest), and reported falls history. Seventeen ambulatory adults with CP, mean age 37 years, participated. Gait speed was typically slow at both preferred and fast speeds (mean 0.97 and 1.21m/s, respectively), with short stride length and high cadence relative to speed. There was a significant, large positive relationship between preferred gait speed and BESTest total score ($\rho=0.573$; $p<0.05$) and fast gait speed and BESTest total score ($\rho=0.647$, $p<0.01$). The stride lengths of fallers at both preferred and fast speeds differed significantly from non-fallers ($\rho=0.032$ and $\rho=0.025$, respectively), with those with a prior history of falls taking shorter strides. Faster gait speed was associated with better performance on tests of anticipatory and postural response components of the BESTest, suggesting potential therapeutic training targets to address either gait speed or balance performance. Future exploration of the implications of slow walking speed and reduced stride length on falls and community engagement, and the potential prognostic value of stride length on identifying falls risk is recommended.

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Implementing exercise programs to prevent falls: systematic descriptive review

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Abstract

BACKGROUND: The United States Preventive Services Task Force recommends exercise to prevent falls in community-dwelling adults aged ≥ 65 years at increased fall risk. However, little is known about how best to implement exercise programs in routine care when a patient's need for exercise is identified within the healthcare system.

METHODS: Using a qualitative approach, we reviewed the literature to determine how exercise programs to prevent falls are implemented from the vantage point of a health care setting. We synthesized descriptive information about each program with data on program features and implementation difficulties and facilitators.

RESULTS: We found that programs sponsored by primary care providers (PCPs) or specialists may

help with recruitment into exercise programs. PCPs have the opportunity to identify people at risk and promote participation since most older adults regularly visit, and inquire about exercise from, their physicians. In terms of referral options, both home-based and group-based exercise programs have been shown effective in preventing falls; however, each approach carries strengths and limitations. Home-based programs can include participants who are reluctant or unable to attend group classes and can be individually tailored, but provide less opportunity for supervision and socialization than classes. Adherence to programs can be encouraged, and attrition minimized, through positive reinforcement. Successful programs ranged in expense for exercise sessions: a weekly class combined with exercises at home cost < \$2 per participant per week, while frequent individual sessions cost > \$100 per participant per week.

CONCLUSIONS: With increasing attention to population-based health management in the United States, clinicians and health system leaders need a deeper understanding of how to link patients in their healthcare systems with appropriate community programs. This review identifies key characteristics of successful fall prevention exercise programs that can be used to determine which local options conform to clinical evidence. In addition, we highlight tradeoffs between program options, such as home versus group exercise programs, to allow referrals to be tailored to local conditions and patient preferences. Finally, our work highlights the key role of the PCP in recruiting patients to participate in exercise programs, and identifies options, such as registries, to support referrals to the community.

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The effect of pulmonary rehabilitation on mortality, balance, and risk of fall in stable patients with chronic obstructive pulmonary disease: A systematic review

Hakamy A, Bolton CE, McKeever TM.

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Abstract

The aim of this study is to conduct a systematic review of published studies that evaluate the impact of pulmonary rehabilitation (PR) on survival and fall (including balance) in patients with chronic obstructive pulmonary disease at stability. OVID, Medline, EMBASE, and Cochrane collaboration library were searched for literature dating from January 1980 up to November 2014 as well as an update in October 2015. Two reviewers screened titles, abstracts and full text records, extracted data, and assessed studies for risk of bias; any disagreements were resolved by a third member of the team, and consensus was always sought. Initial searches yielded 3216 records but after review only seven studies were included and there were no studies focused solely on falls. Two cohort studies found some positive benefits of PR on balance, but the results were inconsistent across the studies. Regarding survival, two randomized controlled trials were conducted; one study showed significant survival benefit at 1 year, while the other one showed nonsignificant survival benefit at 3 years. Neither were adequately powered and in both, survival was a secondary outcome. There was only limited inconclusive evidence to show that PR has a significant beneficial effect on balance or survival.

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Twelve-month mortality and functional outcomes in hip fracture patients under 65 years of age

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Injury 2016; ePub(ePub): ePub.

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Abstract

INTRODUCTION: There has been a recent call for improved functional outcome reporting in younger hip fracture patients. Younger hip fracture patients represent a different population with different functional goals to their older counterparts. Therefore, previous research on mortality and functional outcomes in hip fracture patients may not be generalisable to the younger population. The aims of this study were to report 12-month survival and functional outcomes in hip fracture patients aged <65 years and predictors of functional outcome.

METHODS: Hip fracture patients aged <65 years (range 17-64) registered by the Victorian Orthopaedic Trauma Outcomes Registry over four years were included and their 12-month survival and functional outcomes (Extended Glasgow Outcome Scale) reported. Ordered multivariable logistic regression was used to identify predictors of higher function.

RESULTS: There were 507 patients enrolled in the study and of the 447 patients (88%) with 12-month outcomes, 24 (5%) had died. The majority of patients had no comorbidities or pre-injury disability and were injured via road trauma or low falls. 40% of patients sustained additional injuries to their hip fracture. 23% of patients had fully recovered at 12 months and 39% reported ongoing moderate disability. After adjusting for all key variables, odds of better function 12-months post-fracture were reduced for patients with co-morbidities, previous disability or additional injuries, those receiving compensation or injured via low falls.

CONCLUSIONS: While 12-month survival rates were satisfactory in hip fracture patients aged under 65 years, their functional outcomes were poor, with less than one quarter having fully recovered 12 months following injury. This study provides new information about which patients may have difficulty returning to their pre-injury level of function. These patients may require additional or more intensive post-discharge care in order to fulfil their functional goals and continue to contribute productively to society.

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Wearable sensors used for human gait analysis

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Rom. J. Morphol. Embryol. 2016; 57(2): 373-382.

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Abstract

This paper briefly presents recent developments in the field of wearable sensors and systems that are relevant to the area of normal and pathological human gait analysis. By using wearable sensors, it is possible to monitor the pathological gait disorders and alterations and the changes of balance in

the people and prevent or diagnose of different diseases. The most usable wearable sensors and their applications in clinical field are presented based on specialty literature.

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What's keeping people after stroke from walking outdoors to become physically active? A qualitative study, using an integrated biomedical and behavioral theory of functioning and disability

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BMC Neurol. 2016; 16(1): e137.

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Abstract

BACKGROUND: In general people after stroke do not meet the recommendations for physical activity to conduct a healthy lifestyle. Programs to stimulate walking activity to increase physical activity are based on the available insights into barriers and facilitators to physical activity after stroke. However, these programs are not entirely successful. The purpose of this study was to comprehensively explore perceived barriers and facilitators to outdoor walking using a model of integrated biomedical and behavioral theory, the Physical Activity for people with a Disability model (PAD).

METHODS: Included were community dwelling respondents after stroke, classified ≥ 3 at the Functional Ambulation Categories (FAC), purposively sampled regarding the use of healthcare. The data was collected triangulating in a multi-methods approach, i.e. semi-structured, structured and focus-group interviews. A primarily deductive thematic content analysis using the PAD-model in a framework-analysis' approach was conducted after verbatim transcription.

RESULTS: 36 respondents (FAC 3-5) participated in 16 semi-structured interviews, eight structured interviews and two focus-group interviews. The data from the interviews covered all domains of the PAD model. Intention, ability and opportunity determined outdoor walking activity. Personal factors determined the intention to walk outdoors, e.g. negative social influence, resulting from restrictive caregivers in the social environment, low self-efficacy influenced by physical environment, and also negative attitude towards physical activity. Walking ability was influenced by loss of balance and reduced walking distance and by impairments of motor control, cognition and aerobic capacity as well as fatigue. Opportunities arising from household responsibilities and lively social constructs facilitated outdoor walking.

CONCLUSION: To stimulate outdoor walking activity, it seems important to influence the intention by addressing social influence, self-efficacy and attitude towards physical activity in the development of efficient interventions. At the same time, improvement of walking ability and creation of opportunity should be considered.

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