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A radar-based smart sensor for unobtrusive elderly monitoring in ambient assisted living applications

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DOI 10.3390/bios7040055 **PMID** 29186786

Abstract

Continuous in-home monitoring of older adults living alone aims to improve their quality of life and independence, by detecting early signs of illness and functional decline or emergency conditions. To meet requirements for technology acceptance by seniors (unobtrusiveness, non-intrusiveness, and privacy-preservation), this study presents and discusses a new smart sensor system for the detection of abnormalities during daily activities, based on ultra-wideband radar providing rich, not privacy-sensitive, information useful for sensing both cardiorespiratory and body movements, regardless of ambient lighting conditions and physical obstructions (through-wall sensing). The radar sensing is a very promising technology, enabling the measurement of vital signs and body movements at a distance, and thus meeting both requirements of unobtrusiveness and accuracy. In particular, impulse-radio ultra-wideband radar has attracted considerable attention in recent years thanks to many properties that make it useful for assisted living purposes. The proposed sensing system, evaluated in meaningful assisted living scenarios by involving 30 participants, exhibited the ability to detect vital signs, to discriminate among dangerous situations and activities of daily living, and to accommodate individual physical characteristics and habits. The reported results show that vital signs can be detected also while carrying out daily activities or after a fall event (post-fall phase), with accuracy varying according to the level of movements, reaching up to 95% and 91% in detecting respiration and heart rates, respectively. Similarly, good results were achieved in fall detection by using the micro-motion signature and unsupervised learning, with sensitivity and specificity greater than 97% and 90%, respectively.

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A screening tool using five risk factors was developed for fall-risk prediction in Chinese community-dwelling elderly individuals

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Rejuvenation Res. 2017; ePub(ePub): ePub.

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Abstract

OBJECTIVE: The objective of this study was to determine falls risk profiles to derive a falls risks prediction score and establish a simple and practical clinical screening tool for Chinese community-dwelling elderly individuals.

METHOD: This was a prospective cohort study (N=619) among adults aged 60 years and older. Falls were ascertained at a 1-year follow-up appointment. Sociodemographic information, medical history

and physical performance data were collected.

RESULT: The mean age was 67.4 years; 57.7% were women. Female sex (Odds Ratios (OR) 1.82; 95% CI 1.17-2.82), diabetes (OR 2.13; 95% CI 1.13-3.98), a Timed Up and Go Test \geq 10.49s (OR 1.51; 95% CI 1.23-1.94), a history of falls (OR 3.15; 95% CI 1.72-5.79), and depression (Geriatric Depression Scale (GDS) \geq 11, OR 2.51; 95% CI 1.36-4.63) were the strongest predictors. These predictors were used to establish a risk score. The area under the curve (AUC) of the score was 0.748. From a clinical point of view the most appropriate cutoff value was 7 (97.5% specificity, 70.7% positive predictive value (PPV), and 83.6% negative predictive value (NPV)). For this cutoff, the fraction correctly classified was 82.5%.

CONCLUSION: A cut off score of 7 derived from a risk assessment tool using four risk factors (gender, falls history, diabetes, and depression) and the TUGT may be used in Chinese community-dwelling elderly individuals as an initial step to screen those at low risk for falls.

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Demographics of fall-related trauma among the elderly presenting to emergency department; a cross-sectional study

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Emergency (Tehran, Iran) 2017; 5(1): e78.

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DOI 10.22037/emergency.v5i1.18497 **PMID** 29201960 **PMCID** PMC5703755

Abstract

INTRODUCTION: Falling is reported to be the most common cause of mortality due to trauma in individuals over the age of 75 years. The present study is designed with the aim of determining the demographics of fall-related trauma among the elderly presenting to emergency department (ED).

METHODS: The present prospective cross-sectional study was carried out on all elderly patients \geq 60 years old presenting to ED of a major referral trauma center in North West of Iran during 1 year. Demographic data, location and height of falling, duration of hospitalization, trauma severity and in-hospital outcome of the patients were gathered and reported via descriptive statistics.

RESULTS: 228 patients with the mean age of 70.96 ± 5.2 years were studied (53.9% female). Most patients were in the 66-70 years age range (32.6%) and had a history of hypertension (22.3%), who had visited following a fall inside the house (69.3%), due to slipping (73.7%), and from a height equal to or less than 2m (71.9%). 6 (2.6%) patients died in the hospital. Mean trauma severity of patients based on ISS, RTS, and TRISS were 10.65 ± 3.95 (3-19), $7.84 \pm .21$ (1.4-14.5) and 1.66 ± 1.31 (-1.49-3.82), respectively. Regarding need for hospitalization, only ISS shows a significant difference between outpatients and inpatients ($p = 0.023$). Patients who died had a significantly higher trauma severity based on ISS ($p < 0.0001$) and RTS ($p < 0.0001$).

CONCLUSION: Based on the findings of the present study, slipping and syncope are the most common causes of falling in the studied elderly that had mostly happened inside the house and from a height less than 2m. Therefore, most patients were in the mild to moderate range of trauma severity. ISS and RTS were significantly higher in the 6 (2.6%) patients who died.

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Effect of pain on fear of falling in patients with femoral proximal fracture

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J. Phys. Ther. Sci. 2017; 29(11): 2009-2012.

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(Copyright © 2017, Society of Physical Therapy Science)

DOI 10.1589/jpts.29.2009 **PMID** 29200646 **PMCID** PMC5702836

Abstract

PURPOSE: This study investigated the factors affecting fear of falling in patients with femoral proximal fracture.

SUBJECTS AND METHODS: The participants were 26 patients with femoral proximal fracture (3 males and 23 females, average age: 80.2 ± 7.9 years). Fall self-efficacy, motor functions, and pain intensity were measured 4 weeks post-surgery, and the participants were divided into three groups based on their scores on the Falls Efficacy Scale.

RESULTS: The group with low fall self-efficacy was significantly older and experienced stronger pain than the group with high fall self-efficacy did. In a multivariate analysis, age and pain intensity were extracted as factors influencing fall self-efficacy.

CONCLUSION: For patients with femoral proximal fracture, in addition to age, pain was identified as a correlated factor to fear of falling.

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Fear of falling and postural reactivity in patients with glaucoma

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Abstract

PURPOSE: To investigate the relationship between postural metrics obtained by dynamic visual stimulation in a virtual reality environment and the presence of fear of falling in glaucoma patients.

METHODS: This cross-sectional study included 35 glaucoma patients and 26 controls that underwent evaluation of postural balance by a force platform during presentation of static and dynamic visual stimuli with head-mounted goggles (Oculus Rift). In dynamic condition, a peripheral translational stimulus was used to induce vection and assess postural reactivity. Standard deviations of torque moments (SDTM) were calculated as indicative of postural stability. Fear of falling was assessed by a standardized questionnaire. The relationship between a summary score of fear of falling and postural metrics was investigated using linear regression models, adjusting for potentially confounding factors.

RESULTS: Subjects with glaucoma reported greater fear of falling compared to controls (-0.21 vs. 0.27 ; $P = 0.039$). In glaucoma patients, postural metrics during dynamic visual stimulus were more associated with fear of falling ($R^2 = 18.8\%$; $P = 0.001$) than static ($R^2 = 3.0\%$; $P = 0.005$) and dark field ($R^2 = 5.7\%$; $P = 0.007$) conditions. In the univariable model, fear of falling was not significantly associated with binocular standard perimetry mean sensitivity ($P = 0.855$). In the multivariable model, each 1 Nm larger SDTM in anteroposterior direction during dynamic stimulus was associated with a worsening of 0.42 units in the fear of falling questionnaire score ($P = 0.001$).

CONCLUSION: In glaucoma patients, postural reactivity to a dynamic visual stimulus using a virtual reality environment was more strongly associated with fear of falling than visual field testing and traditional balance assessment.

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Geriatric traumatic brain injury: epidemiology, outcomes, knowledge gaps, and future directions

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(Copyright © 2017, Mary Ann Liebert Publishers)

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Abstract

This review of the literature on traumatic brain injury (TBI) in older adults focuses on incident TBI sustained in older adulthood ("geriatric TBI") rather than on the separate, but related, topic of older adults with a history of earlier-life TBI. We describe the epidemiology of geriatric TBI, the impact of comorbidities and pre-injury function on TBI risk and outcomes, diagnostic testing, management issues, outcomes, and critical directions for future research. The highest incidence of TBI-related emergency department visits, hospitalizations, and deaths occur in older adults. Higher morbidity and mortality rates among older versus younger individuals with TBI may contribute to an assumption of futility about aggressive management of geriatric TBI. However, many older adults with TBI respond well to aggressive management and rehabilitation, suggesting that chronological age and TBI severity alone are inadequate prognostic markers. Yet there are few geriatric-specific TBI guidelines to assist with complex management decisions, and TBI prognostic models do not perform optimally in this population. Major barriers in management of geriatric TBI include underrepresentation of older adults in TBI research, lack of systematic measurement of pre-injury health that may be a better predictor of outcome and response to treatment than age and TBI severity alone, and lack of geriatric-specific TBI common data elements (CDEs). This review highlights the urgent need to develop more age-inclusive TBI research protocols, geriatric TBI CDEs, geriatric TBI prognostic models, and evidence-based geriatric TBI consensus management guidelines aimed at improving short- and long-term outcomes for the large and growing geriatric TBI population.

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High prevalence of prescription of psychotropic drugs for older patients in a general hospital

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DOI 10.1186/s40360-017-0183-0 **PMID** 29202811

Abstract

BACKGROUND: Many elderly patients receive psychotropic drugs. Treatment with psychotropic agents is associated with serious side effects including an increased risk of falls and fractures. Several psychotropic drugs are considered potentially inappropriate for treatment of the elderly.

METHODS: A retrospective chart review was conducted covering all patients aged ≥ 65 years who

were admitted to Evangelisches Krankenhaus Göttingen-Weende between 01/01/2013 and 03/31/2013. Psychotropic drugs reviewed for included benzodiazepines, Z-drugs, antidepressants and neuroleptics, but not drugs for sedation during artificial ventilation or pre-medication before surgery. Potentially inappropriate drugs were identified according to the PRISCUS list. To assess which factors were associated with the administration of psychotropic drugs, univariate and multivariable logistic regression analyses were performed.

RESULTS: The charts of 2130 patients (1231 women) were analyzed. 53.9% of all patients received at least one psychotropic medication (29.5% benzodiazepines, 12.6% Z-drugs, 22.2% antidepressants, 11.9% neuroleptics). The mean number of psychotropic drugs prescribed per patient with at least one prescription was 1.6. Patients treated in the geriatric department most often received antidepressants (45.0%), neuroleptics (20.6%) and Z-drugs (27.5%). Benzodiazepines and Z-drugs were prescribed mostly as medication on demand (77.7% of benzodiazepines, 73.9% of Z-drugs). Surgical patients most frequently received benzodiazepines (37.1%). Nearly one-third of all patients ≥ 65 years was treated with at least one potentially inappropriate psychotropic medication. The mean number of potentially inappropriate psychotropic medications per patient with at least one psychotropic prescription was 0.69. The percentage of patients with potentially inappropriate psychotropic medication was highest in the surgical departments (74.1%). Female gender (adjusted OR 1.36; 95% CI 1.14 to 1.63), stay in the Department of Geriatrics (2.69; 2.01 to 3.60) or the interdisciplinary intensive care unit (1.87; 1.33 to 2.64) and age ≥ 85 years (1.33; 1.10 to 1.60) were associated with psychotropic drug treatment.

CONCLUSIONS: A high percentage of patients aged ≥ 65 years received psychotropic drugs. The chance that a potentially inappropriate psychotropic drug would be administered was highest in the surgical departments. Antidepressants, neuroleptics and Z-drugs were used surprisingly often in geriatric medicine. Educational strategies could reduce the use of psychotropic drugs and the prescription of potentially inappropriate medications.

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Investigation and analysis of osteoporosis, falls, and fragility fractures in elderly people in the Beijing area: a study on the bone health status of elderly people ≥ 80 years old with life self-care

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DOI 10.1007/s11657-017-0408-2 **PMID** 29214357

Abstract

Among ≥ 80 years old and under life self-care in the Beijing area, the prevalences of osteoporosis, falls, and fragility fracture were high; and these prevalences were even higher in women. The treatment rate of osteoporosis is very low. Therefore, comprehensive and standardized prevention and treatment should be promoted.

PURPOSE: The purpose of this study is to investigate prevalence of osteoporosis, falls, and fragility fractures in this population, and analyze related factors, in order to provide a basis for standardized prevention and treatment.

METHODS: From August 2015 to August 2016 in Beijing City, a total of 175 elderly individuals, who were ≥ 80 years old and had good self-care ability, were included into this study. The questionnaire,

risk of falls, grip force, and walking speed were measured, and the Timed Up and Go test (TUG) and chair-rising test (CRT) were performed.

RESULTS: Compared to women, men have higher rates of smoking, drinking, drinking strong tea, longer outdoor activity time, as well as larger muscle strength and pace, and lower consumption of dairy products, fall risk assessment scale (FRA) score, 25OHD, administration rates of calcium and anti-osteoporosis drugs ($P < 0.05$, $P < 0.01$). Compared with men, women had higher bone turnover markers (P1NP, β -CTx, and OC) ($P < 0.05$, $P < 0.01$) and lower levels of sex hormones (E2, T) ($P < 0.01$). The overall prevalence of osteoporosis was 24.6%, and this was significantly higher in women than in men (52.5 vs. 9.6%, $P < 0.01$). Among these subjects, 62.9% had a history of fall after 80 years old, and this rate was higher in women than in men (77 vs. 55.3%, $P < 0.01$). The overall prevalence of fragility fractures was 25.1%, which was higher in women than in men (45.9 vs. 14.0%, $P < 0.01$). Risk factors included falls after age 80, high FRA score, and reduction in bone density of lumbar vertebrae 1-4, and odds ratio (OR) was 12.195, 1.339, and 0.076, respectively ($P < 0.01$). Anti-osteoporosis therapy was only performed on a small number of patients with fractures.

CONCLUSION: The prevalences of falls, prior fracture, and low BMD were high among ≥ 80 years old and under life self-care in the Beijing area. Therefore, a comprehensive approach to assessment and treatment should be promoted.

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Medication use and falls: Applying Beers criteria to medication review in Parkinson's disease

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DOI 10.1177/2050312117743673 **PMID**29201368 **PMCID** PMC5700784

Abstract

OBJECTIVES: Our goal was to assess the association between potentially inappropriate medication use and risk of falls in the Parkinson's disease population.

METHODS: This was a retrospective cohort study conducted at an outpatient Parkinson's Disease Treatment Center. Individuals 65 years of age or older, diagnosed with Parkinson's disease who attended at least three visits in 2015 for physical, occupational therapy, or physician's visits were included in the study. Electronic medical records were utilized to perform chart reviews, and medications were analyzed to identify prescription medications, combination preparations, over-the-counter medications, and dietary supplements. The goal of this study was to test the following hypothesis: elderly individuals with Parkinson's disease who take multiple potentially inappropriate medications are more likely to experience a fall compared to elderly individuals with Parkinson's disease who do not take multiple potentially inappropriate medications.

RESULTS: A higher mean number of prescription medications were associated with falls in elderly Parkinson's disease patients (6.53 vs 5.21, $p < 0.01$). Polypharmacy (taking five or more prescription and nonprescription medications) was not significantly associated with falls. Patients taking potentially inappropriate medications specifically contraindicated for those with a history of falls and fractures were more likely to report falls ($p < 0.04$). Analysis of the specific therapeutic medication categories demonstrated no significant differences between those who did and did not report falls.

CONCLUSION: A future prospective study at Parkinson's disease center should include an electronic

medical record-based intervention to reduce the total number of medications, as well as to minimize the use of high-risk medications.

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Risk factors associated with the fear of falling in community-living elderly people in Korea: role of psychological factors

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Psychiatry Investig. 2017; 14(6): 894-899.

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(Copyright © 2017, Korean Neuropsychiatric Association)

DOI 10.4306/pi.2017.14.6.894 **PMI** 29209398 **PMCID** PMC5714736

Abstract

Little is known about the risk factors for the fear of falling in elderly Korean individuals. Thus, the present study aimed to investigate the risk factors for fear of falling in a representative elderly population of over 10,000 individuals aged 65 years and older. A multivariate multinomial analysis revealed that the risk factors associated with a severe fear of falling were being female [odds ratio (OR)=4.396], older age (OR=5.550 for those aged ≥85 years), lower level of education (OR=0.719 for those with ≥13 years of schooling), chronic illness (OR=2.788 for those with more than three chronic illnesses), poor subjective health (OR=6.268), functional impairments (OR=2.340), a history of falling (OR=7.062), and depression (OR=1.774). The ORs for each of these risk factors were particularly high in participants with a severe fear of falling. Particularly, a history of falling and/or poor subjective health status had strong independent associations with the fear of falling. The present findings may help health care professionals identify individuals that would benefit from interventions aimed at reducing the fear of falling.

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Slipping through the cracks: a cross-sectional study examining older adult emergency department patient fall history, post-fall treatment and prevention

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(Copyright © 2017, Rhode Island Medical Society)

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Abstract

Falls are the leading cause of emergency department (ED) visits for fatal and non-fatal injuries among adults 65 years old and older. We aimed to better understand the fall history, risk for further falls, and actions taken to prevent further falls among this higher fall risk population. This cross-sectional study included older adults without cognitive impairment presenting to the Rhode Island Hospital ED from February to May 2017. Of the 76 participants, 35 self-reported no prior falls, and 41 self-reported at least one prior fall, of whom 20 fell on the day of ED presentation. Participants with vs. without self-reported prior falls were similar in age, gender, race, and substance use. Participants with prior falls scored lower on cognitive testing and had more comorbidities associated with falls. Only one quarter of those with prior falls reported making changes and few were

evaluated by professionals to prevent future falls. This study highlights that older adult ED patients who sustain a fall are at higher risk for subsequent falls, and that greater fall prevention efforts are needed to protect this vulnerable group.

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STEADI: CDC's approach to make older adult fall prevention part of every primary care practice

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J. Saf. Res. 2017; 63: 105-109.

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DOI 10.1016/j.jsr.2017.08.003 **PMID** 29203005

Abstract

INTRODUCTION: Primary care providers play a critical role in protecting older adult patients from one of the biggest threats to their health and independence-falls. A fall among an older adult patient cannot only be fatal or cause a devastating injury, but can also lead to problems that can affect a patient's overall quality of life.

METHODS: In response, the Centers for Disease Control and Prevention (CDC) developed the STEADI initiative to give health care providers the tools they need to help reduce their older adult patient's risk of a fall.

RESULTS: CDC's STEADI resources have been distributed widely and include practical materials and tools for health care providers and their patients that are designed to be integrated into every primary care practice.

CONCLUSION: As the population ages, the need for fall prevention efforts, such as CDC's STEADI, will become increasingly critical to safeguard the health of Americans.

PRACTICAL APPLICATIONS: STEADI's electronic health records (EHRs), online trainings, assessment tools, and patient education materials are available at no-cost and can be downloaded online at www.cdc.gov/STEADI. Health care providers should look for opportunities to integrate STEADI materials into their practice, using a team-based approach, to help protect their older patients.

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The Korean version of relative and absolute reliability of gait and balance assessment tools for patients with dementia in day care center and nursing home

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J. Phys. Ther. Sci. 2017; 29(11): 1934-1939.

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(Copyright © 2017, Society of Physical Therapy Science)

DOI 10.1589/jpts.29.1934 **PMID** 29200628 **PMCID** PMC5702818

Abstract

PURPOSE: This study was aimed to determine the relative and absolute reliability of Korean version tools of the Berg Balance Scale (BBS), the Timed Up and Go (TUG), the Four-Meter Walking Test (4MWT) and the Groningen Meander Walking Test (GMWT) in patients with dementia.

SUBJECTS AND METHODS: A total of 53 patients with dementia were tested on TUG, BBS, 4MWT and GMWT with a prospective cohort methodological design. Intra-class Correlation Coefficients (ICCs) to assess relative reliability and the standard error of measurement (SEM), minimal detectable change (MDC95) and its percentage (MDC%) to analyze the absolute reliability were calculated.

RESULTS: Inter-rater reliability (ICC(2,3)) of TUG, BBS and GMWT was 0.99 and that of 4MWT was 0.82. Inter-rater reliability was high for TUG, BBS and GMWT, with low SEM, MDC95, and MDC%. Inter-rater reliability was low for 4MWT, with high SEM, MDC95, and MDC%. Test-retest (ICC(2,3)) of TUG, BBS and GMWT was 0.96-0.99 and Test-retest (ICC(2,3)) of 4MWT was 0.85. The test-retest was high for TUG, BBS and GMWT, with low SEM, MDC95, and MDC%, but it was low for 4MWT, with high SEM, MDC95, and MDC%.

CONCLUSION: The relative reliability was high for all the assessment tools. The absolute reliability has a reasonable level of stability except the 4MWT.

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Use and clinical efficacy of standard and health information technology fall risk assessment tools

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Australas. J. Ageing 2017; 36(4): 327-331.

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DOI 10.1111/ajag.12473 **PMID** 29205846

Abstract

OBJECTIVE: To evaluate the health information technology (HIT) compared to Fall Risk for Older Persons (FROP) tool in fall risk screening.

METHODS: A HIT tool trial was conducted on the geriatric evaluation and management (GEM, n = 111) and acute medical units (AMU, n = 424).

RESULTS: Health information technology and FROP scores were higher on GEM versus AMU, with no differences between people who fell and people who did not fall. Both score completion rates were similar, and their values correlated marginally (Spearman's correlation coefficient 0.33, P < 0.01). HIT and FROP scores demonstrated similar sensitivity (80 vs 82%) and specificity (32 vs 36%) for detecting hospital falls. Hospital fall rates trended towards reduction on AMU (4.20 vs 6.96, P = 0.15) and increase on GEM (10.98 vs 6.52, P = 0.54) with HIT tool implementation.

CONCLUSIONS: Health information technology tool acceptability and scoring were comparable to FROP screening, with mixed effects on fall rate with HIT tool implementation. Clinician partnership remains key to effective tool development.

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Mechanisms of head stability during gait initiation in young and older women: a neuro-mechanical analysis

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Abstract

Decreased head stability has been reported in older women during locomotor transitions such as the initiation of gait. The aim of the study was to investigate the neuro-mechanical mechanisms underpinning head stabilisation in young and older women during gait initiation. Eleven young (23.1 ± 1.1 yrs) and 12 older (73.9 ± 2.4 yrs) women initiated walking at comfortable speed while focussing on a fixed visual target at eye level. A stereophotogrammetric system was used to assess variability of angular displacement and RMS acceleration of the pelvis, trunk and head, and dynamic stability in the anteroposterior and mediolateral directions. Latency of muscle activation in the sternocleidomastoid, and upper and lower trunk muscles were determined by surface electromyography. Older displayed higher variability of head angular displacement, and a decreased ability to attenuate accelerations from trunk to head, compared to young in the anteroposterior but not mediolateral direction. Moreover, older displayed a delayed onset of sternocleidomastoid activation than young. In conclusion, the age-related decrease in head stability could be attributed to an impaired ability to attenuate accelerations from trunk to head along with delayed onset of neck muscles activation.

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Texting while walking differently alters gait patterns in people with multiple sclerosis and healthy individuals

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Abstract

BACKGROUND: In recent times, increasing safety concerns have been associated with the use of mobile phones by pedestrians. In particular, texting has been shown to significantly alter gait patterns. However, no specific investigations have been performed on people with Multiple Sclerosis (pwMS), who are already characterized by gait dysfunctions caused by the disease.

OBJECTIVE: To assess the existence of possible alterations in spatio-temporal parameters of gait in pwMS when simultaneously texting on a smartphone and walking.

METHODS: Fifty-four pwMS (mean age 40.5 ± 10.5) and 40 age-matched unaffected individuals were tested in two conditions: walking, and walking while texting on a smartphone. Spatio-temporal parameters of gait were assessed using a wearable accelerometer located on the lower back.

RESULTS: Texting induces reduction of gait speed, stride length and cadence in both groups, but such changes were smaller in magnitude in pwMS. An increase of stance and double support and reduction of swing phase were observed in pwMS only.

CONCLUSIONS: Texting alters gait patterns of pwMS differently from unaffected individuals, probably due to a different prioritization of the task, which appears to take into account the motor



and sensory impairments associated with the disease by favoring the motor task.

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