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A multimodal assessment of balance in elderly and young adults

King GW, Abreu EL, Cheng AL, Chertoff KK, Brotto L, Kelly PJ, Brotto M, King GW, Abreu EL, Cheng AL, Chertoff KK, Brotto L, Kelly PJ, Brotto M.

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Abstract

Falling is a significant health issue among elderly adults. Given the multifactorial nature of falls, effective balance and fall risk assessment must take into account factors from multiple sources. Here we investigate the relationship between fall risk and a diverse set of biochemical and biomechanical variables including: skeletal muscle-specific troponin T (sTnT), maximal strength measures derived from isometric grip and leg extension tasks, and postural sway captured from a force platform during a quiet stance task. These measures were performed in eight young and eleven elderly adults, along with estimates of fall risk derived from the Tinetti Balance Assessment. We observed age-related effects in all measurements, including a trend toward increased sTnT levels, increased postural sway, reduced upper and lower extremity strength, and reduced balance scores. We observed a negative correlation between balance scores and sTnT levels, suggesting its use as a biomarker for fall risk. We observed a significant positive correlation between balance scores and strength measures, adding support to the notion that muscle strength plays a significant role in postural control. We observed a significant negative correlation between balance scores and postural sway, suggesting that fall risk is associated with more loosely controlled center of mass regulation.

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Age differences in reactive strategies and execution time during choice stepping with visual interference

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Eur. J. Appl. Physiol. 2015; ePub(ePub): ePub.

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Abstract

PURPOSE: We aimed to explore the effects of visual interference from a flanker task on a reactive strategy and execution speed of choice stepping among young and older adults.

METHODS: Twenty-two healthy young (21.9 ± 1.4 years) and 21 older participants (72.6 ± 4.9 years) were instructed to execute forward stepping as quickly and accurately as possible on the side indicated by a central arrow (\leftarrow left vs. right \rightarrow) of a visual cue during a neutral condition. During a flanker condition, participants were additionally required to ignore flanker arrows on each side of the central arrow ($\rightarrow\rightarrow\rightarrow\rightarrow$ congruent or incongruent $\rightarrow\rightarrow\leftarrow\rightarrow$). Errors in the direction of the initial weight transfer [anticipatory postural adjustment (APA) errors], step execution time, and divided phases (reaction, APA, and swing phases) were measured from the data of vertical force.

RESULTS: Incongruence had larger effects on step execution times and APA phase in older adults than in young adults, while incongruence had smaller effects on reaction phase in older adults than

in young adults. Step execution times were prolonged for trials with APA errors relative to trials without those in both groups. Only older adults showed that step execution times during trials with APA errors increased prominently in the incongruent condition as compared to the other conditions. CONCLUSION: Older adults might have a tendency to make hastier judgments, and might be vulnerable to potential motor program errors caused by an interference effect. Composite measurement of inhibition and stepping in a functional context may increase discriminative ability for age-related deficits in postural control.

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Anticholinergic medication use and falls in postmenopausal women: findings from the women's health initiative cohort study

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BMC Geriatr. 2016; 16(1): e76.

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(Copyright © 2016, BioMed Central)

DOI 10.1186/s12877-016-0251-0 **PMID** 27038789 **PMCID** PMC4818856

Abstract

BACKGROUND: Results from studies assessing the association between anticholinergic use and falls are mixed, and prior studies are limited in their ability to control for important potential confounders. Thus, we sought to examine the association between anticholinergic medication use, including over-the-counter medications, and recurrent falls in community-dwelling older women. **METHODS:** We analyzed data from a prospective cohort study of women aged 65 to 79 years from the Women's Health Initiative Observational Study and Clinical Trials. Women were recruited between 1993 and 1998, and analyses included 61,451 women with complete information. Medications with moderate or strong anticholinergic effects were ascertained directly from drug containers during face-to-face interviews. The main outcome measure was recurrent falls (≥ 2 falls in previous year), which was determined from self-report within 1.5 years subsequent to the medication assessment.

RESULTS: At baseline, 11.3 % were using an anticholinergic medication, of which antihistamines (commonly available over-the-counter) were the most common medication class (received by 45.2 % of individuals on anticholinergic medication). Using multivariable GEE models and controlling for potential confounders, the adjusted odds ratio for anticholinergic medication use was 1.51 (95 % CI, 1.43-1.60) for recurrent falls. Participants using multiple anticholinergic medications had a 100 % increase in likelihood of recurrent falls (adjusted odds ratio 2.00, 95 % CI 1.73-2.32). Results were robust to sensitivity analysis.

CONCLUSIONS: Anticholinergic medication use was associated with increased risk for recurrent falls. Our findings reinforce judicious use of anticholinergic medications in older women. Public health efforts should emphasize educating older women regarding the risk of using over-the-counter anticholinergics, such as first-generation antihistamines.

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Calf circumference and risk of falls among Peruvian older adults

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Abstract

BACKGROUND: Calf circumference is related to sarcopenia in older people and this condition is associated with falls.

OBJECTIVE: Examine the association between calf circumference and falls risk in Peruvian veterans and their family members.

METHOD: Retrospective, hospital based cohort study. A total of 643 non-institutionalized participants from the Geriatrics Service of the Naval Medical Center were assessed. We asked about falls, comorbidities, gait/balance assessment, functional status and calf circumference.

RESULTS: At least 360 (57.42%) out of the 643 participants assessed, experienced one (1) fall during the follow-up. Using a Cox regression analysis we found out that comorbidities, disability, gait/balance and low calf circumference were associated with falls risk. Our data reported high falls risk in lower calf circumference groups, and provided helpful data about anthropometric measures.

CONCLUSION: A low calf circumference increases falls risk in naval veterans.

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Claims-based identification methods and the cost of fall-related injuries among US older adults

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Abstract

OBJECTIVES: Compare expenditures of fall-related injuries (FRIs) using several methods to identify FRIs in administrative claims data.

RESEARCH DESIGN: Using 2007-2009 Medicare claims and 2008 Health and Retirement Survey data, FRIs were identified using external-cause-of-injury (e-codes 880/881/882/884/885/888) only, e-codes plus a broad set of primary diagnosis codes, and a newer approach using e-codes and diagnostic and procedural codes. Linear regression models adjusted for sociodemographic, health, and geographic characteristics were used to estimate per-FRI, service component, patient cost share, expenditures by type of initial FRI treatment (inpatient, emergency department only, outpatient), and total annual FRI-related Medicare expenditures. **SUBJECTS:** The analysis included 5497 community-dwelling adults ≥65 (228 FRI, 5269 non-FRI individuals) with continuous Medicare coverage and alive during the 24-month study.

RESULTS: The 3 FRI identification methods produced differing distributions of index FRI type and varying estimated expenditures: \$12,171 [95% confidence interval (CI), \$4662-\$19,680], \$5648 (95%

CI, \$3819-\$7476), and \$9388 (95% CI, \$5969-\$12,808). In all models, most spending occurred in hospital, outpatient, and skilled nursing facility (SNF) settings, but greater proportions of SNF and outpatient spending were observed with commonly used FRI identification methods. Patient cost-sharing was estimated at \$691-\$1900 across the 3 methods. Inpatient-treated index FRIs were more expensive than emergency department and outpatient-treated FRIs across all methods, but were substantially higher when identifying FRI using only e-codes. Estimated total FRI-related Medicare expenditures were highly variable across methods.

CONCLUSIONS: FRIs are costly, with implications for Medicare and its beneficiaries. However, expenditure estimates vary considerably based on the method used to identify FRIs.

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Differences in functional fitness among older adults with and without risk of falling

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Asian Nurs. Res. (Korean Soc. Nurs. Sci. 2016; 10(1): 51-55.

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Abstract

PURPOSE: This study aimed to identify the differences in functional fitness between older adults who were at risk of falling and those who were not.

METHODS: A total of 104 older adults aged 65-74 years were recruited from a local community senior center. They were independent older adults without a history of falls in the preceding 12 months. Falling risk status was assessed using the Fall Risk Test. Five dimensions of functional fitness with seven testing parameters (i.e., 30-second chair stand test, 30-second arm curl test, 2-minute step test, chair sit and reach test, back scratch test, 8-foot up and go test, and body mass index) were evaluated by the Senior Fitness Test.

RESULTS: Only 78 participants completed all the tests, of which 48 participants were identified with risk of falling, and 30 participants were free from risk of falling. Results from multivariate analysis of variance found significant differences on the combined outcome variables, especially in the 8-foot up and go test, 2-minute step test, and 30-second arm curl test. Results from discriminant analysis found a significant discriminant function among all the seven testing parameters, where the 8-foot up and go test, and the 2-minute step test contributed most.

CONCLUSIONS: Older adults who are at the early stage of risk of falling tend to have lower functional fitness capacities, especially in agility and dynamic balance, aerobic endurance as well as in a combined relationship among all the testing parameters.

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Effects of a health improvement programme on quality of life in elderly people after falls

Leszczyńska A, Daniszewska B, Pruszyńska M, Przedborska A, Hadała M, Raczkowski JW.

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Abstract

INTRODUCTION: Falls of elderly people illustrate a telling health problem related to both physical injury and its psychological effects. They also bring about significant medical and economic consequences.

AIM: The aim of this study is to assess the predisposition to falling as well as the subjective evaluation of quality of life in the elderly after implementation of the fall prevention programme.

MATERIAL AND METHODS: The observational study and statistical methods encompassed people aged 65 or older who reported falls during ordinary daily activity. A group of selected patients took part in a three-stage (three-month) rehabilitation programme designed by the authors. The research tools consisted in modified scales: the Katz ADL scale, the Lawton IADL scale, the Tinetti test for balance and gait evaluation, and the EuroQol 5D questionnaire for subjective evaluation of quality of life. The study included test performer before implementing the programme as well as after its completion.

RESULTS AND DISCUSSION: Slipping at home was the most frequent cause of falling, as it constituted almost 50% of the analyzed cases. During the programme no falls were observed. Patients who completed the programme showed improvements in all the analyzed aspects, especially in activities of daily living and the level of pain.

CONCLUSIONS: Both considerable functional and physical improvement as well as lower levels of pain was observed in the participants of the programme. A systematically conducted health improvement exercise programme minimizes susceptibility to falls and has a beneficial effect on improvement of quality of life in elderly people.

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Fall risk assessment through automatic combination of clinical fall risk factors and body-worn sensor data

Greene BR, Redmond SJ, Caulfield B. IEEE J. Biomed. Health Inform. 2016; ePub(ePub): ePub.
(Copyright © 2016, Institute of Electrical and Electronics Engineers)

DOI 10.1109/JBHI.2016.2539098 **PMID** 27046856

Abstract

Falls are the leading global cause of accidental death and disability in older adults, and are the most common cause of injury and hospitalization. Accurate, early identification of patients at risk of falling, could lead to timely intervention and a reduction in the incidence of fall-related injury and associated costs. We report a statistical method for fall risk assessment using standard clinical fall risk factors (N=748). We also report a means of improving this method by automatically combining it, with a fall risk assessment algorithm based on inertial sensor data and the timed up and go (TUG) test. Furthermore, we provide validation data on the sensor based fall risk assessment method using a statistically independent data set.

RESULTS obtained using cross-validation on a sample of 292 community dwelling older adults, suggest that a combined clinical and sensor-based approach yields a classification accuracy of 76.0%, compared to either 73.6% for sensor-based assessment alone, or 68.8% for clinical risk factors alone. Increasing the cohort size by adding an additional 130 subjects from a separate recruitment wave (N=422), and applying the same model building and validation method, resulted in a decrease in classification performance (68.5% for combined classifier, 66.8% for sensor data alone, and 58.5% for clinical data alone). This suggests heterogeneity between cohorts may be a major challenge when attempting to develop fall risk assessment algorithms which generalize well. Independent validation of the sensor-based fall risk assessment algorithm on an independent cohort of 22

community dwelling older adults yielded a classification accuracy of 72.7%. Results suggest that the present method compares well to previously reported sensor based fall risk assessment methods in assessing falls risk. Implementation of objective fall risk assessment methods on a large scale has the potential to improve quality of care and lead to a reduction in associated hospital costs, due to fewer admissions and reduced injuries due to falling.

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Fall risk screening in the elderly: a comparison of the minimal chair height standing ability test and 5-repetition sit-to-stand test

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Abstract

BACKGROUND: Successfully identifying older adults with a high risk of falling can be complicated, time consuming and not feasible in daily medical practice. This study compared the effectiveness of the Minimal Chair Height Standing Ability Test (MCHSAT) and 5-repetition sit-to-stand test (5R-STST) as fall risk-screening instruments for the elderly.

METHODS: 167 community-dwelling older adults (mean age=83.6±7.3years) were interviewed for demographics, fall history, cognition, and mobility status. MCHSAT performance was assessed using a chair whose seat height was modifiable by increments of 5cm, starting at 47cm and lowering after each successful attempt. 5R-STST performance was assessed by recording the time it took to rise and sit back down five consecutive times from a chair of 47cm high. Operating Receiving Characteristic (ROC) curves and Area under the Curve (AUC) were calculated for each test as well as for sub-groups of participants classified based on medical comorbidities (e.g. cardiac disease/stroke, lower limb arthritis).

RESULTS: The MCHSAT and 5R-STST were equally effective fall-risk screening instruments for the overall population (AUC (95% CI)=0.72 (0.63-0.82) and 0.73(0.64-0.81) respectively). The 5R-STST was more effective than the MCHSAT for participants suffering from lower limb arthritis (AUC (95% CI)=0.81(0.70-0.92) and 0.71(0.58-0.85) respectively) while the opposite was true for participants with a history of cardiac disease or stroke (AUC (95% CI)=0.59 (0.44-0.80) and 0.65 (0.47-0.84) respectively).

CONCLUSION: Due to their simplicity and quick administration time, the MCHSAT and 5R-STST are equally suitable for implementation in clinical settings.

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Impact of a medication therapy management intervention targeting medications associated with falling: results of a pilot study

Mott DA, Martin B, Breslow R, Michaels B, Kirchner J, Mahoney J, Margolis A.

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Abstract

BACKGROUND: The use of fall risk-increasing drugs (FRIDs) by older adults is one factor associated with falling, and FRID use is common among older adults. A targeted medication therapy management intervention focused on FRID use that included prescription and over-the-counter (OTC) medications, along with follow-up telephone calls was designed.

OBJECTIVE: The purpose of this pilot study was to examine preliminary effects of a medication therapy management (MTM) intervention focused on FRIDs provided by a community pharmacist to older adults.

DESIGN: Randomized, controlled trial.

SETTING: One community pharmacy.

PARTICIPANTS: Eighty older adults who completed a fall prevention workshop.

MAIN OUTCOME MEASURES: The main outcome measures were the rate of discontinuing FRIDs, the proportion of older adults falling, and the number of falls. A secondary outcome was the acceptance rate of medication recommendations by patients and prescribers.

RESULTS: Thirty-eight older adults received the targeted MTM intervention. Of the 31 older adults using a FRID, a larger proportion in the intervention group had FRID use modified relative to controls (77% and 28%, respectively; $P < 0.05$). There were no significant changes between the study groups in the risk and rate of falling. Medication recommendations in the intervention group had a 75% acceptance rate by patients and prescribers.

CONCLUSION: A targeted MTM intervention provided by a community pharmacist and focused on FRID use among older adults was effective in modifying FRID use. This result supports the preliminary conclusion that community pharmacists can play an important role in modifying FRID use among older adults.

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Long term effects of an intervention in the outdoor environment--a comparison of older people's perception in two residential areas, in one of which accessibility improvements were introduced

Hallgrimsdottir B, Svensson H, Stahl A.

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Abstract

Walking and participating in activities outdoors in old age can be restricted both by the physical capacity of the individual and by the maintenance and/or the design of the outdoor environment. The purpose of this paper is to compare frequency of walking and frequency of activity outside the home, reported environmental barriers and valuation of the outdoor environment between two areas, in one of which there was an intervention in the outdoor environment 5-8 years prior to this study. The paper is based on a questionnaire sent out in 2011, to all residents 65 years and older in two different areas, the Study Area, an area with an intervention, and the Reference Area. The results show that reports on functional limitations, use of mobility devices and walking difficulties were similar in both areas. Despite that, respondents in the Study Area had a significantly higher frequency of walking and they also participated to a higher degree in activities than respondents in the Reference Area, even though they reported more environmental barriers. The valuation of the outdoor environment was, however, similar in both areas.

The results indicate that older people benefit from interventions in the outdoor environment. However, the results also emphasize the importance of good maintenance of the environment.

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MAPx (Mobility Aid Personalization): examining why older adults "pimp their ride" and the impact of doing so

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Disabil. Rehabil. Assist. Technol. 2016; ePub(ePub): ePub.

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DOI 10.3109/17483107.2016.1158327 **PMID** 27050840

Abstract

We all do this. We personalize things. We buy leopard-printed seat covers and fuzzy dice for our cars, and display action figures and photographs in our offices. Studying older adults who have extended this process of personalization to their mobility devices, the purpose of the mobility aid personalization (MAPx) project is to examine MAPx and its impact on the health and mobility of older adults. Using a qualitative research design, field observations and interviews were conducted with 72 older adults to gain an in-depth understanding of device customization from an emic (insider's) perspective.

FINDINGS illustrate that older adults personalize their devices for reasons of fun, function and fashion. MAPx - the process of purposefully selecting or modifying a mobility device to suit individual needs and preferences - was also found to promote health and mobility by encouraging device acceptance, increasing social participation, enhancing joy and preserving identity. MAPx makes an important contribution to our understanding of the complex relationship between older adults and assistive devices and provides a new approach to some old problems including falls, inactivity and social isolation. Encouraging MAPx is a promising rehabilitation strategy for promoting health and community mobility among the older adult population. Implications for Rehabilitation Personalizing an assistive device facilitates device acceptance, promotes health and well-being and should be supported and encouraged in rehabilitative care. Choice, variety and access are critical aspects of assistive devices; vendors, manufacturers and practitioners should work together to provide clients with a greater range of affordable options for new devices. Function is more than mechanical or physical; social factors including social identity, stigma and social roles must be adequately considered and explicit in rehabilitative practice.

PDF Y Endnote Y

Mobility in old age: capacity is not performance

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Biomed. Res. Int. 2016; 2016: e3261567.

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DOI 10.1155/2016/3261567 **PMID** 27034932 **PMCID** PMC4789440

Abstract

BACKGROUND: Outcomes of laboratory-based tests for mobility are often used to infer about older adults' performance in real life; however, it is unclear whether such association exists. We hypothesized that mobility capacity, as measured in the laboratory, and mobility performance, as measured in real life, would be poorly linked.

METHODS: The sample consisted of 84 older adults (72.5 ± 5.9 years). Capacity was assessed via the iTUG and standard gait parameters (stride length, stride velocity, and cadence). Performance was assessed in real life over a period of 6.95 ± 1.99 days using smartphone technology to calculate following parameters: active and gait time, number of steps, life-space, mean action-range, and maximum action-range. Correlation analyses and stepwise multiple regression analyses were applied.

RESULTS: All laboratory measures demonstrated significant associations with the real-life measures (between $r = .229$ and $r = .461$). The multiple regression analyses indicated that the laboratory measures accounted for a significant but very low proportion of variance (between 5% and 21%) in real-life measures.

CONCLUSION: In older adults without mobility impairments, capacity-related measures of mobility bear little significance for predicting real-life performance. Hence, other factors play a role in how older people manage their daily-life mobility. This should be considered for diagnosis and treatment of mobility deficits in older people.

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Older women's responses and decisions after a fall: the work of getting "back to normal"

Bergeron CD, Friedman DB, Messias DK, Spencer SM, Miller SC.

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Abstract

In this descriptive qualitative research, we examined older women's responses and decisions after experiencing a fall. Falls were unexpected, sudden events that heightened these women's awareness of their physical, emotional, spiritual, and social independence. Interviewees reported assessing personal physical and emotional needs; feeling burdened by the extra work; trying to get back to normal; seeking and obtaining assistance and spiritual support; avoiding specific people, objects, and places; planning ahead; and putting the fall out of mind. Consideration of older women's post-fall responses and decisions should be incorporated into falls prevention and management programs, services, and clinical recommendations.

PDF Y Endnote Y

Study protocol for the Flooring for Injury Prevention (FLIP) Study: a randomised controlled trial in long-term care

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Inj. Prev. 2016; ePub(ePub): ePub.

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Abstract

BACKGROUND: A promising strategy for reducing the incidence and severity of fall-related injuries in long-term care (LTC) is to decrease the ground surface stiffness, and the subsequent forces applied to the body parts at impact, through installation of compliant flooring that does not substantially affect balance or mobility. Definitive evidence of the effects of compliant flooring on fall-related injuries in LTC is lacking. The Flooring for Injury Prevention (FLIP) Study is designed to address this gap.

METHODS: The FLIP Study is a 4-year, parallel-group, 2-arm, randomised controlled superiority trial of flooring in 150 resident rooms at a LTC site. The primary objective is to determine whether compliant flooring reduces serious fall-related injuries relative to control flooring. Intervention (2.54 cm SmartCells compliant; 74 rooms) and control (2.54 cm plywood; 76 rooms) floorings were installed over the top of existing concrete floors and covered with identical 2.00 mm vinyl. The primary outcome is serious fall-related injury, defined as any impact-related injury due to a fall in a study room that results in Emergency Department visit or hospital admission. Secondary outcomes include minor fall-related injury, any fall-related injury, falls, number of fallers, fractures, and healthcare utilisation and costs for serious fall-related injuries. Randomisation of study rooms, and residents in rooms, was stratified by residential unit, and flooring assignments were concealed. Outcome ascertainment began September 2013.

DISCUSSION: Results from the FLIP Study will provide evidence about the effects of compliant flooring on fall-related injuries in LTC and will guide development of safer environments for vulnerable older adults. TRIAL REGISTRATION NUMBER: NCT01618786.

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The association of medication-use and frailty-related factors with gait performance in older patients

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Abstract

The increased fall risk associated with the use of psychotropic drugs might be caused by underlying problems in postural control that are induced by sedative side-effects of these drugs. The current literature on the effects of psychotropics on postural control only examined acute single-drug effects, and included relatively healthy young elderly. Consequently, it is unclear what the impact of the long-term use of these drugs is on gait in frail older persons with polypharmacy. Therefore, it was aimed in the present study to explore the association between the use of psychotropics, multiple other medications, frailty-related parameters and gait performance in older patients. Eighty older persons (79±5.6 years) were recruited. Comorbid diseases, frailty-related parameters, and medication-use were registered. Trunk accelerations during a 3-minute-walking-task were recorded, whereof walking speed, mean stride times, coefficient of variation (CV) of stride times, and step consistency were determined. Multivariate Partial Least Squares (PLS) regression analysis was used to examine the association between population characteristics and medication-use, versus gait

parameters. A PLS-model existing of four latent variables was built, explaining 45% of the variance in four gait parameters. Frailty-related factors, being female, and laxative-use were most strongly associated with lower walking speed, higher mean stride times, higher CV of stride times, and less consistent steps. In conclusion, frailty-related parameters were stronger associated with impaired gait performance than the use of psychotropic drugs. Possibly, at a certain frailty-level, the effect of the deterioration in physical functioning in frailty is so large, that the instability-provoking side-effects of psychotropic drugs have less impact on gait.

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The impact of preventive measures on the burden of femoral fractures - a modelling approach to estimating the impact of fall prevention exercises and oral bisphosphonate treatment for the years 2014 and 2025

Benzinger P, Becker C, Todd C, Bleibler F, Rothenbacher D, König HH, Rapp K.
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DOI 10.1186/s12877-016-0247-9 **PMID** 27038629 **PMCID** PMC4818493

Abstract

BACKGROUND: Due to the demographic transition with a growing number of old and oldest-old persons the absolute number of fragility fractures is expected to increase in industrialized countries unless effective preventive efforts are intensified. The main causes leading to fractures are osteoporosis and falls. The aim of this study is to develop population based models of the potential impact of fall-prevention exercise and oral bisphosphonates over the coming decade.

METHODS: The German federal state of Bavaria served as the model population. Model interventions were limited to community-dwelling persons aged 65 years and older. Models are based on fall-prevention exercise being offered to all persons aged 70 to 89 years and oral bisphosphonate treatment offered to all persons with osteoporosis as defined by a T-score of ≤ -2.5 . Treatment effect sizes are estimated from meta-analyses. Reduction in all femoral fractures in the population of community-dwelling persons aged 65 years and older is the outcome of interest. A spreadsheet-based modelling approach was used for prediction.

RESULTS: In 2014, reduction of femoral fractures by 10 % required 21 % of all community-dwelling persons aged 70-89 to participate in fall-prevention exercise, or 37 % of those with osteoporosis to receive oral bisphosphonates. Without intervention, demographic changes will result in a 24 % increase in femoral fractures by 2025. To lower the increase of fractures between 2014 and 2025 to 10 %, fall-prevention-exercise participation rate needs to be 25 % and bisphosphonate treatment rates 41 %, whereas to hold the 2025 rates flat at 2014 rates require 43 % fall-prevention-exercises participation, and is not achievable using oral bisphosphonates.

CONCLUSIONS: Unrealistic high treatment and participation rates of the two analysed measures are needed to achieve substantial effects on the expected burden of femoral fractures at present and in the future.

PDF Y Endnote Y

Wearable barometric pressure sensor to improve postural transition recognition of mobility-impaired stroke patients

Masse F, Gonzenbach R, Paraschiv-Ionescu A, Luft A, Aminian K.

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Abstract

Sit-to-stand and Stand-to-sit transfers (STS) provide relevant information regarding the functional limitation of mobility-impaired patients. The characterization of STS pattern using a single trunk fixed inertial sensor has been proposed as an objective tool to assess changes in functional ability and balance due to disease. Despite significant research efforts, STS quantification remains challenging due to the high inter- and between- subject variability of this motion pattern. The present study aims to improve the performance of STS detection and classification by fusing the information from barometric pressure (BP) and inertial sensors while keeping a single sensor located at the trunk. A total number of 345 STSs were recorded from 12 post-stroke patients monitored in a semi-structured conditioned protocol. Model-based features of BP signal were combined with kinematic parameters from accelerometer and/or gyroscope and used in a logistic regression-based classifier to detect STS and then identify their types. The correct classification rate was 90.6% with full sensor (BP and inertial) configuration and 75.4% with single inertial sensor. Receiver-Operating-Characteristics analysis was carried out to characterize the robustness of the models. The results demonstrate the potential of BP sensor to improve the detection and classification of STSs when monitoring is performed unobtrusively in every-day life.

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Wearable-sensor-based classification models of faller status in older adults

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Abstract

Wearable sensors have potential for quantitative, gait-based, point-of-care fall risk assessment that can be easily and quickly implemented in clinical-care and older-adult living environments. This investigation generated models for wearable-sensor based fall-risk classification in older adults and identified the optimal sensor type, location, combination, and modelling method; for walking with and without a cognitive load task. A convenience sample of 100 older individuals (75.5 ± 6.7 years; 76 non-fallers, 24 fallers based on 6 month retrospective fall occurrence) walked 7.62 m under single-task and dual-task conditions while wearing pressure-sensing insoles and tri-axial accelerometers at the head, pelvis, and left and right shanks. Participants also completed the Activities-specific Balance Confidence scale, Community Health Activities Model Program for Seniors questionnaire, six minute walk test, and ranked their fear of falling. Fall risk classification models were assessed for all sensor combinations and three model types: multi-layer perceptron neural network, naïve Bayesian, and support vector machine. The best performing model was a multi-layer perceptron neural network with input parameters from pressure-sensing insoles and head, pelvis, and left shank accelerometers (accuracy = 84%, F1 score = 0.600, MCC score = 0.521). Head sensor-

based models had the best performance of the single-sensor models for single-task gait assessment. Single-task gait assessment models outperformed models based on dual-task walking or clinical assessment data. Support vector machines and neural networks were the best modelling technique for fall risk classification. Fall risk classification models developed for point-of-care environments should be developed using support vector machines and neural networks, with a multi-sensor single-task gait assessment.

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A selective corrective exercise to decrease falling and improve functional balance in idiopathic Parkinson's disease

Sedaghati P, Daneshmandi H, Karimi N, Barati AH.

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Abstract

BACKGROUND: Posture instability and unsteady gait disorders in Parkinson's Disease (PD) usually contribute to fall-related fractures. Fall-related trauma in PD is the most common reason for injury. Despite providing modern care for PD patients (PP) in the recent years, anti-PD drugs have no effect on falling. There is an urgent need to administer exercise interventions to reduce falls and related injuries in the rehabilitation program of PP.

OBJECTIVES: To explore the effect of a selective 10-week corrective exercise with an emphasis on gait training activities (GTA) on the number of falls (NOFs), fear of falling, functional balance, timed up and go (TUG) test among PD patients.

PATIENTS AND METHODS: A purposeful sampling was performed on PP who had fallen or were at risk of falling in 2014. The study intervention consisted of a 10-week (3 sessions each week, each lasting 60 min) corrective exercise program. Participants were randomly allocated to control and two exercise groups; the exercise group with balance pad (EGBP) or exercise group with no balance pad (EGNBP). The analysis of variance (ANOVA) and paired t-test were used for comparison between the groups ($P \leq 0.05$).

RESULTS: Administrating a selective corrective exercise in exercise group with balance pad (EGBP) showed a significant difference in number of falls (NOF), Fall Efficacy Scale-international (FES-I), Berg balance scale (BBS) (and timed up and go) TUG ($P = 0.001$); while administrating the same exercise in exercise group with no balance pad (EGNBP) showed no significant difference in NOF ($P = 0.225$) and a significant difference in FES-I ($P = 0.031$), BBS ($P = 0.047$) and TUG ($P = 0.012$). The control group showed no significant difference in each of the dependent variables.

CONCLUSIONS: Performing a selective corrective exercise on balance pad improves falling and functional balance in idiopathic PD.

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Balance improvement effects of biofeedback systems with state-of-the-art wearable sensors: a systematic review

Ma CZ, Wong DW, Lam WK, Wan AH, Lee WC.

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Abstract

Falls and fall-induced injuries are major global public health problems. Balance and gait disorders have been the second leading cause of falls. Inertial motion sensors and force sensors have been widely used to monitor both static and dynamic balance performance. Based on the detected performance, instant visual, auditory, electrotactile and vibrotactile biofeedback could be provided to augment the somatosensory input and enhance balance control. This review aims to synthesize the research examining the effect of biofeedback systems, with wearable inertial motion sensors and force sensors, on balance performance. Randomized and non-randomized clinical trials were included in this review. All studies were evaluated based on the methodological quality. Sample characteristics, device design and study characteristics were summarized. Most previous studies suggested that biofeedback devices were effective in enhancing static and dynamic balance in healthy young and older adults, and patients with balance and gait disorders. Attention should be paid to the choice of appropriate types of sensors and biofeedback for different intended purposes. Maximizing the computing capacity of the micro-processor, while minimizing the size of the electronic components, appears to be the future direction of optimizing the devices. Wearable balance-improving devices have their potential of serving as balance aids in daily life, which can be used indoors and outdoors.

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Clinical medication review and falls in older people: what is the evidence base?

Tanna N, Tatla T, Winn T, Chita S, Ramdoo K, Batten C, Pitkin J.

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Abstract

BACKGROUND: This paper reports findings from a literature review undertaken to assess the current evidence base for clinical medication review and falls in older people. This forms part of a larger, organisational supported project design work-stream, where the objectives are to define the operational details for clinical medication review as part of multi-factorial assessment for elderly fallers in the community. Patients will be identified and targeted through an integrated care pathway mapping and elderly patient care screening service.

OBJECTIVE: A review of national and best practice guidance to help our understanding of how clinical medication review could be optimised.

METHODS: A PubMed database search was undertaken with search terms including "elderly" and "falls" and "medicines" followed by study of relevant publications in English and including cited referenced publications within selected papers.

RESULTS: Our findings were that both medication over-use and under-use in the elderly occur frequently and can be harmful. Many drugs commonly used by older persons have not been systematically studied as risk factors for falls. The screening tool of older people's prescriptions (STOPP) and screening tool to alert to right treatment (START), validated for assessment of potentially inappropriate prescribing in the elderly, offer the possibility of provision of a structured

clinical medication review to patients, with a need for more research on the impact of the STOPP START interventions on both the rates of falls and risk of falls in the elderly.

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Effects of slip severity on muscle activation of the trailing leg during an unexpected slip

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J. Electromyogr. Kinesiol. 2016; 28: 61-66.

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Abstract

Falls and injuries due to falls are a major health concern, and accidental slips are a leading cause of falls during gait. Understanding how the body reacts to an unexpected slip can aid in developing intervention techniques to reduce the number of injuries due to falls. In this study, muscle activation patterns, specifically those of the trailing (non-slipping) limb, were studied in unexpected slips of 24 young and 24 middle-aged adults. The typical reaction of the trailing limb is swing phase interruption in an attempt to arrest the slip. Variables examined were the reactive muscle activation onset, peak electromyography (EMG) magnitude, and time-to-peak of the vastus lateralis and medial hamstring of the trailing limb. Statistical analysis was performed to determine the effects of slip severity, quantified by peak slip velocity, and age on outcome variables. As slip severity increased, the reactive activation onset of the medial hamstring was significantly faster and there was a trend approaching significance for the onset of the vastus lateralis. Additionally, the peak magnitude and time-to-peak of the vastus lateralis increased with slip severity. No significant effects of age were found on any of the output variables. These findings may aid in development of perturbation-based paradigms, as it may be possible to "tune" the postural control system to generate an appropriate response to unexpected slips.

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The effect of a translating research into practice intervention to promote use of evidence-based fall prevention interventions in hospitalized adults: a prospective pre-post implementation study in the U.S

Titler MG, Conlon P, Reynolds MA, Ripley R, Tsodikov A, Wilson DS, Montie M.

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Abstract

BACKGROUND: Falls are a major public health problem internationally. Many hospitals have implemented fall risk assessment tools, but few have implemented interventions to mitigate patient-specific fall risks. Little research has been done to examine the effect of implementing evidence-based fall prevention interventions to mitigate patient-specific fall risk factors in hospitalized adults. **OBJECTIVES:** To evaluate the impact of implementing, in 3 U.S. hospitals, evidence-based fall prevention interventions targeted to patient-specific fall risk factors (Targeted Risk Factor Fall Prevention Bundle). Fall rates, fall injury rates, types of fall injuries and adoption of the Targeted Risk

Factor Fall Prevention Bundle were compared prior to and following implementation.

DESIGN: A prospective pre-post implementation cohort design.

SETTING: Thirteen adult medical-surgical units from three community hospitals in the Midwest region of the U.S.

PARTICIPANTS: Nurses who were employed at least 20 hours/week, provided direct patient care, and licensed as an RN (n = 157 pre; 140 post); and medical records of patients 21 years of age or older, who received care on the study unit for more than 24 hours during the designated data collection period (n = 390 pre and post).

METHODS: A multi-faceted Translating Research Into Practice Intervention was used to implement the Targeted Risk Factor Fall Prevention Bundle composed of evidence-based fall prevention interventions designed to mitigate patient-specific fall risks. Dependent variables (fall rates, fall injury rates, fall injury type, use of Targeted Risk Factor Fall Prevention Bundle) were collected at baseline, and following completion of the 15 month implementation phase. Nurse questionnaires included the Stage of Adoption Scale, and the Use of Research Findings in Practice Scale to measure adoption of evidence-based fall prevention practices. A Medical Record Abstract Form was used to abstract data about use of targeted risk-specific fall prevention interventions. Number of falls, and number and types of fall injuries were collected for each study unit for 3 months pre- and post-implementation. Data were analyzed using multivariate analysis.

RESULTS: Fall rates declined 22% (p = 0.09). Types of fall injuries changed from major and moderate to minor injuries. Fall injury rates did not decline. Use of fall prevention interventions improved significantly (p < 0.001) for mobility, toileting, cognition, and risk reduction for injury, but did not change for those targeting medications.

CONCLUSIONS: Using the Translating Research Into Practice intervention promoted use of many evidence-based fall prevention interventions to mitigate patient-specific fall risk factors in hospitalized adults.

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The effect of two different cognitive tests on gait parameters during dual tasks in healthy postmenopausal women

Hagner-Derengowska M, Kałużny K, Hagner W, Kałużna A, Kochański B, Borkowska A, Budzyński J. *Biomed. Res. Int.* 2016; 2016: e1205469.

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Abstract

INTRODUCTION: The paper aims to evaluate the influence of two different demanding cognitive tasks on gait parameters using BTS SMART system analysis. Patients and Methods. The study comprised 53 postmenopausal women aged 64.5 ± 6.7 years (range: 47-79). For every subject, gait analysis using a BTS SMART system was performed in a dual-task study design under three conditions: (I) while walking only (single task), (II) walking while performing a simultaneous simple cognitive task (SCT) (dual task), and (III) walking while performing a simultaneous complex cognitive task (CCT) (dual task). Time-space parameters of gait pertaining to the length of a single support phase, double support phase, gait speed, step length, step width, and leg swing speed were analyzed.

RESULTS: Performance of cognitive tests during gait resulted in a statistically significant prolongation of the left (by 7%) and right (by 7%) foot gait cycle, shortening of the length of steps made with the right extremity (by 4%), reduction of speed of swings made with the left (by 11%) and right (by 8%) extremity, and reduction in gait speed (by 6%).

CONCLUSIONS: Performance of cognitive tests during gait changes its individual pattern in relation to the level of the difficulty of the task.

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