

## SafetyLit August 7, 2016

### **A comparison of objective physical performance tests and future mortality in the elderly people**

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

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#### **Abstract**

**BACKGROUND:** Physical performance is an important predictor of mortality, but little is known on the comparative prognostic utility of different objective physical performance tests in community-dwelling older adults. We compared the prognostic usefulness of several objective physical performance tests on mortality, adjusting our analyses for potential confounders.

**METHODS:** Among 3,099 older community-dwelling participants included in the Progetto Veneto Anziani study, 2,096 were followed for a mean of 4.4 years. Physical performance tests measured were Short Physical Performance Battery (SPPB), 4-meter gait speed, chair stands time, leg extension and flexion, handgrip strength, and 6-Minute Walking Test (6MWT), treated as continuous variables and categorized in gender-specific quartiles. The main outcome was mortality assessed with death certificates.

**RESULTS:** Participants who died during the follow-up (n = 327) scored significantly worse in all physical performance tests measured at baseline than those who survived (n = 1,769). Using a Harrell's C-index, the highest C-index was observed for 6MWT in men (C-index = 0.735; 95% confidence interval [CI]: 0.701-0.770, p <.0001) and SPPB in women (C-index = 0.781; 95% CI: 0.740-0.822, p =.0009). However, in both genders, only SPPB, 4-meter walking speed, and 6MWT are significant predictors of mortality. Analyses using sex-specific quartiles substantially confirmed these findings.

**CONCLUSIONS:** Slow gait speed, 6MWT, and SPPB are significant predictors for mortality in community-dwelling older men and women. Physicians should consider using these tests to identify elderly individuals who are at higher risk of death to improve clinical decision making.

#### **PDF Y Endnote Y**

### **Cognitive-behavioural therapy-based intervention to reduce fear of falling in older people: therapy development and randomised controlled trial - the Strategies for Increasing Independence, Confidence and Energy (STRIDE) study**

Parry SW, Bamford C, Deary V, Finch TL, Gray J, Macdonald C, McMeekin P, Sabin NJ, Steen IN, Whitney SL, McColl EM.

*Health Technol. Assess.* 2016; 20(56): 1-206.

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#### **Abstract**

**BACKGROUND:** Falls cause fear, anxiety and loss of confidence, resulting in activity avoidance, social isolation and increasing frailty. The umbrella term for these problems is 'fear of falling', seen in up to 85% of older adults who fall. Evidence of effectiveness of physical and psychological interventions is limited, with no previous studies examining the role of an individually delivered cognitive-

behavioural therapy (CBT) approach.

**OBJECTIVES:** Primary objective To develop and then determine the effectiveness of a new CBT intervention (CBTi) delivered by health-care assistants (HCAs) plus usual care compared with usual care alone in reducing fear of falling. Secondary objectives To measure the impact of the intervention on falls, injuries, functional abilities, anxiety/depression, quality of life, social participation and loneliness; investigate the acceptability of the intervention for patients, family members and professionals and factors that promote or inhibit its implementation; and measure the costs and benefits of the intervention.

**DESIGN:** Phase I CBTi development. Phase II Parallel-group patient randomised controlled trial (RCT) of the new CBTi plus usual care compared with usual care alone.

**SETTING:** Multidisciplinary falls services.

**PARTICIPANTS:** Consecutive community-dwelling older adults, both sexes, aged  $\geq 60$  years, with excessive or undue fear of falling per Falls Efficacy Scale-International (FES-I) score of  $> 23$ .

**INTERVENTIONS:** Phase I Development of the CBTi. The CBTi was developed following patient interviews and taught to HCAs to maximise the potential for uptake and generalisability to a UK NHS setting. Phase II RCT. The CBTi was delivered by HCAs weekly for 8 weeks, with a 6-month booster session plus usual care.

**MAIN OUTCOME MEASURES:** These were assessed at baseline, 8 weeks, 6 months and 12 months.

Primary outcome measure Fear of falling measured by change in FES-I scores at 12 months.

Secondary outcome measures These comprised falls, injuries, anxiety/depression [Hospital Anxiety and Depression Scale (HADS)], quality of life, social participation, loneliness and measures of physical function. There were process and health-economic evaluations alongside the trial.

**RESULTS:** Four hundred and fifteen patients were recruited, with 210 patients randomised to CBTi group and 205 to the control group. There were significant reductions in mean FES-I [-4.02; 95% confidence interval (CI) -5.95 to -2.1], single-item numerical fear of falling scale (-1.42; 95% CI -1.87 to 1.07) and HADS (-1; 95% CI -1.6 to -0.3) scores at 12 months in the CBTi group compared with the usual care group. There were no differences in the other secondary outcome measures. Most patients found the CBTi acceptable. Factors affecting the delivery of the CBTi as part of routine practice were identified. There was no evidence that the intervention was cost-effective.

**CONCLUSIONS:** Our new CBTi delivered by HCAs significantly improved fear of falling and depression scores in older adults who were attending falls services. There was no impact on other measures.

**FURTHER WORK:** Further work should focus on a joint CBTi and physical training approach to fear of falling, more rational targeting of CBTi, the possibility of mixed group and individual CBTi, and the cost-effectiveness of provision of CBTi by non-specialists.

**TRIAL REGISTRATION:** Current Controlled Trials ISRCTN78396615. **FUNDING:** This project was funded by the NIHR Health Technology Assessment programme and will be published in full in Health Technology Assessment; Vol. 20, No. 56. See the NIHR Journals Library website for further project information.

#### **PDF Y Endnote Y**

#### **Comparison of 10 single and stepped methods to identify frail older persons in primary care: diagnostic and prognostic accuracy**

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*BMC Fam. Pract.* 2016; 17(1): e102.

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### **Abstract**

**BACKGROUND:** Many instruments have been developed to identify frail older adults in primary care. A direct comparison of the accuracy and prevalence of identification methods is rare and most studies ignore the stepped selection typically employed in routine care practice. Also it is unclear whether the various methods select persons with different characteristics. We aimed to estimate the accuracy of 10 single and stepped methods to identify frailty in older adults and to predict adverse health outcomes. In addition, the methods were compared on their prevalence of the identified frail persons and on the characteristics of persons identified.

**METHODS:** The Groningen Frailty Indicator (GFI), the PRISMA-7, polypharmacy, the clinical judgment of the general practitioner (GP), the self-rated health of the older adult, the Edmonton Frail Scale (EFS), the Identification Seniors At Risk Primary Care (ISAR PC), the Frailty Index (FI), the InterRAI screener and gait speed were compared to three measures: two reference standards (the clinical judgment of a multidisciplinary expert panel and Fried's frailty criteria) and 6-years mortality or long term care admission. Data were used from the Dutch Identification of Frail Elderly Study, consisting of 102 people aged 65 and over from a primary care practice in Amsterdam. Frail older adults were oversampled. The accuracy of each instrument and several stepped strategies was estimated by calculating the area under the ROC-curve.

**RESULTS:** Prevalence rates of frailty ranged from 14.8 to 52.9 %. The accuracy for recommended cut off values ranged from poor (AUC = 0.556 ISAR-PC) to good (AUC = 0.865 gait speed). PRISMA-7 performed best over two reference standards, GP predicted adversities best. Stepped strategies resulted in lower prevalence rates and accuracy. Persons selected by the different instruments varied greatly in age, IADL dependency, receiving homecare and mood.

**CONCLUSION:** We found huge differences between methods to identify frail persons in prevalence, accuracy and in characteristics of persons they select. A necessary next step is to find out which frail persons can benefit from intervention before case finding programs are implemented. Further evidence is needed to guide this emerging clinical field.

### **PDF Y Endnote Y**

#### **Comparison of Ai Chi and impairment-based aquatic therapy for older adults with balance problems: a clinical study**

Covill LG, Utley C, Hochstein C.

*J. Geriatr. Phys. Ther.* 2016; ePub(ePub): ePub.

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### **Abstract**

**BACKGROUND AND PURPOSE:** Older adults with balance deficits often fear falling and limit their mobility. Poor balance is multifactorial, influenced by medication interactions, musculoskeletal and sensory system changes, and poor neuromuscular response to changes in body positions. Aquatic

physical therapy (APT) is an intervention used to improve balance and decrease falls. Ai Chi is a water-based exercise program. It incorporates slow movements of progressive difficulty utilizing the upper and lower extremities and trunk coordinated with deep breathing. It is used for relaxation, strengthening, and balance. The purpose of this study was to determine whether Ai Chi provides better results than conventional impairment-based aquatic therapy (IBAT) for older adults with balance deficits.

**METHODS:** Thirty-two community-dwelling adults, 65 to 85 years old, were referred to 2 different community pools for APT. Fifteen participants received Ai Chi-based aquatic interventions and 17 participants received an IBAT program. Physical therapists trained in both programs completed interventions and determined discharge. Physical balance measures, which included the Berg Balance Scale (BBS) and Timed Up and Go (TUG), were collected pre- and posttherapy. Self-reported outcome measures, the Activities-Specific Balance Confidence Scale (ABC) and Numerical Pain Rating Scale (NPRS), were collected pre- and posttherapy and 3- and 6-month postdischarge.

**RESULTS:** A 2-way (group by time) mixed-model analysis of covariance was used to analyze the data. The covariate was the initial outcome scores. Comparison of the 2 groups revealed no difference between groups in any of the outcome measures (BBS,  $P = .53$ ; TUG,  $P = .39$ ; ABC,  $P = .63$ ; NPRS,  $P = .27$ ). Repeated-measures analysis and dependent t test were done on the entire aquatic cohort to assess improvement over time. The BBS and TUG showed significant improvement (BBS,  $P = .00$ ; TUG  $P = .03$ ) after APT. The ABC and NPRS did not improve significantly (ABC,  $P = .27$ ; NPRS,  $P = .77$ ).

**CONCLUSIONS:** There were no significant differences found in balance measures, balance confidence, or pain levels for community-dwelling older adults between the Ai Chi and IBAT programs. Physical outcome measures improved with APT but patient-reported measures did not. Further study is indicated to determine the most effective treatment frequency and duration for this population.

#### PDF Endnote Y

#### Effects of aging on the relationship between cognitive demand and step variability during dual-task walking

Decker LM, Cignetti F, Hunt N, Potter JF, Stergiou N, Studenski SA.

*Age (Dordr)* 2016; ePub(ePub): ePub.

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#### Abstract

A U-shaped relationship between cognitive demand and gait control may exist in dual-task situations, reflecting opposing effects of external focus of attention and attentional resource competition. The purpose of the study was twofold: to examine whether gait control, as evaluated from step-to-step variability, is related to cognitive task difficulty in a U-shaped manner and to determine whether age modifies this relationship. Young and older adults walked on a treadmill without attentional requirement and while performing a dichotic listening task under three attention conditions: non-forced (NF), forced-right (FR), and forced-left (FL). The conditions increased in their attentional demand and requirement for inhibitory control. Gait control was evaluated by the variability of step parameters related to balance control (step width) and rhythmic stepping pattern (step length and step time). A U-shaped relationship was found for step width

variability in both young and older adults and for step time variability in older adults only. Cognitive performance during dual tasking was maintained in both young and older adults. The U-shaped relationship, which presumably results from a trade-off between an external focus of attention and competition for attentional resources, implies that higher-level cognitive processes are involved in walking in young and older adults. Specifically, while these processes are initially involved only in the control of (lateral) balance during gait, they become necessary for the control of (fore-aft) rhythmic stepping pattern in older adults, suggesting that attentional resources turn out to be needed in all facets of walking with aging. Finally, despite the cognitive resources required by walking, both young and older adults spontaneously adopted a "posture second" strategy, prioritizing the cognitive task over the gait task.

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### **Exercise interventions and prevention of fall-related fractures in older people: a meta-analysis of randomized controlled trials**

Zhao R, Feng F, Wang X.

*Int. J. Epidemiol.* 2016; ePub(ePub): ePub.

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#### **Abstract**

**BACKGROUND:** This meta-analysis aimed to determine whether exercise interventions were effective in preventing fall-related fractures in older people. The treatment effects on rate of falls, leg strength and balance were also examined.

**METHODS:** An electronic database search was conducted in PubMed, EMBASE, the Cochrane library and PEDro up to 1 September 2015. Randomized controlled trials (RCTs) that conducted exercise interventions and reported fall-related fracture data in older people were included. The primary outcome was the treatment effects on fall-related fractures determined by relative risk (RR) and 95% confidence interval (CI). The treatment effects on falls, leg strength and balance were also reported using rate ratio (RaR) with 95% CI and standardized mean difference (SMD) with 95% CI, respectively. Random effects models were used for meta-analysis.

**RESULTS:** Fifteen studies including 3136 participants met the inclusion criteria. Exercise had a beneficial effect on reduction of fall-related fractures, with pooled estimates of RR 0.604 (95% CI 0.453 - 0.840,  $P = 0.003$ ,  $I(2) = 0\%$ ). The rate of falls (RaR 0.856, 95% CI 0.778 - 0.941,  $P = 0.001$ ,  $I(2) = 45\%$ ) and leg strength (SMD 0.613, 95% CI 0.119 - 1.107,  $P = 0.015$ ,  $I(2) = 76.7\%$ ) were also potentially affected by exercise interventions. These only had a marginally beneficial effect on balance (SMD 0.468, 95% CI -0.011 - 0.947,  $P = 0.055$ ,  $I(2) = 93.6\%$ ).

**CONCLUSIONS:** Our findings implied that exercise interventions were effective in preventing fall-related fractures and reducing risk factors of fall-related fractures in older people.

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### **Feasibility of nurses measuring gait speed in older community-dwelling Emergency Department patients**

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*Geriatr. Nurs.* 2016; ePub(ePub): ePub.

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#### **Abstract**

Gait speed assessment is a rapid, simple and objective measure for predicting risk of unfavorable outcomes which may provide better prognostic and reliable information than existing geriatric ED (Emergency Department) screening tools. This descriptive pilot project was designed to determine feasibility of implementing gait speed screening into routine nursing practice by objectively identifying patients with sub-optimal gait speeds. Participants included community-dwelling adults 65 years and older with plans for discharge following ED treatment. Patients with a gait speed <1.0 m/s were identified as "high-risk" for an adverse event, and referred to the ED social worker for individualized resources prior to discharge. Thirty-five patients were screened and nurse initiated gait speed screens were completed 60% of the time. This project demonstrates ED gait speed screening may be feasible. Implications for practice should consider incorporating gait speed screening into routine nursing assessment to improve provider ED decision-making and disposition planning.

#### **PDF Y Endnote Y**

#### **Neighborhood safety factors associated with older adults' health-related outcomes: a systematic literature review**

Won J, Lee C, Forjuoh SN, Ory MG.

*Soc. Sci. Med.* 2016; ePub(ePub): ePub.

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#### **Abstract**

**RATIONALE:** Neighborhood safety is important for older adults' health and wellbeing, but there has not been a synthesis in the literature of what is currently known about this construct.

**OBJECTIVES:** This systematic literature review, following the PRISMA guidelines, focuses on identifying neighborhood safety factors associated with health-related outcomes and behaviors of older adults in the U.S.

**METHODS:** A search was conducted in 2014 via Academic Search Complete, CINAHL, Embase, MEDLINE, SportDis, and Transportation Databases. Based on our inclusion and exclusion criteria, we identified thirty-two articles for review.

**RESULTS:** Sixteen studies examined health outcomes such as health status, mental health, physical function, morbidity/mortality, and obesity; the other sixteen studies focused on health behaviors, such as physical activity and walking. Four domains of neighborhood safety were identified: overall/general neighborhood safety; crime-related safety; traffic-related safety; and proxies for safety (e.g., vandalism, graffiti). Overall/general neighborhood safety appeared most relevant to mental health and physical function. Traffic-related safety was most pertinent to physical activity,



while crime-related safety was more consistently associated with mental health and walking. While all safety variables were significantly associated with mental health, no significant associations were found for obesity. We also found that specific measures or constructs of safety were not applied consistently across the examined studies, making it difficult to compare the results.

**CONCLUSION:** This review identified several important gaps in the existing studies dealing with neighborhood safety-health relationships among older adults. Further studies are needed that examine the different roles of multidimensional neighborhood safety in promoting the community health, not only in the U.S., but globally.

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### **Postural instability and falls are more frequent in Parkinson's disease patients with worse trunk mobility**

Artigas NR, Franco C, Leão P, Rieder CR.

*Arq. Neuropsiquiatr.* 2016; 74(7): 519-523.

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**DOI** 10.1590/0004-282X20160074 **PMID** 27487370

#### **Abstract**

**OBJECTIVE:** Correlate the occurrence of falls and the activity of rolling over in bed with performance on the Trunk Mobility Scale (TMS) in patients with PD, and determine whether this instrument score can predict the risk of falls.

**METHOD:** This is a cross-sectional study. Assessed patients reported the frequency of falls in the previous year and whether they had difficulties rolling over in bed. Then, the following scales were applied: TMS, Hoehn and Yahr, Unified Parkinson's Disease Rating Scale-III and Schwab and England Activities of Daily Living.

**RESULTS:** Eighty-five patients were analyzed. Patients with a history of falling showed worse performance in the TMS ( $p < 0.01$ ). There is a significant correlation between TMS and the activity of rolling over in bed ( $p < 0.01$ ).

**CONCLUSION:** PD fallers present worse scores in TMS, and there is a significant correlation between difficulty rolling over in bed and TMS score.

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### **Visually Impaired OLder people's Exercise programme for falls prevenTion (VIOLET): a feasibility study protocol**

Skelton DA, Bailey C, Howel D, Cattan M, Deary V, Coe D, de Jong LD, Gawler S, Gray J, Lampitt R, Wilkinson J, Adams N.

*BMJ Open* 2016; 6(8): e011996.

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**DOI** 10.1136/bmjopen-2016-011996 **PMID** 27486124

#### **Abstract**

**INTRODUCTION:** In the UK, 1 in 5 people aged 75 and over live with sight loss. Visually impaired older people (VIOP) have an above average incidence of falls and 1.3-1.9 times more likely to

experience hip fractures, than the general population. Older people with eye diseases are ~3 times more likely than those with good vision, to limit activities due to fear of falling. This feasibility study aims to adapt the group-based Falls Management Exercise (FaME) programme to the needs of VIOP and carry out an external pilot trial to inform the design of a future definitive randomised controlled trial.

**METHODS AND DESIGN:** A UK based 2-centre mixed methods, randomised, feasibility study will be conducted over 28 months. Stakeholder panels, including VIOP, will make recommendations for adaptations to an existing exercise programme (FaME), to meet the needs of VIOP, promoting uptake and adherence, while retaining required effective components of the exercise programme. 80 VIOP aged 60 and over, living at home, ambulant with or without a walking aid, will be recruited in Newcastle (n=40) and Glasgow (n=40) through National Health Service (NHS) Trusts and third sector partners. Participants randomised into the intervention arm will receive the adapted FaME programme. Participants randomised into the control arm will continue with usual activity. Outcomes are, recruitment rate, adherence and validated measures including fear of falling and quality of life. Postintervention in-depth qualitative interviews will be conducted with a purposive sample of VIOP (N=10). Postural stability instructors will be interviewed, before trial-specific training and following the intervention.

**ETHICS AND DISSEMINATION:** Ethics approval was secured through the National Research Ethics Service (NRES) Committee North East, Newcastle and North Tyneside 2. Glasgow Caledonian University was approved as a non-NHS site with local ethics approval.

**FINDINGS** will be disseminated through peer-reviewed journals, national and international conferences.

**TRIAL REGISTRATION NUMBER:** ISRCTN16949845.

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### **Assessment for benign paroxysmal positional vertigo in medical patients admitted with falls in a district general hospital**

Abbott J, Tomassen S, Lane L, Bishop K, Thomas N.

*Clin. Med. (Lond.)* 2016; 16(4): 335-338.

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#### **Abstract**

Having benign paroxysmal positional vertigo (BPPV) puts patients at a significantly higher risk of falling. It is poorly recognised and diagnosis is frequently delayed. BPPV has been studied in outpatient settings, but there have been no studies looking at the prevalence in patients admitted with falls. This study aims to establish how common BPPV is in these patients. For a 4-month period, patients admitted on an unselected medical take were screened for an admission precipitated by a fall. Patients who consented were assessed for BPPV using the Dix-Hallpike manoeuvre. Patients who tested positive were treated using the Epley manoeuvre. The assessments were carried out by specialist physiotherapists who were experienced at assessing and diagnosing patients with peripheral vestibular disorders. Out of the 111 patients initially identified, 37 (33%) were considered to be appropriate and consented to be part of the study. Of these, 20 patients (54%) had a positive Dix-Hallpike manoeuvre. Of the patients included in the study, over half tested positive for BPPV. This



merits further study. Potentially, there is a proportion of patients admitted with falls who have an easily treatable contributing factor that is not being identified with standard practice.

#### PDF Y Endnote Y

### Exercise loading history and femoral neck strength in a sideways fall: a three-dimensional finite element modeling study

Abe S, Narra N, Nikander R, Hyttinen J, Kouhia R, Sievänen H.

*Bone* 2016; ePub(ePub): ePub.

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#### Abstract

Over 90% of hip fractures are caused by falls. Due to a fall-induced impact on the greater trochanter, the posterior part of the thin superolateral cortex of the femoral neck is known to experience the highest stress, making it a fracture-prone region. Cortical geometry of the proximal femur, in turn, reflects a mechanically appropriate form with respect to habitual exercise loading. In this finite element (FE) modeling study, we investigated whether specific exercise loading history is associated with femoral neck structural strength and estimated fall-induced stresses along the femoral neck. One hundred and eleven three-dimensional (3D) proximal femur FE models for a sideways falling situation were constructed from magnetic resonance (MR) images of 91 female athletes (aged 24.7±6.1years, >8years competitive career) and 20 non-competitive habitually active women (aged 23.7±3.8years) that served as a control group. The athletes were divided into five distinct groups based on the typical loading pattern of their sports: high-impact (H-I: triple-jumpers and high-jumpers), odd-impact (O-I: soccer and squash players), high-magnitude (H-M: power-lifters), repetitive-impact (R-I: endurance runners), and repetitive non-impact (R-NI: swimmers). The von Mises stresses obtained from the FE models were used to estimate mean fall-induced stresses in eight anatomical octants of the cortical bone cross-sections at the proximal, middle, and distal sites along the femoral neck axis. Significantly ( $p<0.05$ ) lower stresses compared to the control group were observed: the H-I group - in the superoposterior (10%) and posterior (19%) octants at the middle site, and in the superoposterior (13%) and posterior (22%) octants at the distal site; the O-I group - in the superior (16%), superoposterior (16%), and posterior (12%) octants at the middle site, and in the superoposterior (14%) octant at the distal site; the H-M group - in the superior (13%) and superoposterior (15%) octants at the middle site, and a trend ( $p=0.07$ , 9%) in the superoposterior octant at the distal site; the R-I group - in the superior (14%), superoposterior (23%) and posterior (22%) octants at the middle site, and in the superoposterior (19%) and posterior (20%) octants at the distal site. The R-NI group did not differ significantly from the control group. These results suggest that exercise loading history comprising various impacts in particular is associated with a stronger femoral neck in a falling situation and may have potential to reduce hip fragility.

#### PDF Y Endnote Y

## Preprocessing the Nintendo Wii board signal to derive more accurate descriptors of statokinesigrams

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*Sensors (Basel)* 2016; 16(8): e16081208.

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### Abstract

During the past few years, the Nintendo Wii Balance Board (WBB) has been used in postural control research as an affordable but less reliable replacement for laboratory grade force platforms. However, the WBB suffers some limitations, such as a lower accuracy and an inconsistent sampling rate. In this study, we focus on the latter, namely the non uniform acquisition frequency. We show that this problem, combined with the poor signal to noise ratio of the WBB, can drastically decrease the quality of the obtained information if not handled properly. We propose a new resampling method, Sliding Window Average with Relevance Interval Interpolation (SWARII), specifically designed with the WBB in mind, for which we provide an open source implementation. We compare it with several existing methods commonly used in postural control, both on synthetic and experimental data. The results show that some methods, such as linear and piecewise constant interpolations should definitely be avoided, particularly when the resulting signal is differentiated, which is necessary to estimate speed, an important feature in postural control. Other methods, such as averaging on sliding windows or SWARII, perform significantly better on synthetic dataset, and produce results more similar to the laboratory-grade AMTI force plate (AFP) during experiments. Those methods should be preferred when resampling data collected from a WBB.

**PDF Y Endnote Y**

## Risk factors for falls in people with a lower limb amputation: a systematic review

Hunter SW, Batchelor F, Hill KD, Hill AM, Mackintosh S, Payne M.

*PM R* 2016; ePub(ePub): ePub.

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### Abstract

**OBJECTIVE:** To review the evidence connecting risk factors to falls in adults with a lower limb amputation (LLA) across the continuum of care settings.

**DESIGN:** Systematic review.

**LITERATURE SURVEY:** Electronic database searches were conducted in MEDLINE, Pubmed, CINAHL and EMBASE covering 01/1988 and 01/2016. Non-interventional studies, including cohort and cross-sectional studies were included. Two reviewers independently completed data extraction and quality evaluation.

**METHODOLOGY:** Twelve studies met the inclusion criteria and quality of reporting of reporting was evaluated using the criteria by Tooth et al.. **SYNTHESIS:** The average quality of reporting score was 19.8, scores ranged from 16 to 29. Studies covered the acute hospital stay after the amputation,

inpatient rehabilitation and community living. Falls were a common occurrence, with the cohort studies reporting 20.8% for acute hospital stay to 58% in the community years after the amputation. Injurious falls were also common, occurrence ranging from 40% to 60%. Risk factors that increase falls, and are shared with the general population of older adults, include lower extremity muscle weakness, increasing age, comorbidities and number of prescription medications. Risk factors for falls that are unique to adults with LLA are dysvascular etiology of the amputation, trans-tibial level of amputation in the post-operative period and trans-femoral level post-rehabilitation, and reduced vibration sense.

**CONCLUSIONS:** Falls in adults with an LLA are common from the time of the amputation to years later living in the community. Risk factors vary across care settings after the amputation and this has implications for safety and fall prevention strategies.

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