Update on Falls Prevention Research

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Coffs Harbour Falls Prevention Network Rural Forum

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Acknowledgments: Dr Jasmine Menant, Mr. Daniel Schoene

Recent falls risk factor studies

Background on dual-tasking

- **Walking is not just rhythmic and automatic**
- Slowing of gait may have its onset up to 12 years before the clinical presentation of cognitive changes in older adults who later convert to mild cognitive impairment (MCI) (Burrachio et al., 2010).

- **Dual-tasking**: walking while completing a secondary task – to examine the attentional requirement of balance
- Decreased performance in one or both tasks (Woollacott & Shumway-Cook, 2002)
  - in ageing (neural changes in frontal lobe; reduction in central neurons)
  - clinical groups with reduced sensorimotor and/or cognitive function

Background on dual-tasking

- **Gait speed**
  - Reliable measure, can be recorded without equipment
  - quantitative estimate of future risk of hospitalization and decline in health and function (Guralnik et al., 2000; Studenski et al., 2003)
  - predictor of mortality in older community-dwellers (Hardy et al., JAGS, 2000)
  - predictor of falls in older people (Callisaya et al., 2011; Verghese et al., 2009)

- **Dual-tasking during gait**
  - Performance changes significantly associated with an increased risk of falling (Ziljstra et al., 2008; Beauchet et al., 2009)

- **Research question:** does a dual-task walking test predict risk of falls better than a single-task walking test?

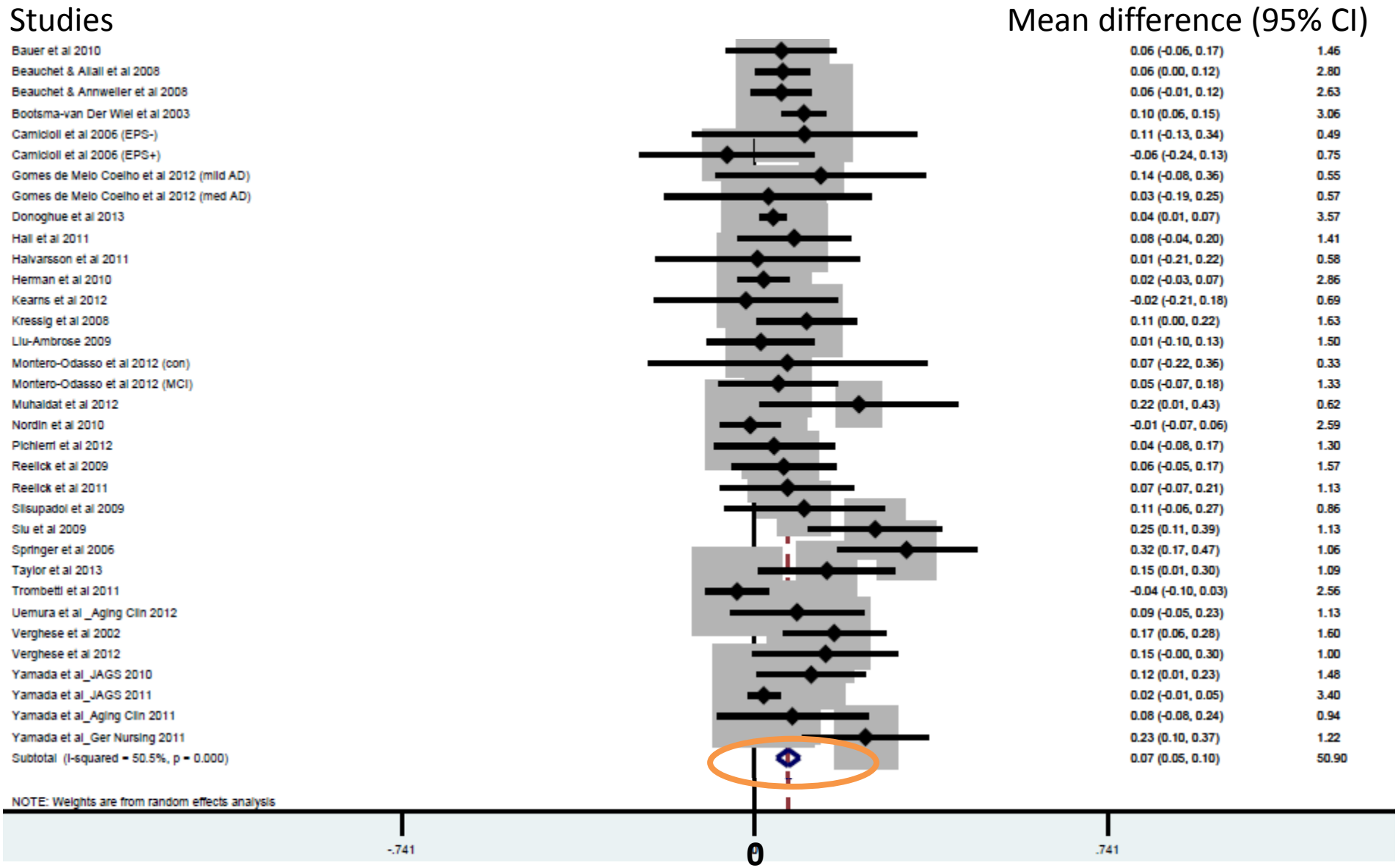
Systematic literature search

- **Range of databases**
- **Strict inclusion / exclusion criteria**
  - gait speed over unobstructed flat path under single and dual-task conditions
  - Secondary cognitive task
  - Min age: 60 years and over or mean age: 65+ years
  - Fallers vs. non-fallers
  - No patient groups other than dementias and Alzheimer's
  - No abstracts, case studies or reviews
  - Only English, Dutch, French, or German articles

Systematic literature review results

- 31 studies included (34 groups)
- n= 4524 participants
- 12 prospective studies
- Types of secondary cognitive tasks
  - Mental tracking (serial subtractions, reciting alternate letters of the alphabet…) – n=28
  - Verbal fluency (ex: generating as many animals names as possible) – n=7
  - Discrimination and decision making task (N=2)
- 7 studies included in a cognitive impairment sub-analysis

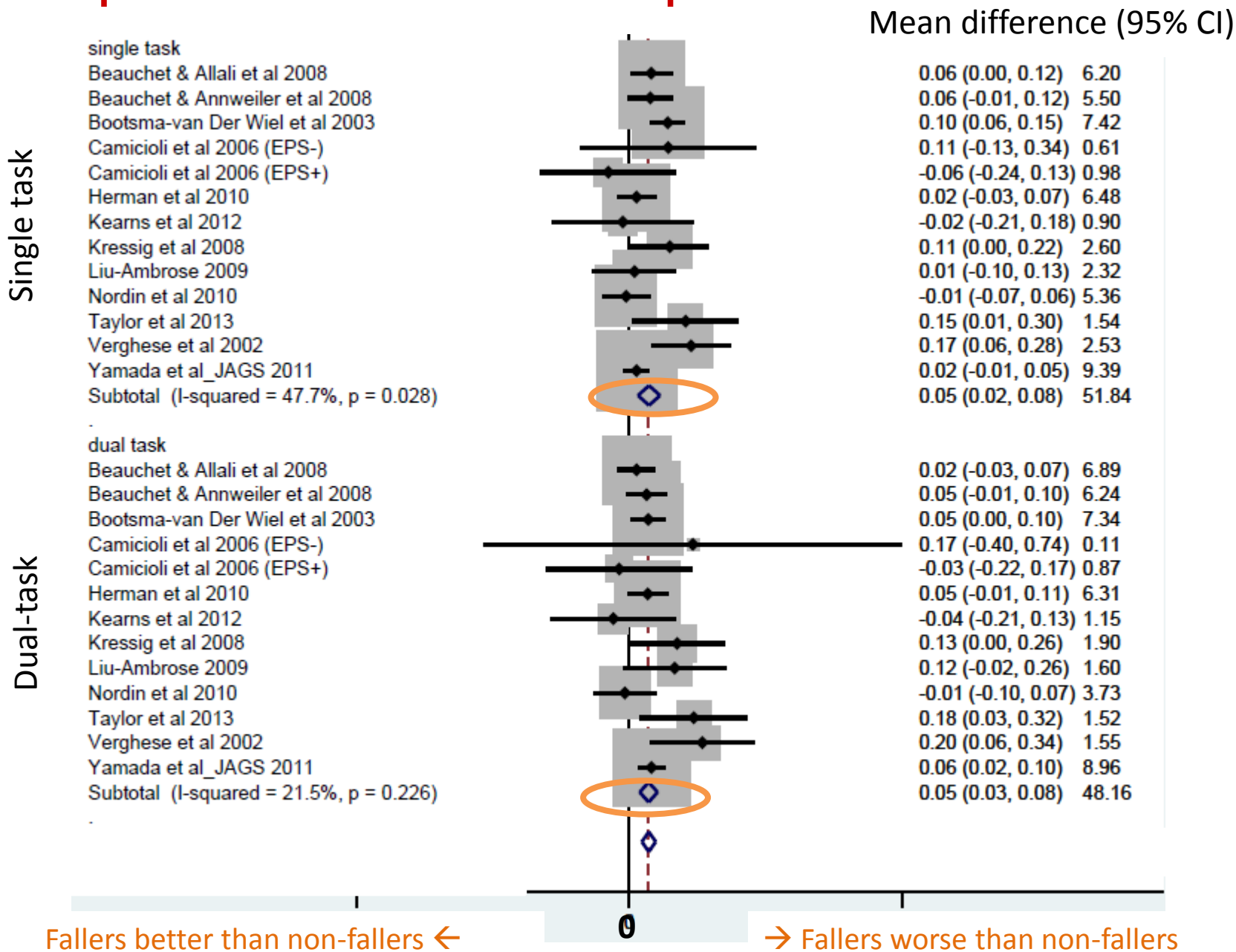
Gait speed – single task – all studies



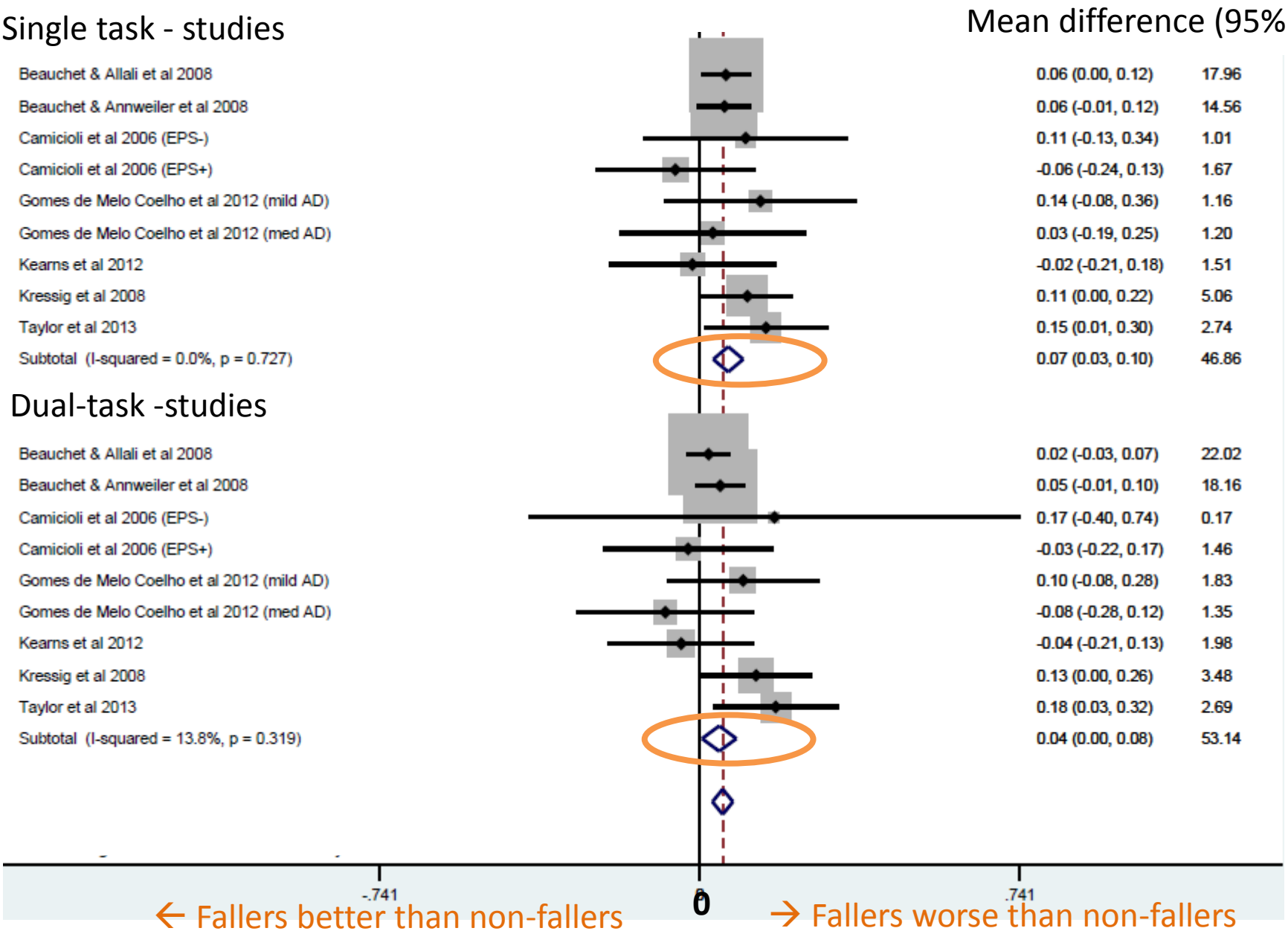
← Fallers better than non-fallers

→ Fallers worse than non-fallers

Prospective falls follow-up



Gait speed – cognitive impairment



Systematic review & meta-analysis summary

- Gait speed under both single and dual-task significantly discriminates between fallers and non-fallers
- **However** the measurement of gait speed under dual-task paradigms does not add any value to the prediction of falls as compared to a single-task paradigm
  - Overall
  - In physically or cognitively frailer samples
  - Across different types of cognitive tasks

- Dual-task designs highly valuable to detect subtle deficits in executive function
- Simple tests of gait speed can be used as part of fall risk assessments

A Stroop stepping test for fall risk

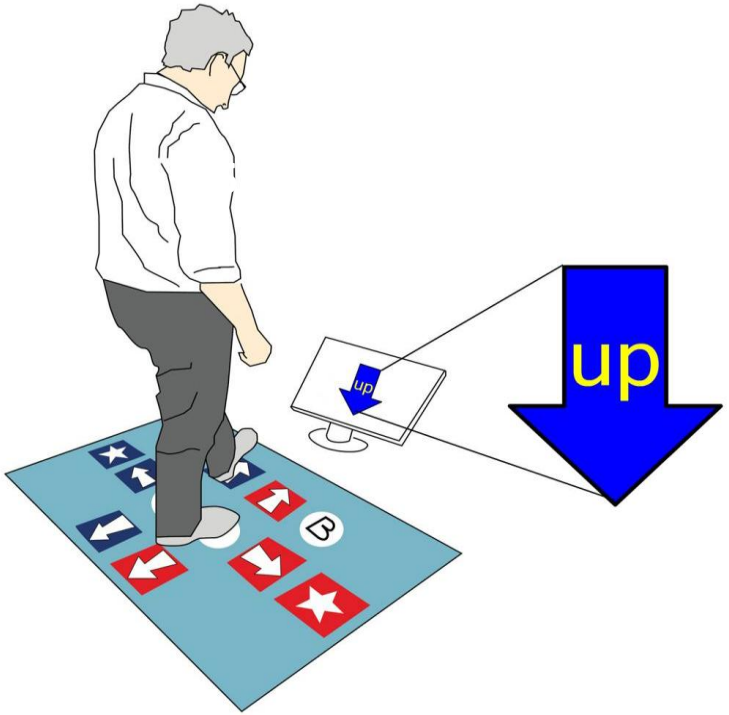
Schoene et al., Age & Ageing, 2013

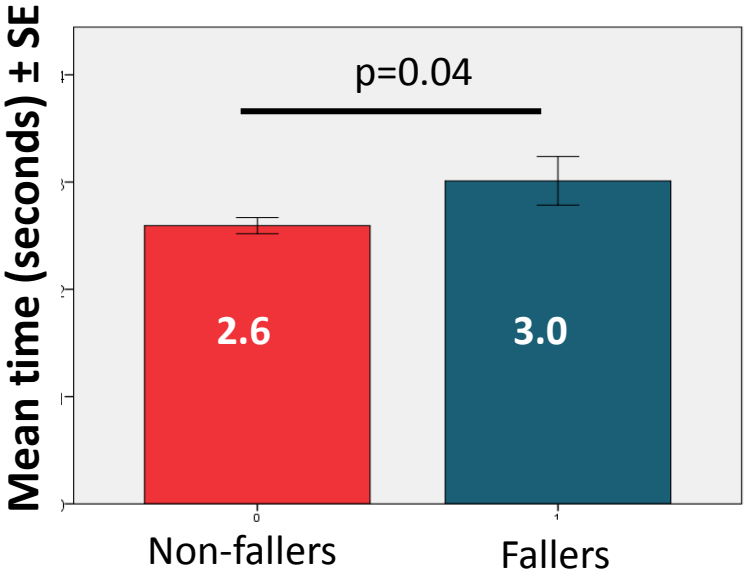
- 103 independent living older people aged 70-93 years
- Cognitively intact (mean (SD) MMSE: 28.9(1.1))
- 28% of participants : 1+ fall(s) in the past 12 months

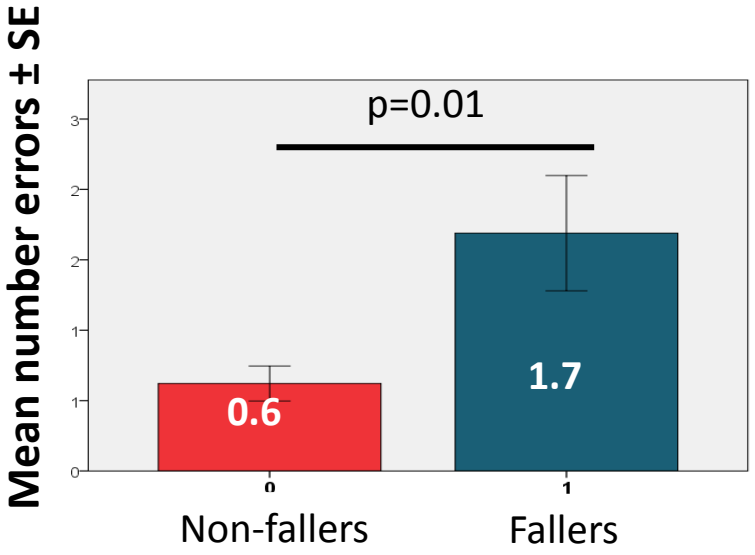
- Stroop test adapted to a stepping mat:
  - Cognition: motor response inhibition
  - Stepping: balance, strength, reaction time
- Tests of executive & sensorimotor function

Methods

- 4 stepping directions
- “Step by the word”
- 20 trials
- Average step time & errors







Stroop stepping and fall risk

- Each error on the SST task: increased odds of past fall 1.7 times [OR: 1.65 (1.17–2.34)]
- Longer SST time significantly associated with poorer executive function, processing speed, balance & step coordination
- Errors significantly associated with poorer executive function & proprioception
- Standard neuropsychological tests did not discriminate between fallers and non-fallers

- Feasibility of using a low-cost computer game device to screen older people for risk of falls

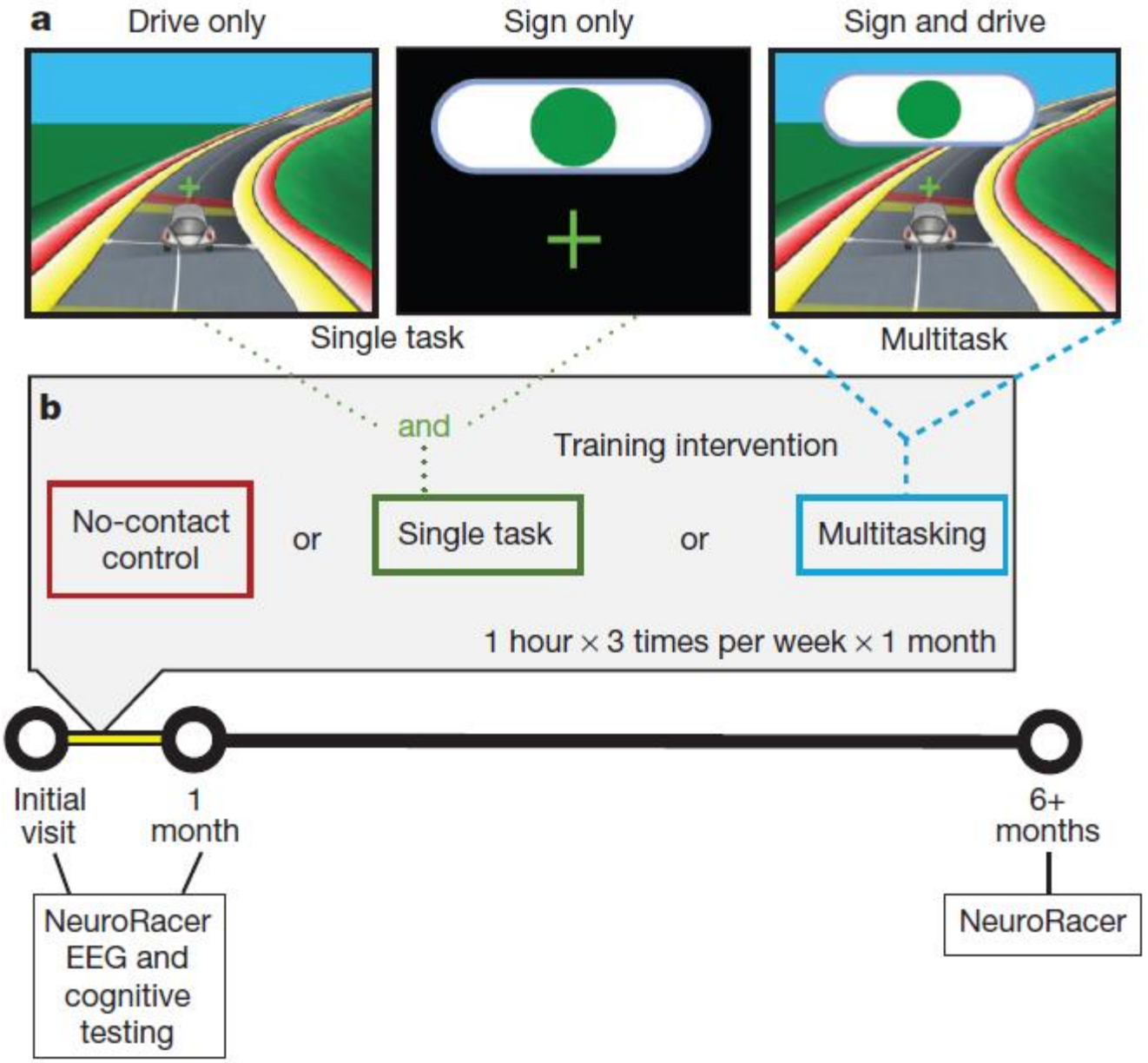
Recent interventions

Benefits of cognitive training

Anguera et al., Nature, 2013 “Video game training enhances cognitive control in older adults”

- Pilot RCT of computer game training on:
  - Performance in the game
  - Other cognitive functions: working memory, sustained attention
  - Neural changes in prefrontal cortex using electroencephalography

- 46 older people aged 60-85 years

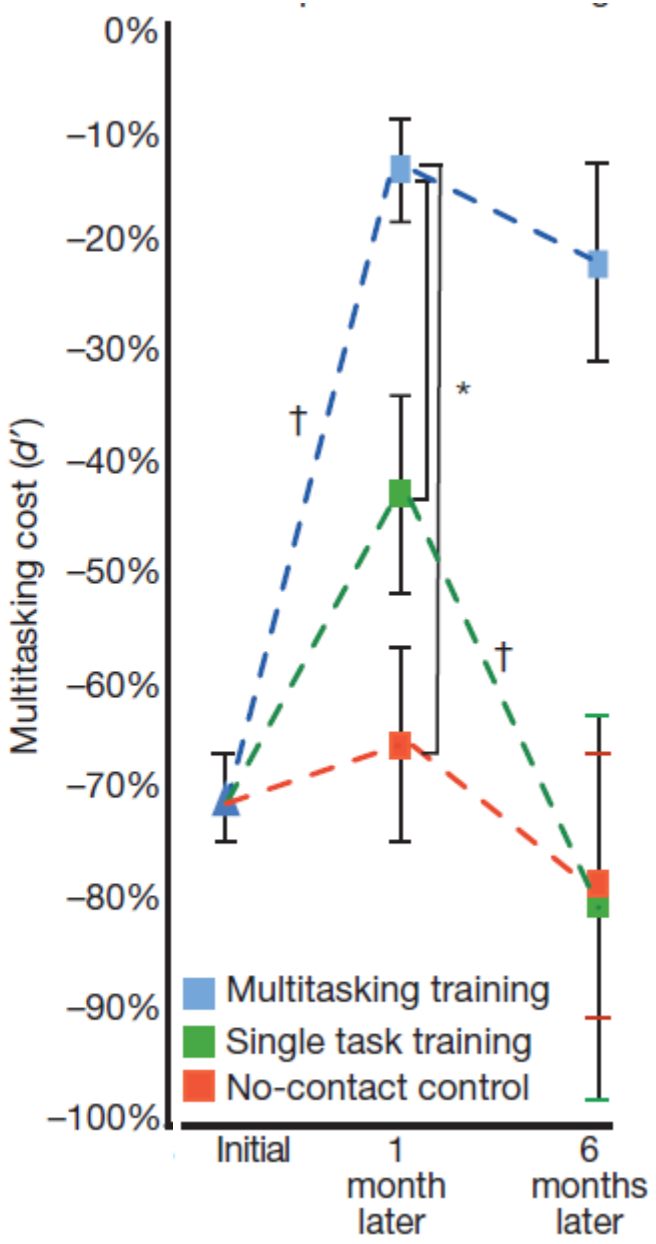


Anguera et al., Nature, 2013

Benefits of cognitive training

- Both single & multitask training (STT & MTT) groups improved in both tasks
- Only the MTT's group multitasking performance improved sig → interference resolution
- Multitasking training also led to
  - improvements in working memory and sustained attention
  - Enhancements in neural function (deactivation of medial prefrontal activity)

- Evidence that custom-designed video game training improves cognitive abilities in older people at both behavioural and neural levels



Anguera et al., Nature, 2013

Cost-effectiveness of vitamin D supplementation vs. population screening

- Vitamin D supplementation is effective in reducing the rate of falls in nursing care facilities (Cameron et al.,2012).

Lee et al., J Am Geriatr Soc, 2013

- Vit D supplementation reduces the rate of falls in community-dwelling older adults in those with low serum 25-hydroxyvitamin D levels
- but identifying individuals with vitamin D insufficiency would require population screening.

- Cost effectiveness of Vit D screening vs. universal supplementation
- Use of a model based on published meta-analyses of RCTs simulating accidental falls over a 36-months period

Cost-effectiveness of Vitamin D supplementation vs. population screening

- Population screening strategy- assumptions
  - **Vit D insufficiency** (15–25 ng/mL)→supplementation with cholecalciferol 1,000 IU daily
  - **Vit D deficiency** (<15 ng/mL)→2,000 to 4,000 IU cholecalciferol daily

- Universal supplementation strategy – assumptions
  - All subjects: 1,000 IU cholecalciferol daily
  - **Subjects with sufficient levels**: costs of supplementation, but falls risk would not change.
  - **Subjects with Vit D insufficiency**: costs of supplementation, and falls risk would return to that of subjects with sufficient VitD levels;
  - **Subjects with Vit D deficiency**: cost of supplementation, but their falls risk would remain high

Lee et al., 2013

Cost-effectiveness of Vitamin D supplementation vs. population screening

- **In those aged 65 -80 years:** similar cost-effectiveness for population screening vs. universal supplementation in women ($59 vs $71) and men ($114 vs $120)
- **But in those aged 80+**: population screening was substantially more cost-effective than universal supplementation in women ($563 vs $428) and men ($703 vs $571)

- Both Vit D population screening & universal supplementation are cost-effective although population screening might be more effective at an older age in community-dwellers
- Clinical & cost implications: screening and treating vitamin D deficiency in persons at highest risk

Lee et al., 2013

Yoga to improve balance & mobility

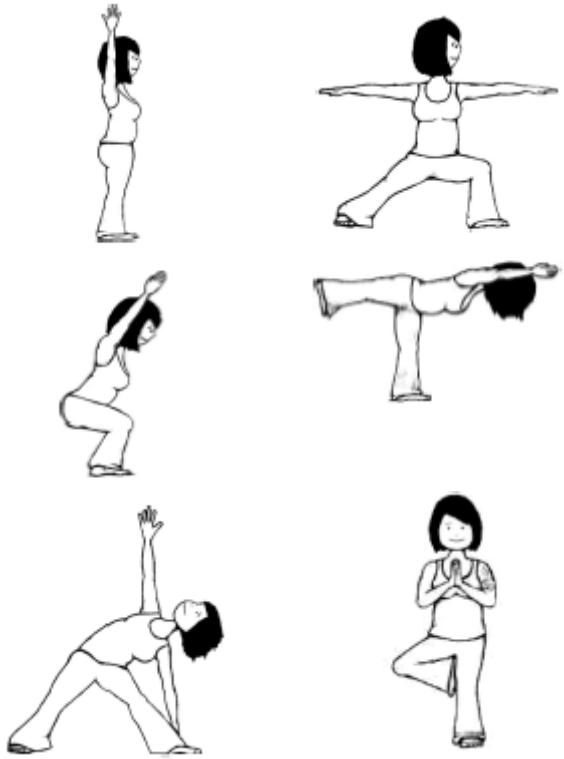
- Exercise that challenges balance is effective in improving mobility and reducing the rate of falls in the community and subacute hospital settings (Gillespie LD et al., 2012; Cameron I et al., 2012).
- Problem: Uptake and adherence by older people

Tiedemann et al., J Gerontol Med Sci, 2013

- Pilot blinded RCT of yoga program
- 54 community-dwellers mean (SD) age: 68.0 (7.1) years
  - 12-week, 2x1hr sessions/week yoga (increasing balance challenge) & fall prevention education booklet (n=27)
  - vs. fall prevention education booklet (n=27)
- Outcome measures: balance, mobility and fear of falling.
- Feasibility: class attendance, enjoyment and adverse events.

Yoga to improve balance & mobility

- Mean attendance: 83% of all available classes
- No serious adverse events
- Intervention vs. control group – significant improvements in:
  - Standing balance
  - One-legged stance with eyes closed
  - Sit-to-stand (5reps)
  - Timed 4-m walk
- sit-to-stand & timed walk valid predictors of falls
- 13 participants still doing yoga classes 4 months after the end of the study



- Beneficial effect of yoga program on balance and mobility, as well as demonstrated feasibility & enjoyment in participants in older community-dwellers → promising falls prevention strategy

Falls prevention – what works

- Highest level of evidence given by meta-analyses of RCTs

- Gillespie LD et al. Interventions for preventing falls in older people living in **the community**. Cochrane Database Syst Rev. 2012 Sep 12;9

- Cameron ID et al. Interventions for preventing falls in older people in **care facilities and hospitals**. Cochrane Database Syst Rev. 2012 Dec 12;12:

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Gold bar evidence scale

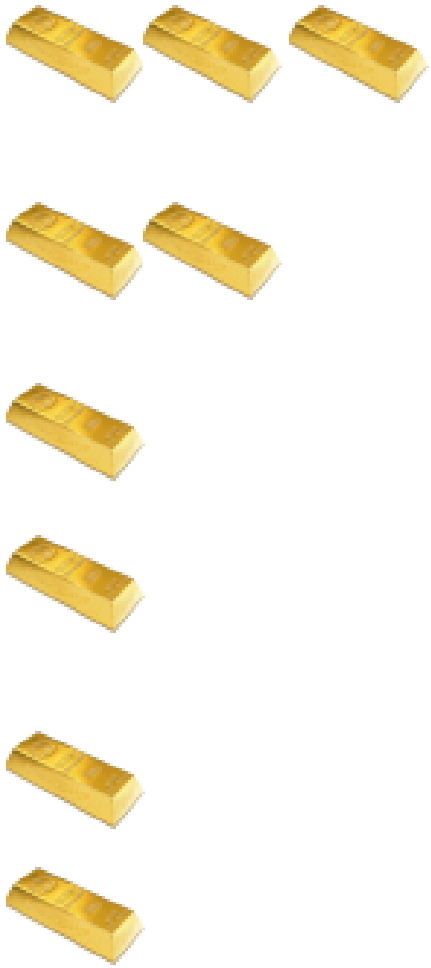
- One good quality RCT

- At least two good quality RCTs – little inconsistency

- Multiple RCTs and/or systematic reviews –little inconsistency

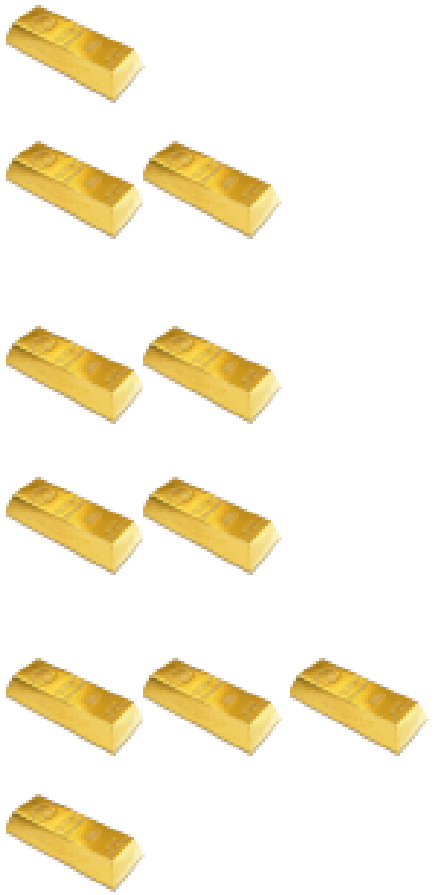
Falls prevention – what works

- High level balance exercise in group or home settings (functional balance exercises, Otago, Tai Chi)
- Occupational therapy interventions (home safety modifications in association with transfer training and education) in high risk populations
- Expedited first eye cataract surgery
- Restriction of multifocal glasses use in older people who take part in regular outdoor activity
- Pharmacist-led education and GP medication review
- Podiatry intervention in people with disabling foot pain



Falls prevention – what works

- Withdrawal of psychoactive medications
- Intensive multidisciplinary assessment of high risk populations
- Intensive interventions in hospitals
- Comprehensive geriatric assessment in residential aged care
- Vitamin D supplementation in residential aged care
- Medication review in residential aged care



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Thank you

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