Falls Prevention Research Update, 2017

Stephen Lord

Gait adaptability impaired as an indicator of fall risk in older people

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53% of falls are caused by trips and slips

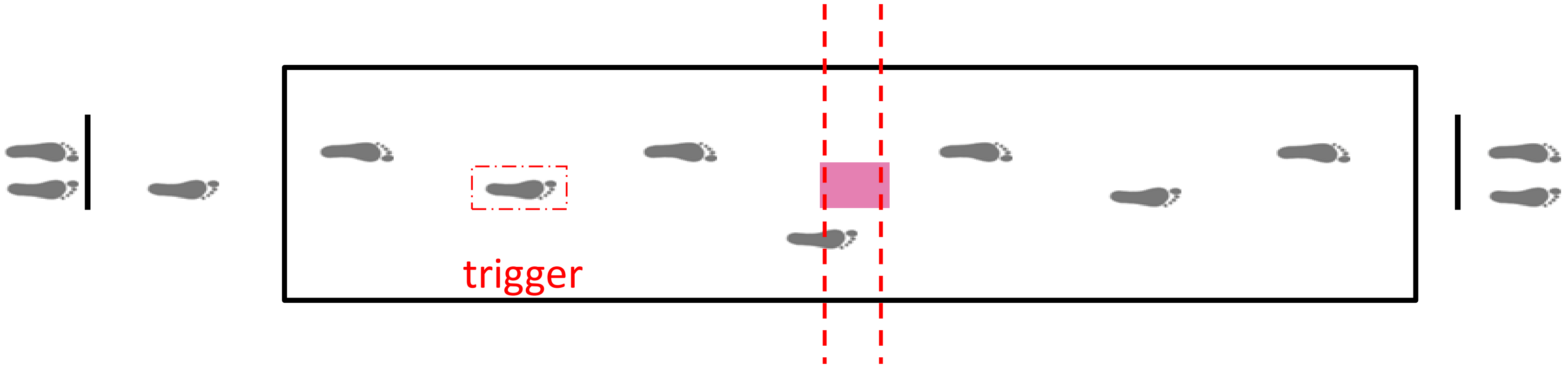
Being able to adapt walking pattern is an important mechanism to avoid tripping and/or falling.

Gait adaptability

- Refers to our ability to change walking pattern when moving around (crossing streets, negotiating obstacles or uneven surfaces)

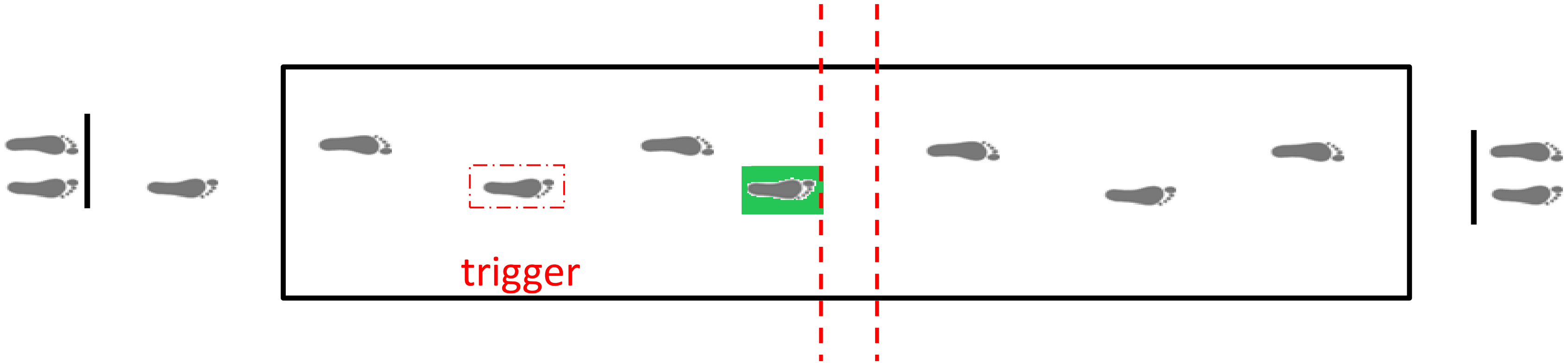
Gait Adaptability Test

- Avoid pink obstacle



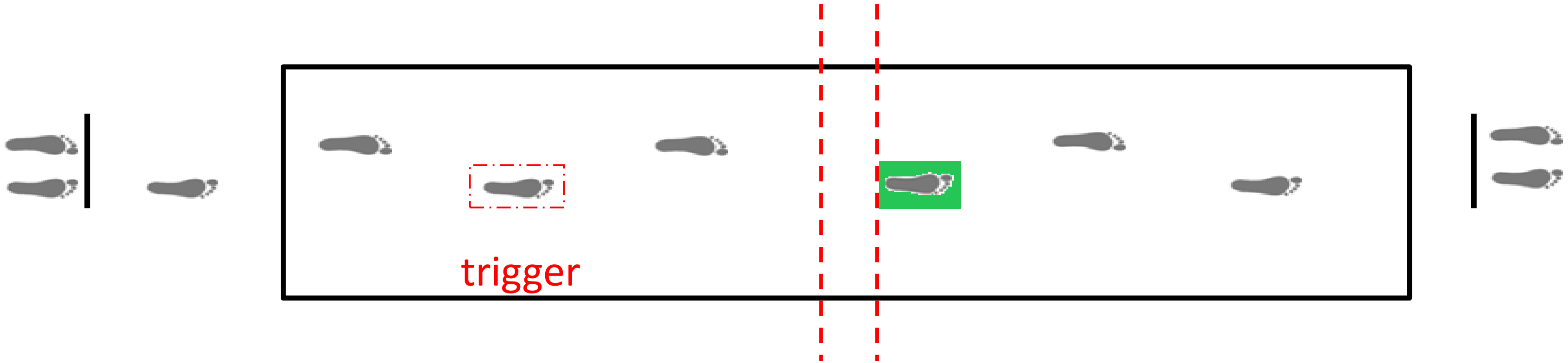
Gait Adaptability Test

- Step on short green target

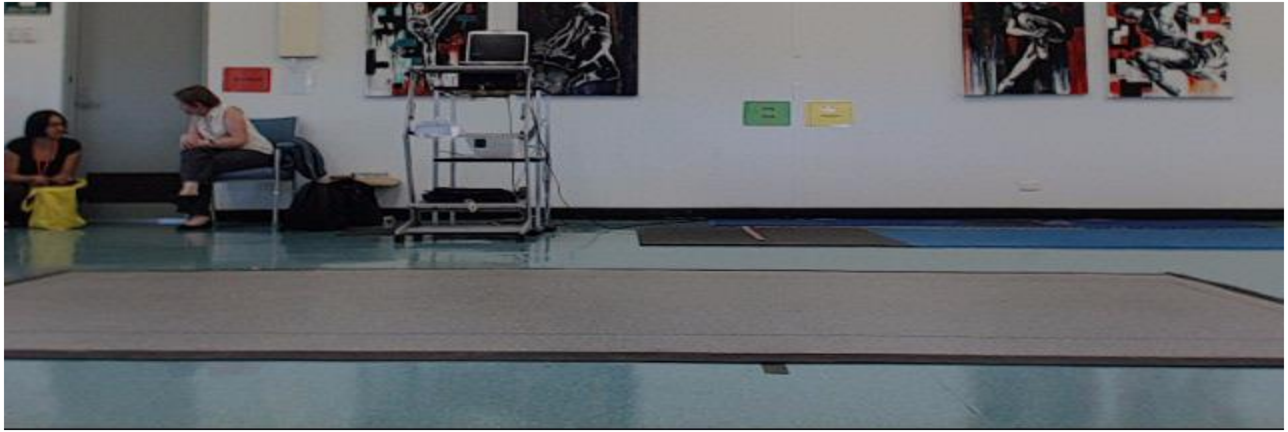


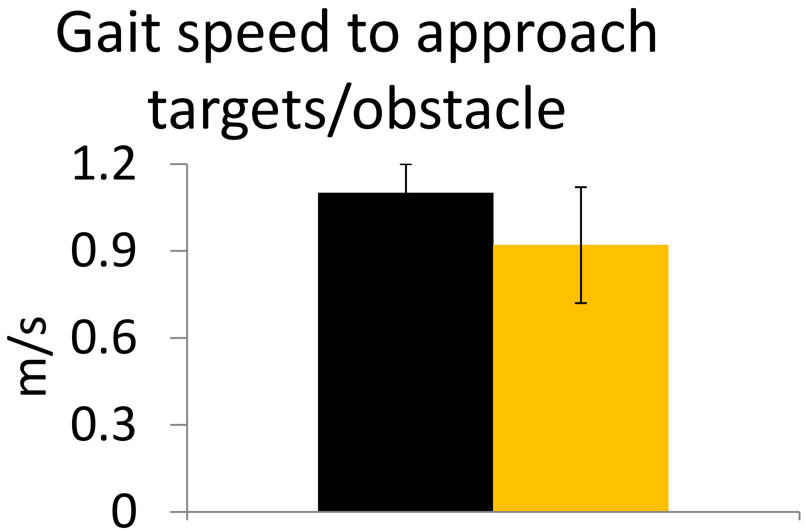
Gait Adaptability Test

- Step on long green target



Gait adaptability test





Even though older adults at high fall risk adopted a slower gait speed to approach the targets/obstacle, they still made more stepping errors.

Logistic Regression Analysis

- Gait speed and fall risk association

Mediating variable	Odds ratio reduction
Executive function	9%
Quadriceps strength	13%
Concern about falling	20%
Combined model	37%

Adjusted model
1.96 (95%CI=0.77-4.98)

- Stepping errors and fall risk association

Mediating variable	Odds ratio reduction
Executive function	24%

Adjusted model
3.6 (95%CI=0.76-17.03)

Conclusions

- Impaired gait adaptability performance increased fall risk in older people;
- The association between impaired gait adaptability performance and increased fall risk was mediated by reduced strength, impaired executive functioning and fear of falling;
- Interventions to prevent falls could address poor gait adaptability directly and/or target the cognitive, physical and psychological mediators for increased fall risk.

PLOS | MEDICINE

RESEARCH ARTICLE

Social Dancing and Incidence of Falls in Older Adults: A Cluster Randomised Controlled Trial

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Methods

- All adults who lived independently in 23 retirement villages across Sydney, Australia, were invited to participate in social dance classes (folk dance or ballroom) twice weekly over 12 mo, in total 80 h
- 12.3% of the residents expressed interest in the program
- The retirement villages were randomly assigned to the social dancing, (12 villages, 279 participants) or a “wait-listed” comparison group (11 villages, 251 participants).

Main findings

- Social dancing was not effective in reducing the number of falls; nor did it improve a variety of fall-related risk factors (e.g., balance, lower leg strength, cognitive processing speed, or task shifting), apart from a small apparent improvement in gait speed, particularly among ballroom participants.
- Older adults who had multiple falls in the year prior to the study and received the dance program seemed to fall more often than their counterparts in the comparison group.

Effect on Falls

Table 3. Number of falls and incidence of falling among study groups and by baseline falls history.

	Dance (*N* = 275)	Control (*N* = 247)	Unadjusted	Adjusted
	Falls (rate [a])	Falls (rate)	IRR [b] (95% CI)	IRR [c] (95% CI)
All study participants (*n* = 522)	257 (1.03)	187 (0.80)	1.34 (0.98–1.83)	1.19 (0.83–1.71)
Falls in the past 12 mo				
No fall (*n* = 377)	142 (0.78)	103 (0.61)	1.35 (0.83–2.21)	1.19 (0.67–2.10)
1 fall (*n* = 92)	34 (0.81)	44 (1.06)	0.77 (0.42–1.38)	0.78 (0.45–1.35)
≥2 falls (*n* = 51)	74 (3.12)	40 (1.78)	1.69 (1.17–2.44)	2.02 (1.15–3.54)

[a] = fall rates per person-year

[b] = IRR for dance group compared to control group, allowing for cluster

[c] = Adjusted for age, sex, educational attainment, baseline MMSE, dancing status at baseline, fall risk at baseline.

The adjusted model included 521 participants due to one person with missing data on dancing status, and the adjusted model comparing previous fallers included 141 participants due to two participants with no data on history of falls.

doi:10.1371/journal.pmed.1002112.t003

Conclusions

- This large-scale pragmatic trial suggests that social dance, as delivered in this trial, should not be considered as a fall prevention strategy.
- The mixture of participants with a variety of fall-risk levels, the inclusion of active participants, and the relatively low attendance, on average 51% of the classes prescribed, may explain these results.
- A modified social dance program that contains “training elements” of structured exercise, particularly balance, targeting low and high risk groups separately, should be tested to ascertain whether dance is an effective fall prevention strategy.

CLINICAL INVESTIGATIONS

Effects of Tai Chi on Cognition and Fall Risk in Older Adults with Mild Cognitive Impairment: A Randomized Controlled Trial

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J AM Geriatr Soc, 2016

Methods

- AIM: To examine whether combined centre- and home-based Tai Chi training can improve cognitive ability and reduce physiological fall risk in older adults with amnestic mild cognitive impairment (a-MCI)
- DESIGN: Randomized controlled trial
- SETTING: Chiang Mai, Thailand
- PARTICIPANTS: Adults aged 60 and older who met Petersen's criteria for multiple-domain a-MCI (N = 66)
- INTERVENTION: Three weeks centre-based and 12 weeks home-based Tai Chi (50 minutes per session, 3 times per week)

Results

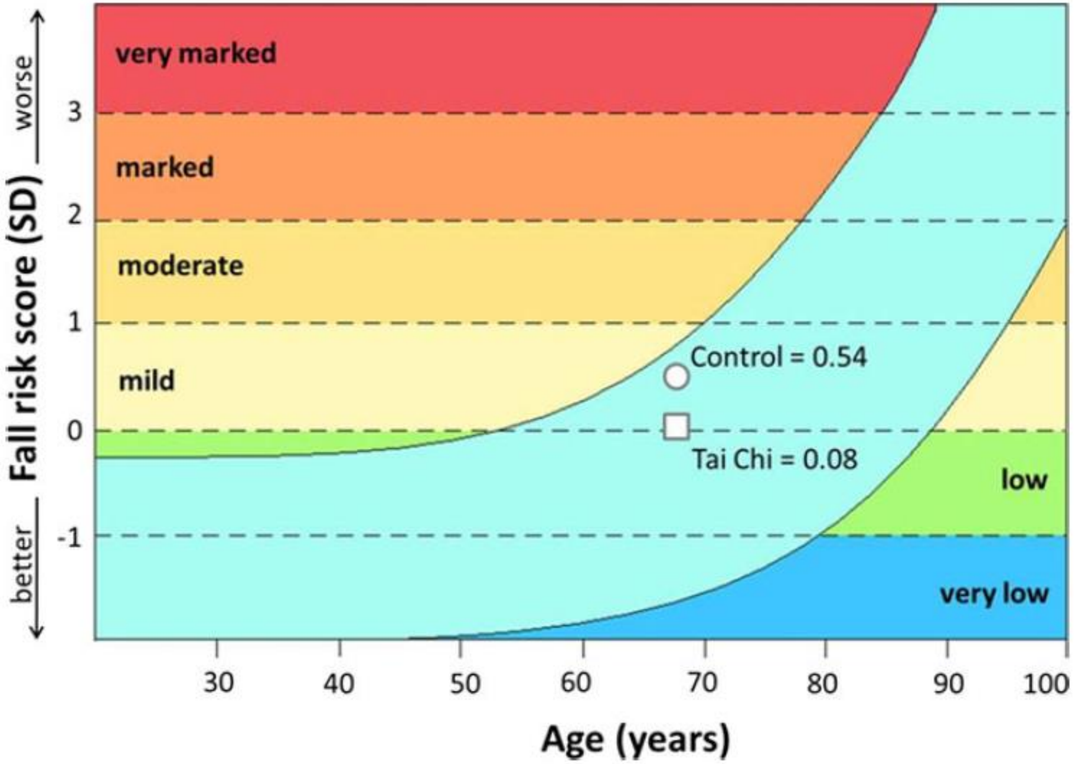
- At the end of the trial, performance on LM, Block Design, and TMT B–A were significantly better for the Tai Chi group than the control group The Tai Chi group also had significantly better composite PPA score and PPA parameter scores: knee extension strength, reaction time, postural sway, and lower limb proprioception

Results

Table 2. Test Results

Outcome Variable	Tai Chi, n = 33		Control, n = 33		Change from Baseline to 15 Weeks, Mean (Standard Error)		Between-Group Differences, Mean (95% CI)	*P*-Value[a]
	Baseline	Retest	Baseline	Retest	Tai Chi	Control		
	Mean±Standard Deviation							
Logical Memory delayed recall score (range 0–75)	21.7 ± 9.5	31.8 ± 7.4	19.1 ± 9.5	25.6 ± 8.9	10.1 (1.5)	6.5 (2.0)	5.5 (1.6–9.4)	.006
Digit Span forward/backward score (range 0–28)	12.4 ± 2.8	13.8 ± 3.2	12.3 ± 2.9	13.2 ± 2.6	1.4 (0.6)	0.9 (0.6)	0.5 (−0.8–1.9)	.43
Block design score (range 0–51)	17.2 ± 7.0	20.4 ± 5.5	16.8 ± 8.3	16.9 ± 7.6	3.2 (1.1)	0.2 (1.1)	3.2 (0.6–5.8)	.01
Trail-Making Test Part B–A score	100.8 ± 49.4	71.4 ± 34.2	100.6 ± 60.8	107.9 ± 63.3	−29.4 (7.7)	7.3 (15)	−36.6 (−61.5 to −11.8)	.005
Edge-contrast sensitivity, dB	20.2 ± 1.3	20.7 ± 1.2	20.6 ± 1.7	20.4 ± 1.9	0.5 (0.3)	−0.1 (0.3)	0.4 (−0.3–1.1)	.21
Knee proprioception, degrees error in aligning lower limbs	2.2 ± 1.2	1.8 ± 0.9	2.3 ± 1.2	2.7 ± 1.3	−0.4 (0.2)	0.5 (0.3)	−0.9 (−1.5 to −0.4)	.002
Knee extension strength, kg maximal isometric force	26.7 ± 5.9	30.3 ± 6.0	26.1 ± 6.0	27.4 ± 4.9	3.6 (0.7)	1.4 (0.7)	2.4 (0.6–4.2)	.008
Hand reaction time, ms	270 ± 40	245 ± 45	272 ± 73	272 ± 73	−25 (5)	0.3 (12)	−26 (−50 to −1)	.04
Postural sway, mm^2[b]	554 ± 291	395 ± 194	593 ± 292	598 ± 370	−159 (50)	4 (70)	−191 (−332 to −1)	.009
PPA fall risk index score[c]	0.65 ± 0.8	0.08 ± 0.8	0.64 ± 0.8	0.54 ± 1.1	−0.57 (0.13)	−0.10 (0.14)	−.47 (−0.84 to −0.09)	.015

PPA scores at trial completion



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

Anat Mirelman, Lynn Rochester, Inbal Maidan, Silvia Del Din, Lisa Alcock, Freek Nieuwhof, Marcel Olde Rikkert, Bastiaan R Bloem, Elisa Pelosin, Laura Avanzino, Giovanni Abbruzzese, Kim Dockx, Esther Bekkers, Nir Giladi, Alice Nieuwboer, Jeffrey M Hausdorff

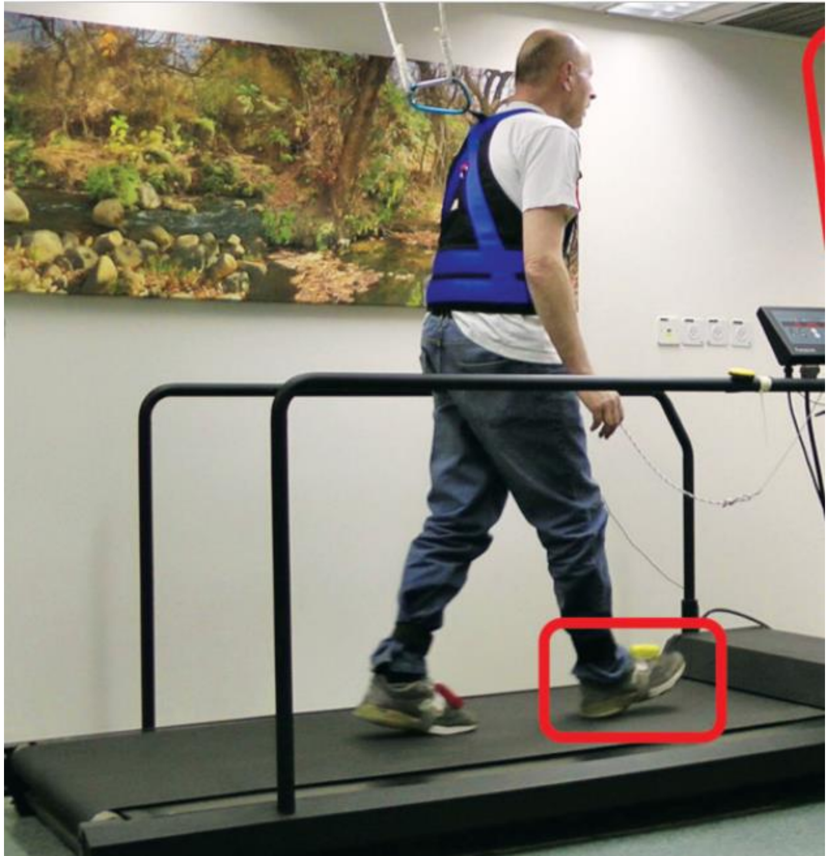
Lancet 2016; 388: 1170–82

Methods

- 202 participants assigned to either treadmill training plus VR or treadmill training alone
- Both groups aimed to train three times per week for 6 weeks, with each session lasting about 45 min and structured training progression individualised to the participant's level of performance
- Stratified by subgroups: history of falls (109), mild cognitive impairment (43), Parkinson’s disease (130)

The VR intervention

The VR system consisted of a motion-capture camera and a computer-generated simulation projected on to a large screen, including challenges such as obstacles, multiple pathways, and distracters that required continual adjustment of steps.



Falls

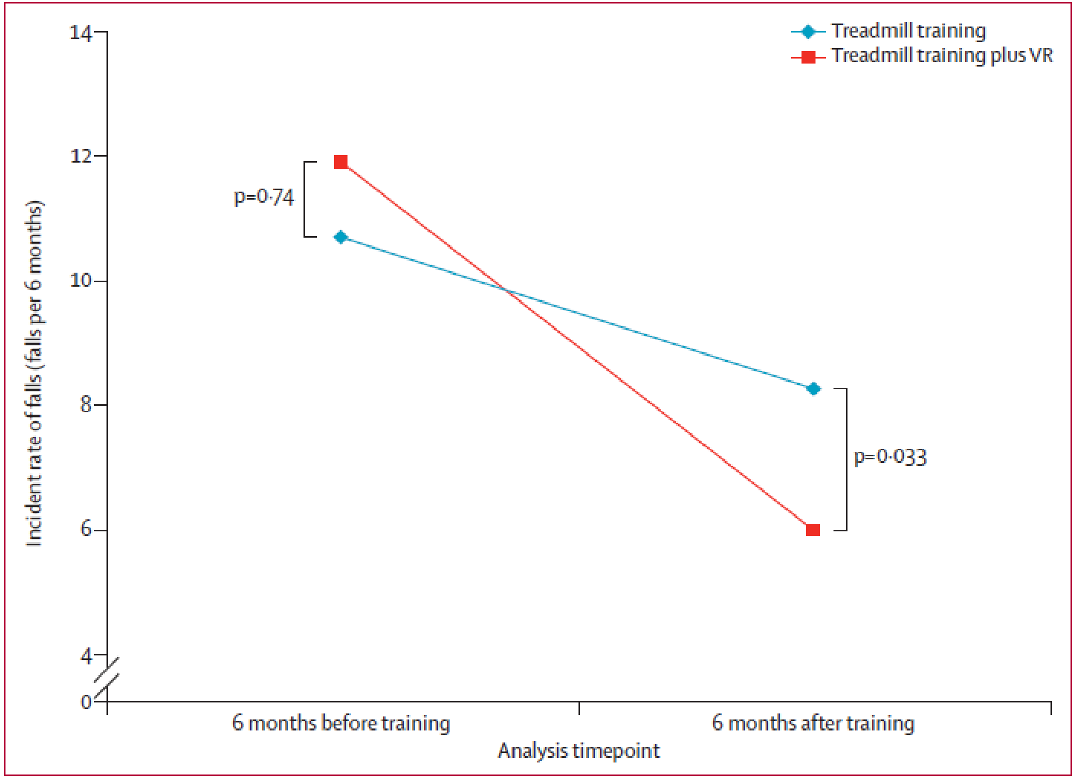


Figure 3: **Differences in fall incident rates within and between training groups before and after training**
95% CIs and incidence rates for the subgroups are shown in table 2. VR=non-immersive virtual reality.

Results

	6 months before training				6 months after training			
	All participants	People with idiopathic falls	Mild cognitive impairment	Parkinson's disease	All participants	People with idiopathic falls	Mild cognitive impairment	Parkinson's disease
Incident rate of falls (95% CI)								
Treadmill training	10·71 (8·51–13·47)	3·23 (2·70–3·86)	2·85 (2·20–3·69)	19·23 (13·39–27·64)	8·27 (5·55–12·31)	0·89 (0·55–1·44)	1·28 (0·58–2·79)	16·48 (9·96–27·29)
Treadmill training plus VR	11·92 (9·47–15·01)	8·07 (5·67–11·49)	3·30 (2·64–4·14)	18·26 (12·79–26·07)	6·00 (4·36–8·25)	5·10 (2·65–9·80)	2·35 (1·11–4·96)	8·06 (5·55–11·71)
p value	0·29	0·0001	0·29	0·34	0·03	0·10	0·99	0·01

Data are n or n (%) unless otherwise specified. Fall status (ie, whether a participant had ≥2 falls) was a prespecified secondary analysis. VR=non-immersive virtual reality.

6 months after the end of training, the incident rate of falls was significantly lower in the treadmill training plus VR group than in the treadmill training group (incident rate ratio 0·58, 95% CI 0·36–0·96; p=0·033).

6 months after training			
All participants	People with idiopathic falls	Mild cognitive impairment	Parkinson's disease
8·27 (5·55–12·31)	0·89 (0·55–1·44)	1·28 (0·58–2·79)	16·48 (9·96–27·29)
6·00 (4·36–8·25)	5·10 (2·65–9·80)	2·35 (1·11–4·96)	8·06 (5·55–11·71)
0·03	0·10	0·99	0·01

JAMDA

journal homepage: www.jamda.com

Original Study

Low-Impact Flooring: Does It Reduce Fall-Related Injuries?

H. Carl Hanger MBChB, FRACP *

Older Persons Health Specialist Service, Canterbury District Health Board; and Christchurch School of Medicine, University of Otago, Christchurch, New Zealand

Aim and methods

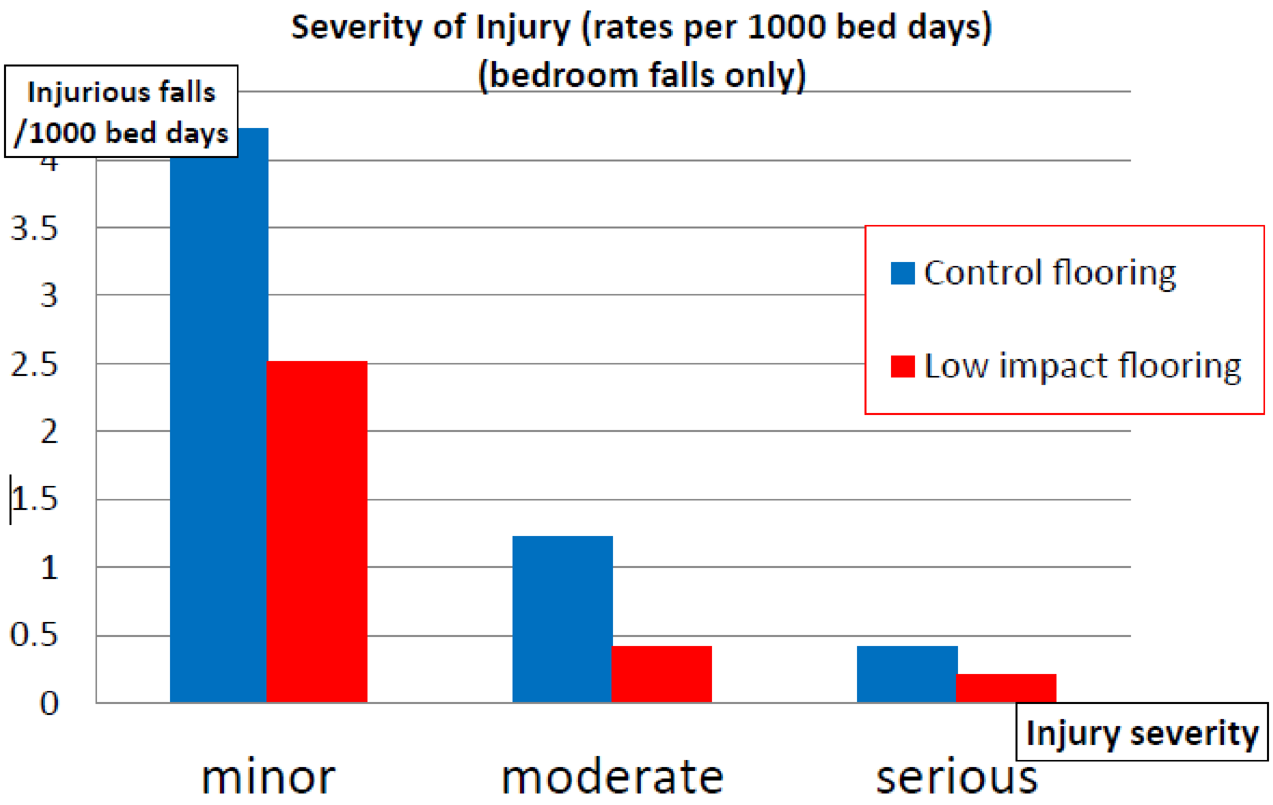
- Aim: To compare fall rates and injuries from falls on low-impact flooring (LIF) compared with a standard vinyl flooring
- Design: Prospective, nonrandomized controlled study
- Setting: Subacute Older Persons Health ward (N = 20 beds)
- Measurements: All falls in the ward were monitored using incident reporting, noting location and consequences of each fall
- Fall rates (per 1000 bed days) and injuries, were compared between bedroom falls on LIF against those occurring on standard vinyl flooring (controls)

The intervention

- Three different LIFs were used based on international trials to date : SmartCell (25 mm thick), Tarkett Excell Omnisport (8 mm thick), and Kradal (12 mm thick) – 4 bed spaces each
- 8 bed spaces were surrounded by standard vinyl flooring (3-4 mm thick) laid on subflooring of concrete

Results

- Over 31 months, there were 278 bedroom falls (from 178 fallers).
- The bedroom fall rate (falls per 1000 bed days occupied) did not differ between the LIF and control groups (median 15 [IQR 8-18] versus 17 [IQR 9-23], respectively; P =0.47).
- However, fall-related injuries were significantly less frequent when they occurred on LIFs (22% of falls versus 34% of falls on control flooring; P =0 .02).
- Fractures occurred in 0.7% of falls in the LIF cohort versus 2.3% in the control cohort.
- Rolling resistance when moving heavier equipment, such as beds or hoists, was an issue for staff on LIF.


Severity of Injury (rates per 1000 bed days)
(bedroom falls only)
Injurious falls
/1000 bed days
4
3.5
3
2.5
2
1.5
1
0.5
0
Control flooring
Low impact flooring
minor
moderate
serious
Injury severity

Gold bar evidence scale

- One good quality RCT

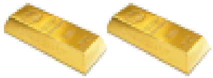
- At least two good quality RCTs – little inconsistency

- Multiple RCTs and/or systematic reviews –little inconsistency

Falls prevention – what works

- High level balance exercise in group or home settings (functional balance exercises, step training, 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

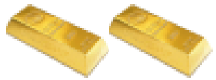
- Pharmacist-led education and GP medication review

- Podiatry intervention in people with disabling foot pain

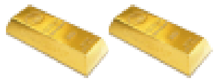
Falls prevention – what works

- Withdrawal of psychoactive medications

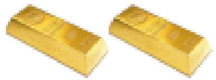
- Intensive multidisciplinary assessment of high risk populations



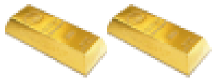
- Intensive interventions in hospitals



- Comprehensive geriatric assessment in residential aged care



- Vitamin D supplementation in residential aged care – excluding megadoses



- Medication review in residential aged care

Thank You

NeuRA Discover. Conquer. Cure.

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