

Valproblematiek na CVA: mechanismen, risicofactoren en behandeling

Radboudumc



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Nijmegen, Netherlands

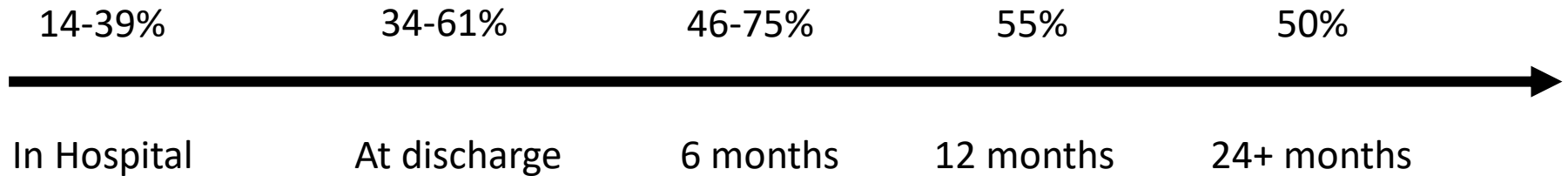


St Maartenskliniek
Rehabilitation Center

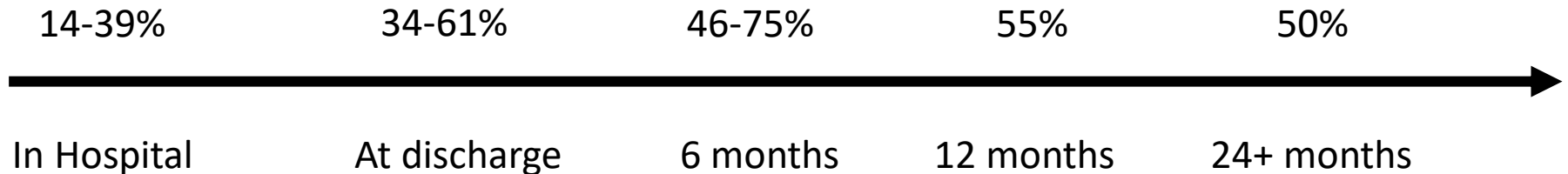


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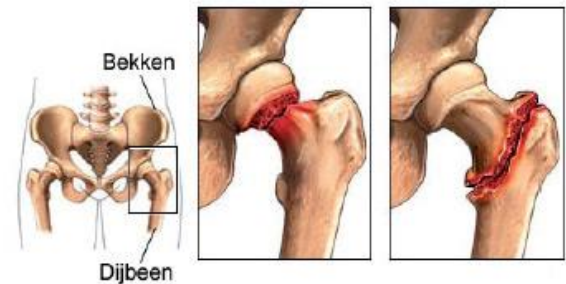
Fall incidence after stroke



Fall incidence after stroke

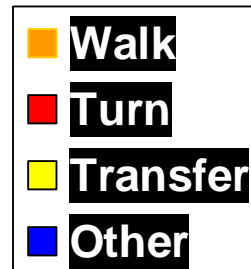
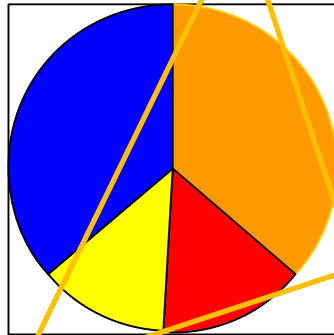


- 3-10 times greater fall rates than healthy
- 55% of all falls in PwS lead to injuries
- 10% of all falls lead to severe injuries (e.g. fracture)

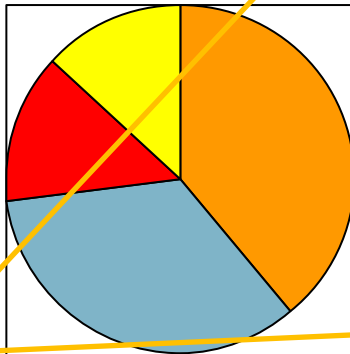


Circumstances of falls after stroke

Activity

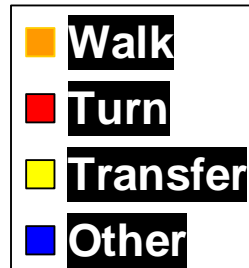
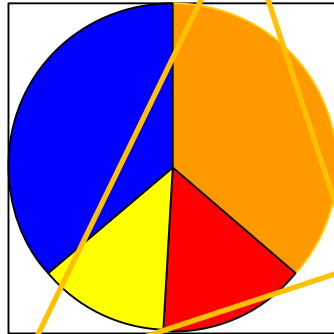


Hyndman et al (2002)



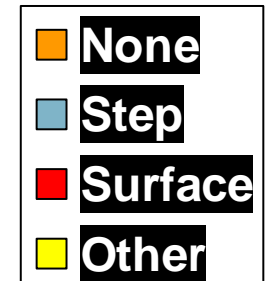
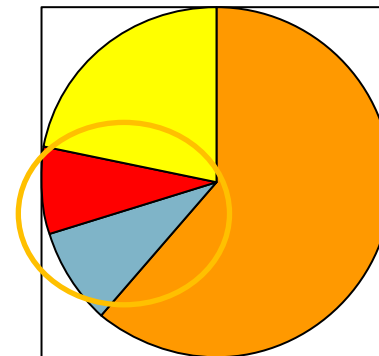
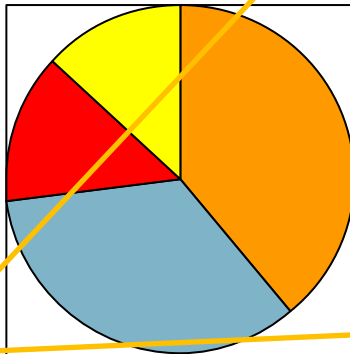
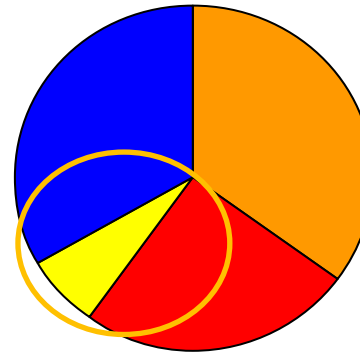
Circumstances of falls after stroke

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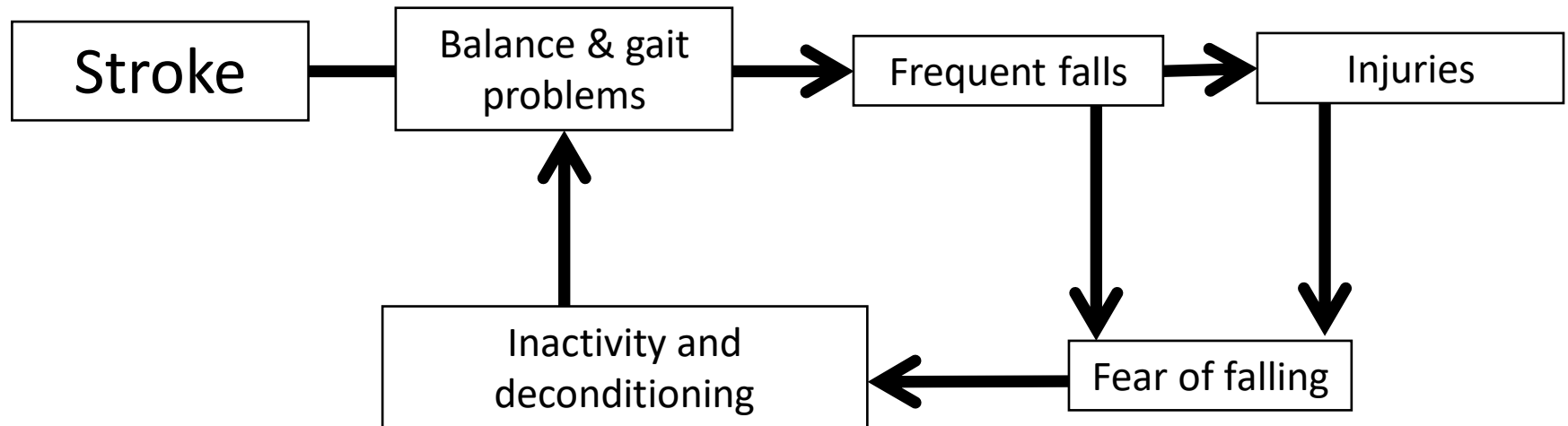
Hyndman et al (2002)

Cause

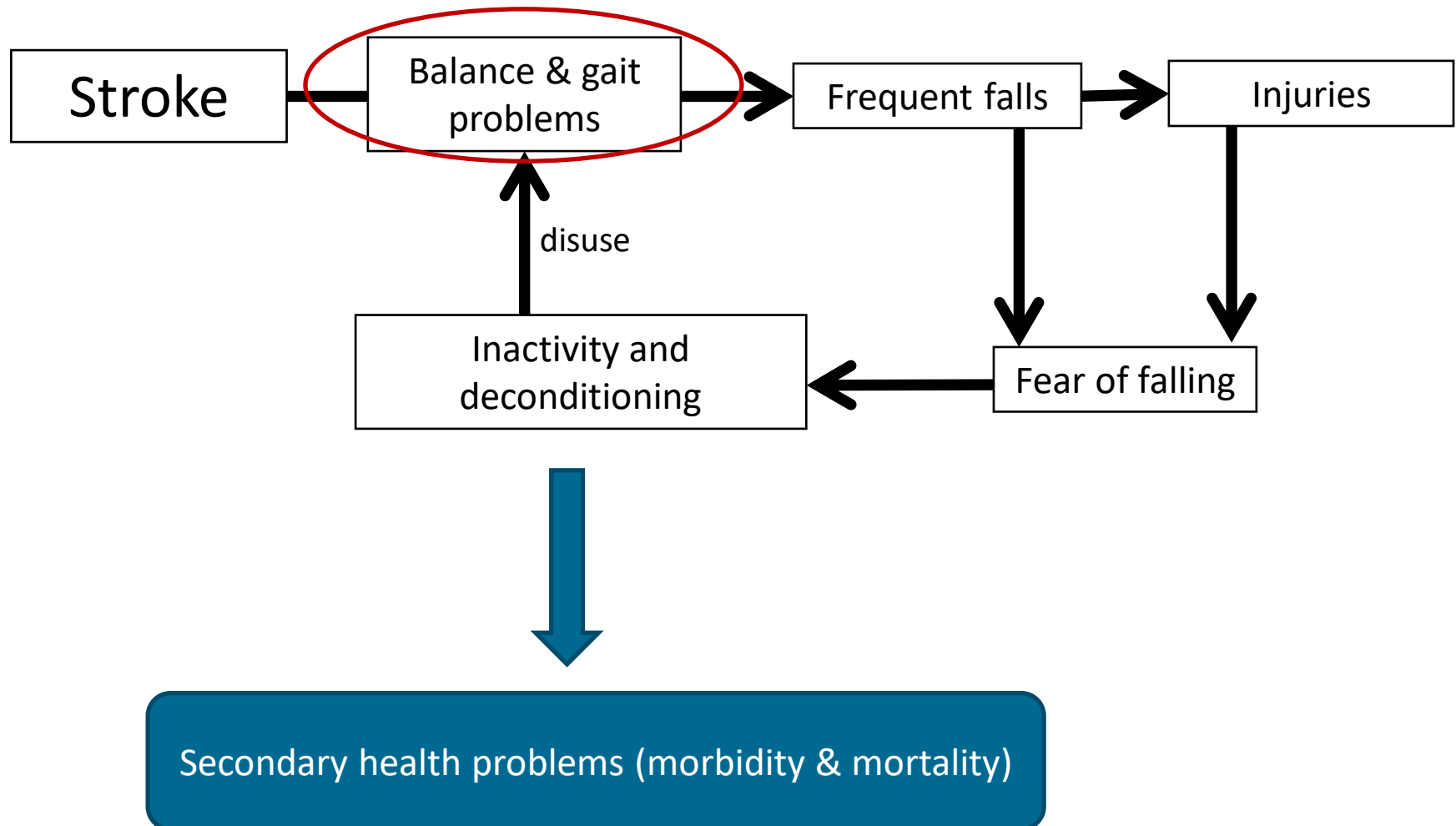


'Intrinsic' falls!

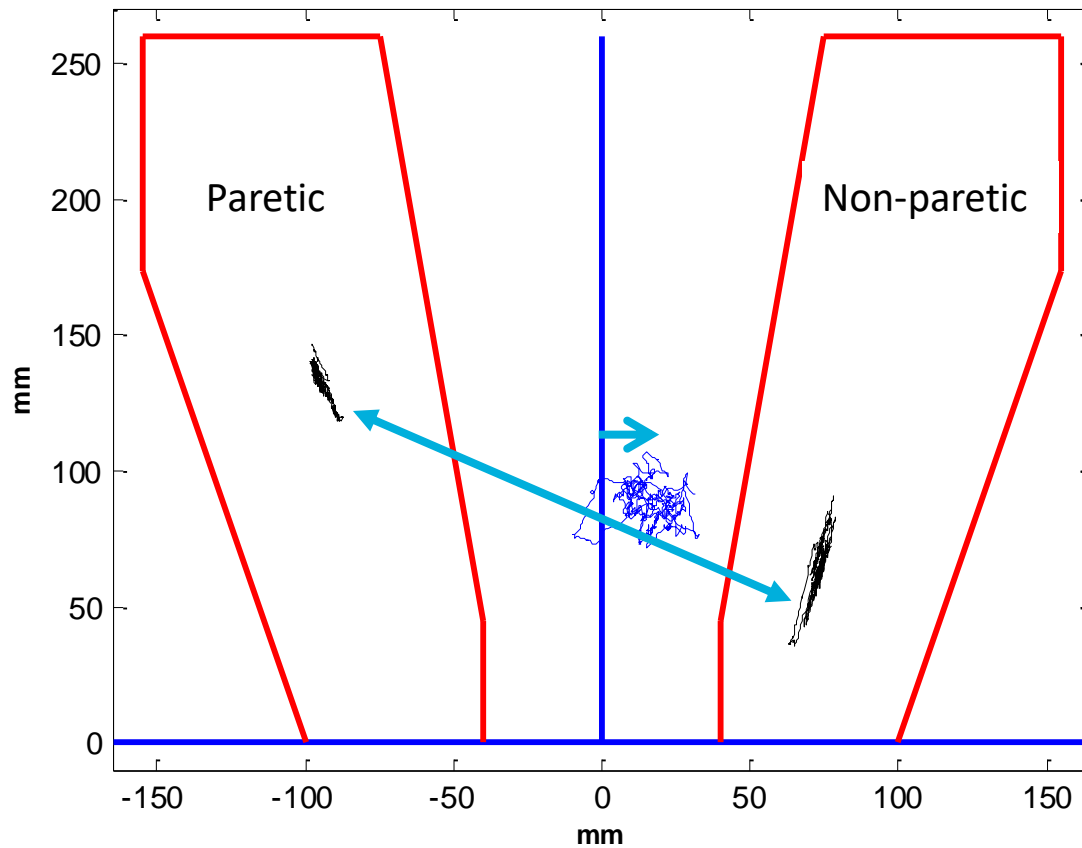
Vicious circle



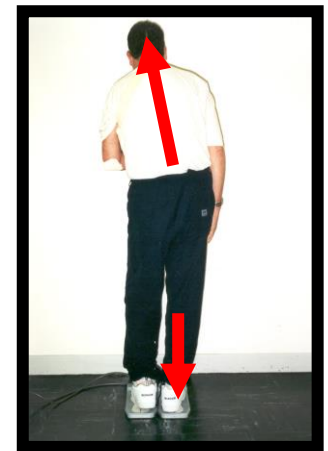
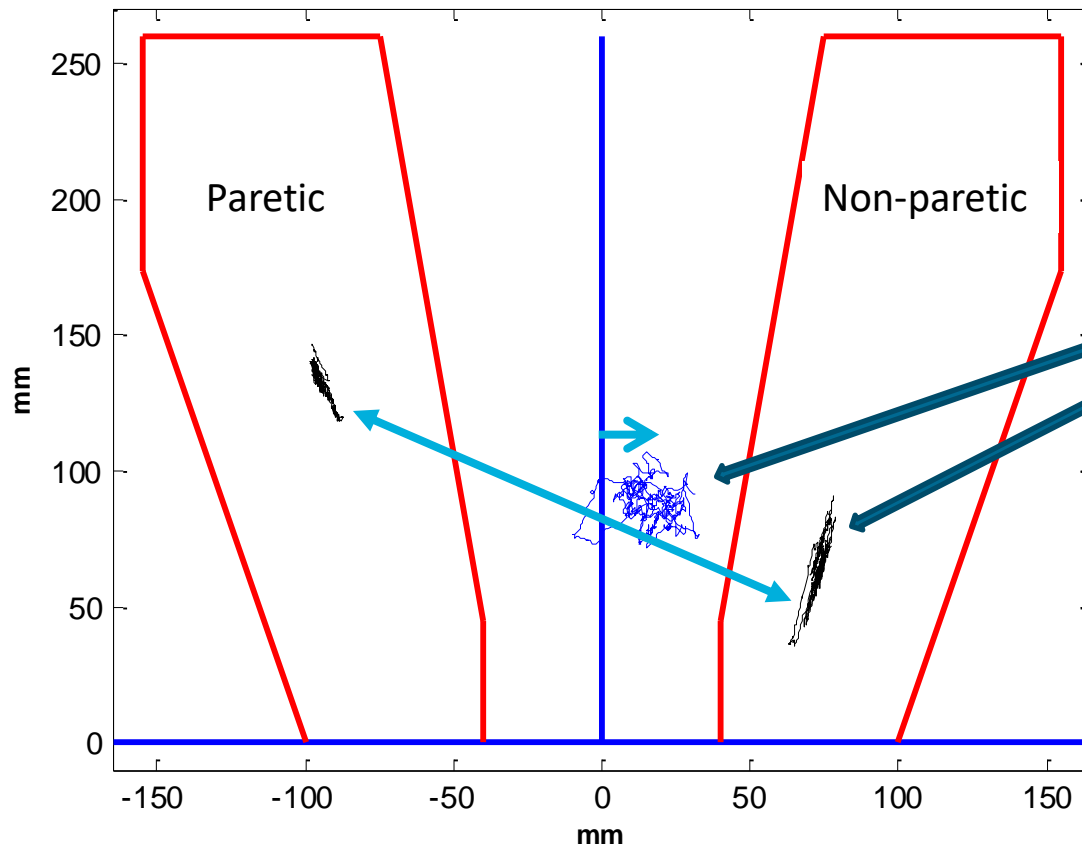
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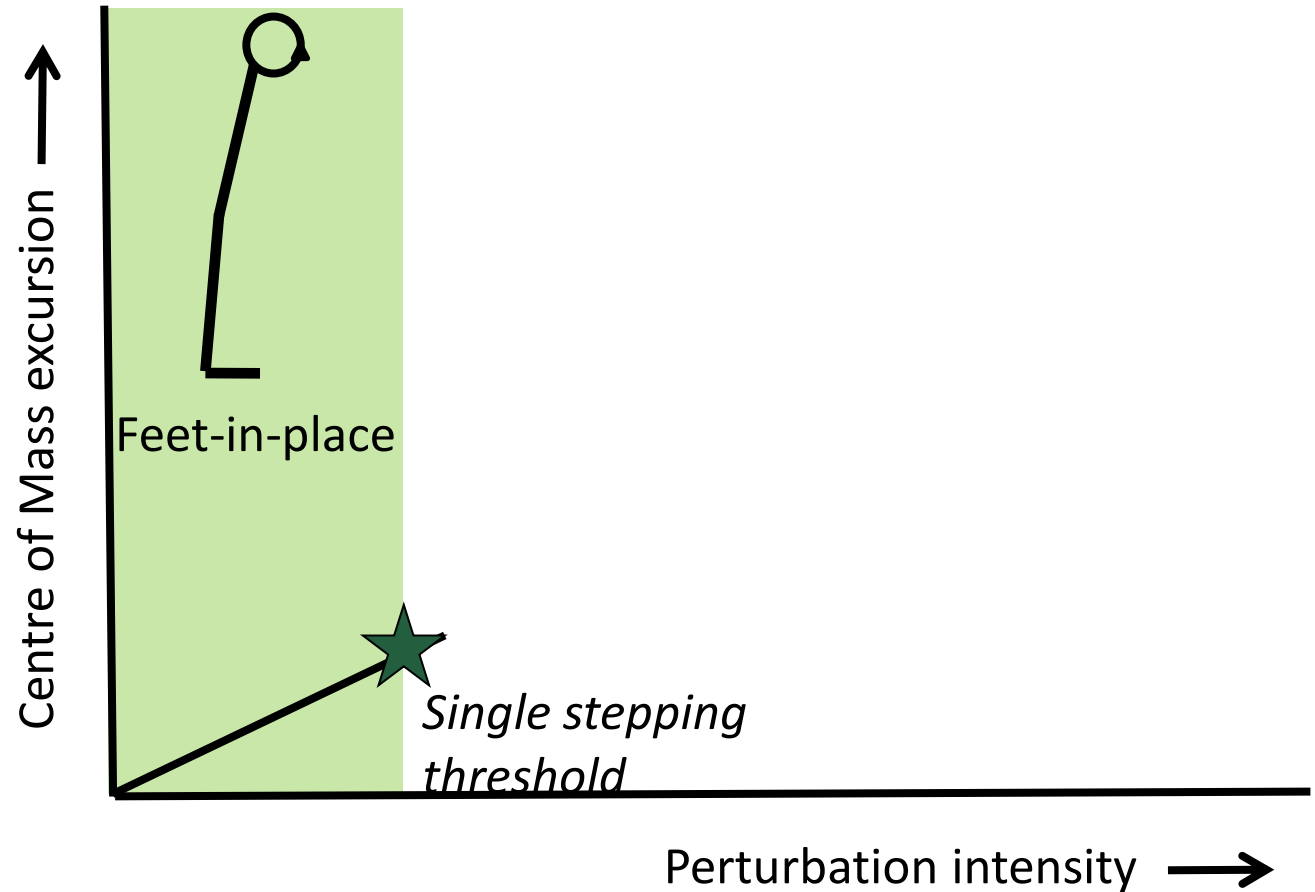
Typical quiet stance in stroke



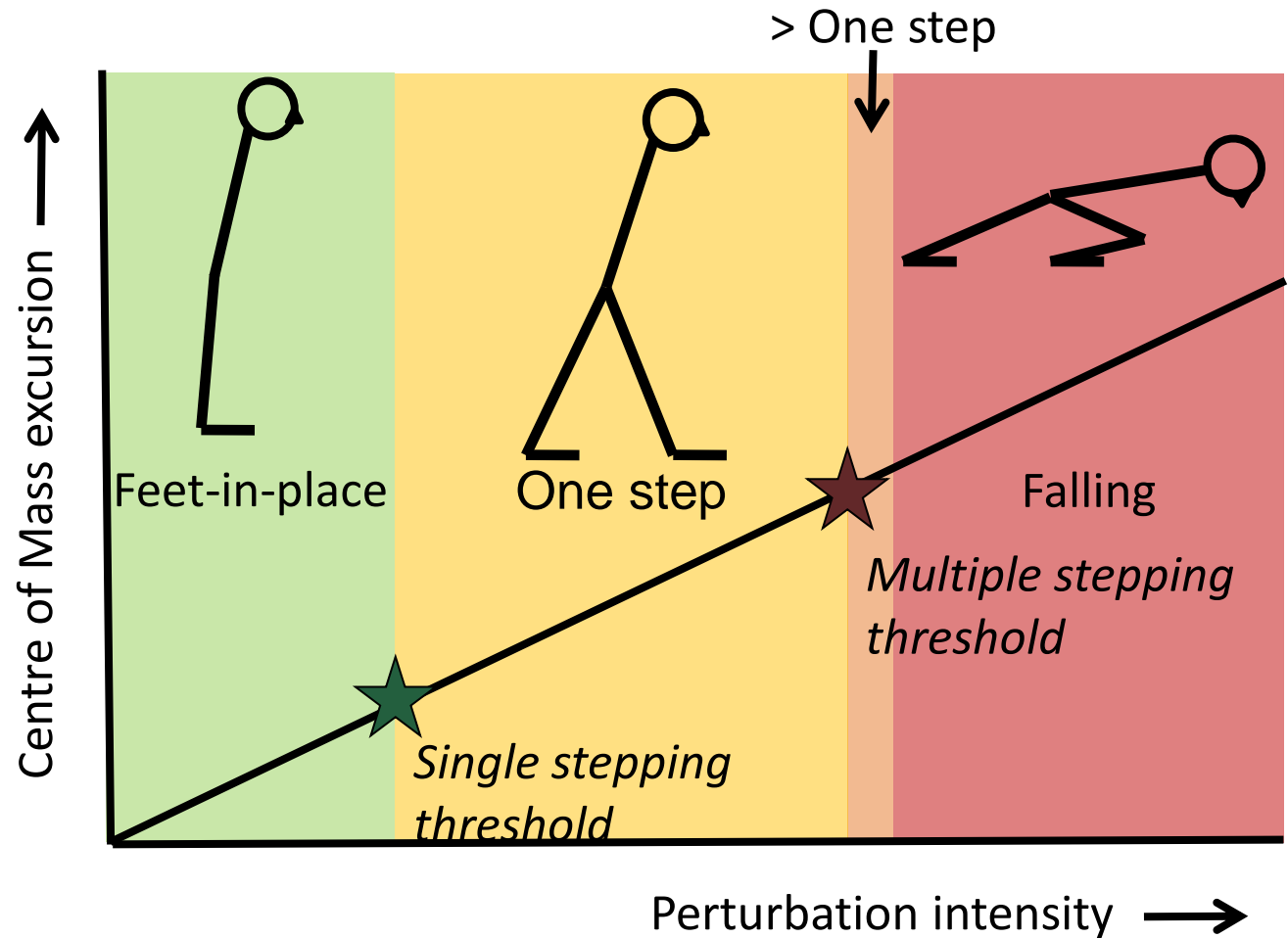
Typical quiet stance in stroke



Balance recovery from perturbation

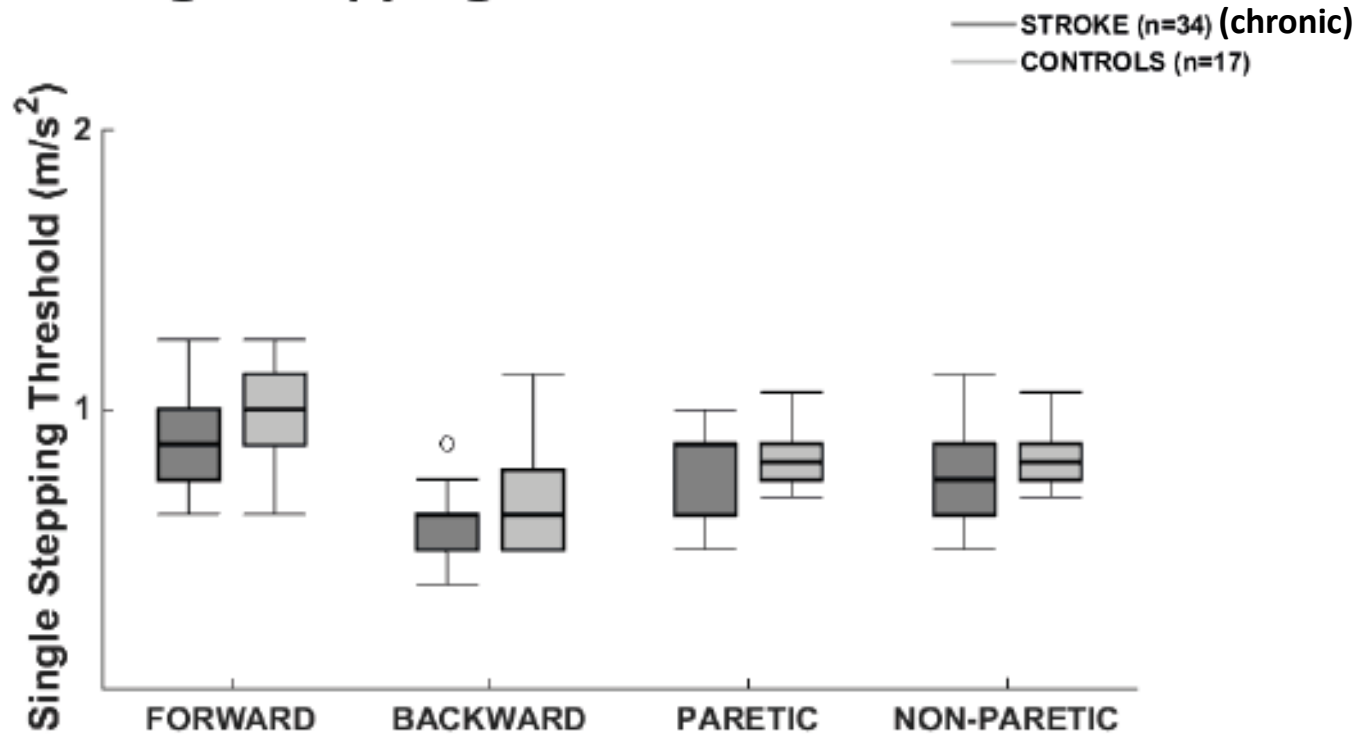


Balance recovery from perturbation



“Feet in place”

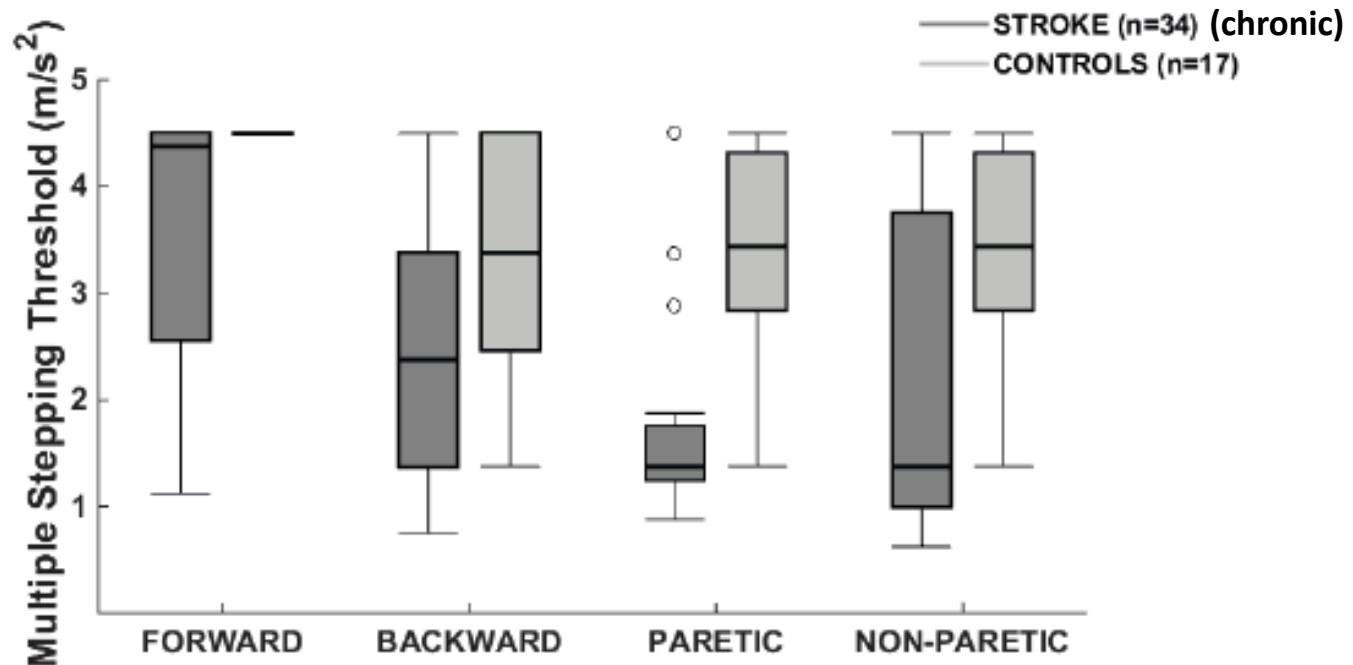
A: Single Stepping Threshold



No significant group differences

“Recover in one step”

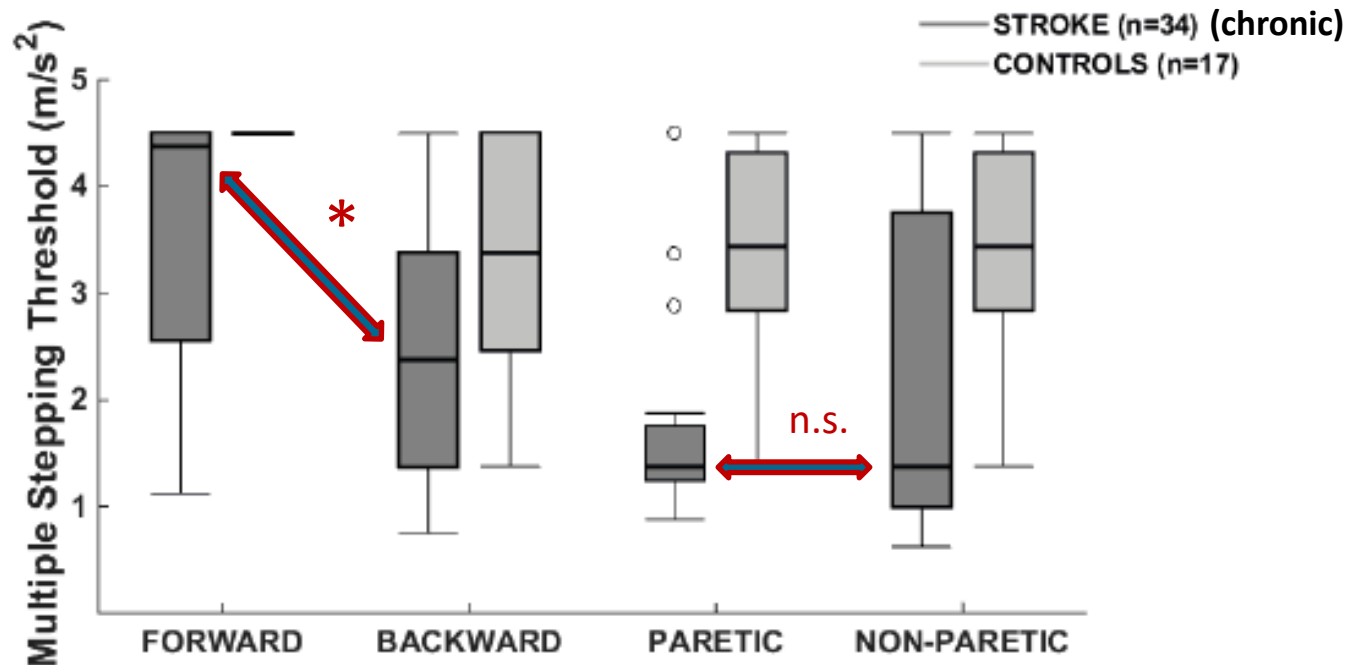
B: Multiple Stepping Threshold



Significant group differences all directions ($p < .01$)

“Recover in one step”

B: Multiple Stepping Threshold



Significant group differences all directions ($p < .01$)

Falls after stroke: 3 statements

Huge clinical and societal problem

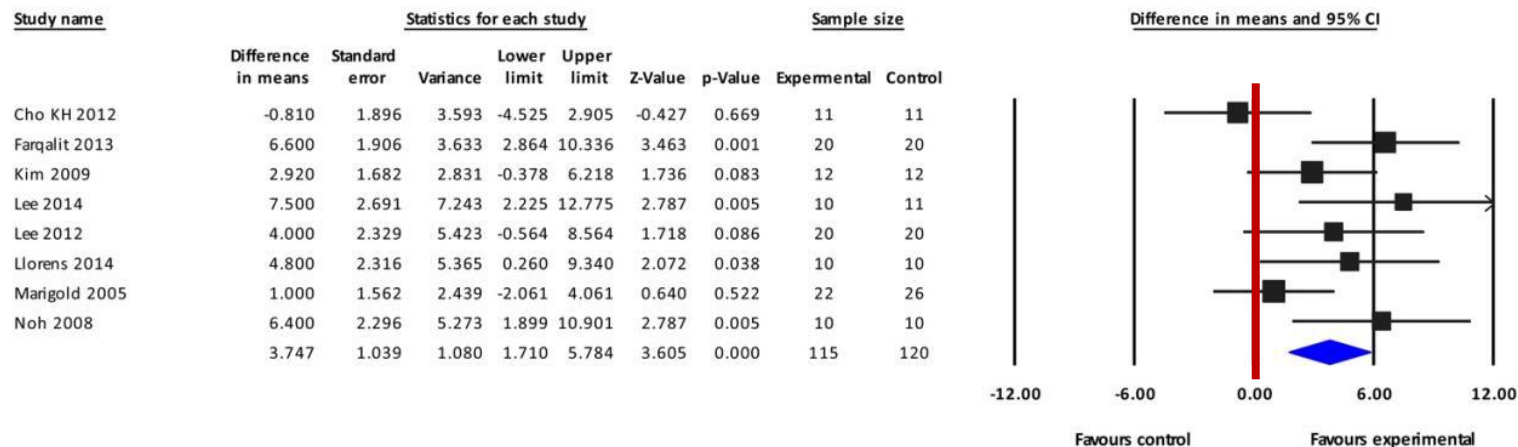


**Dynamic balance deficits are important
underlying factor**

Little proof of effective interventions

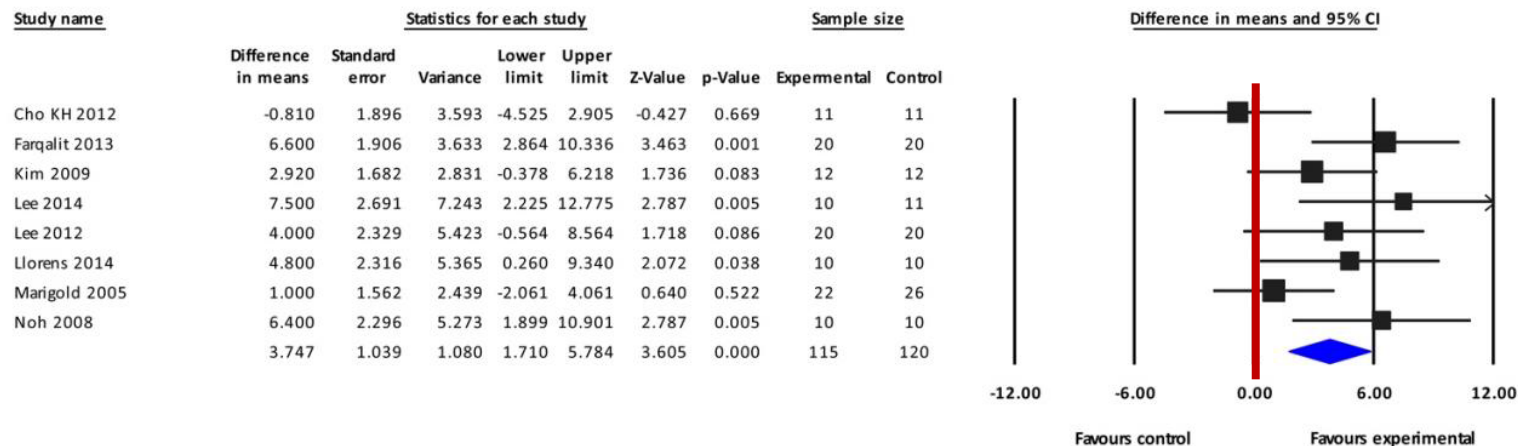
Exercise training in chronic stroke

BBS post intervention | experimental: balance training

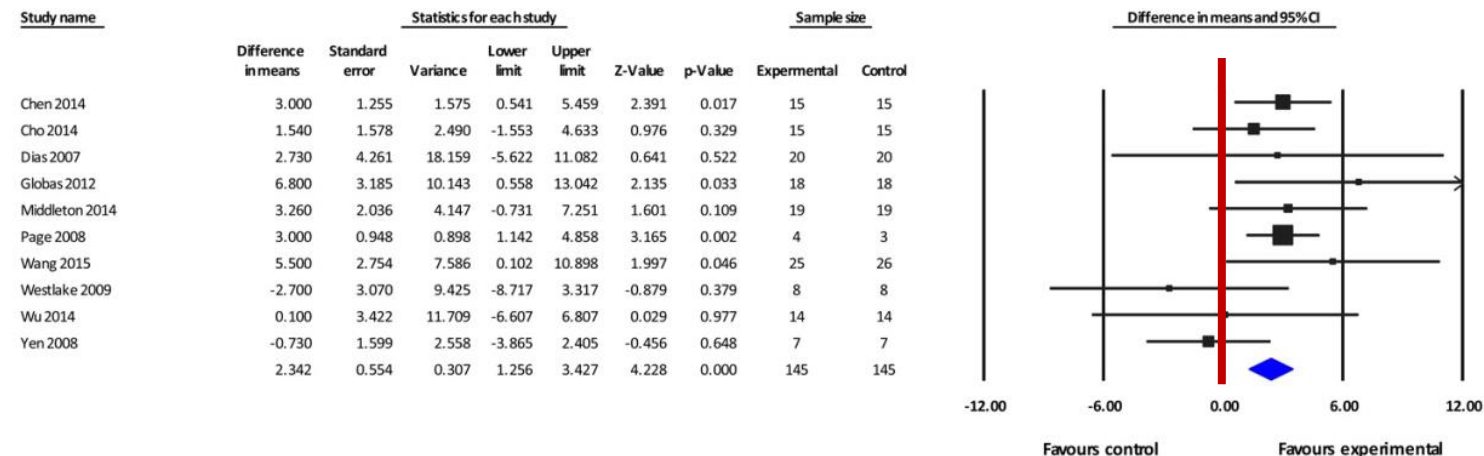


Exercise training in chronic stroke

BBS post intervention | experimental: **balance training**

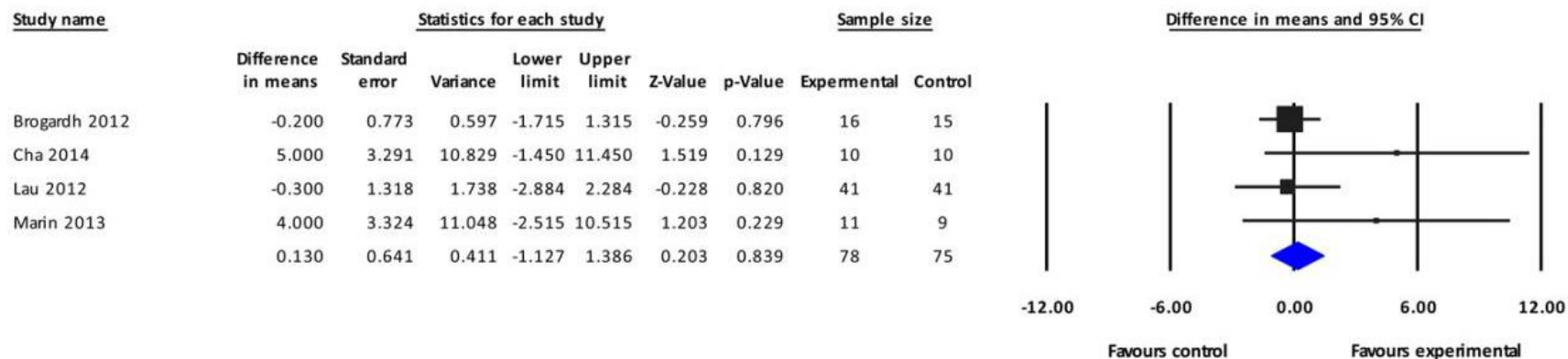


BBS post intervention | experimental: **gait training**



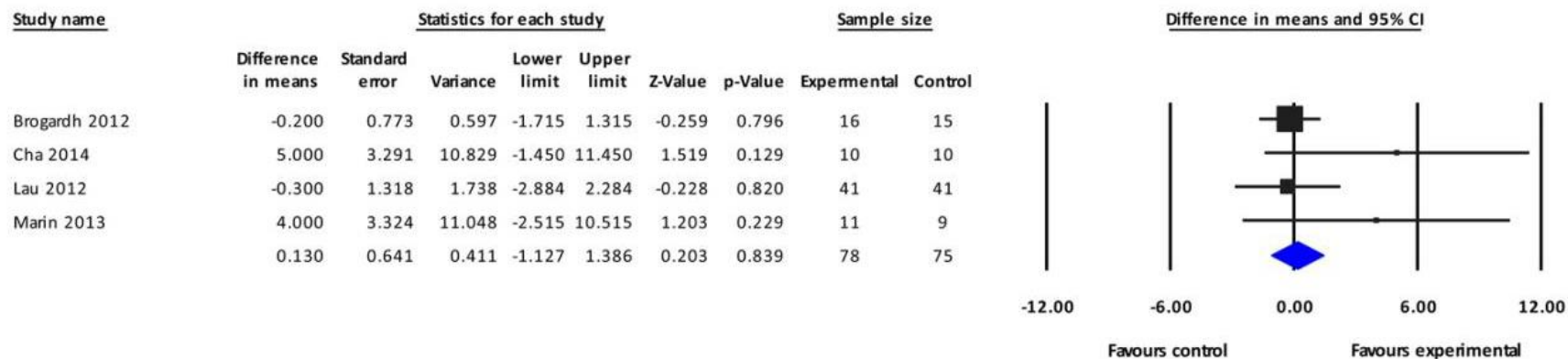
Exercise training in chronic stroke

BBS post intervention | experimental: multisensory training

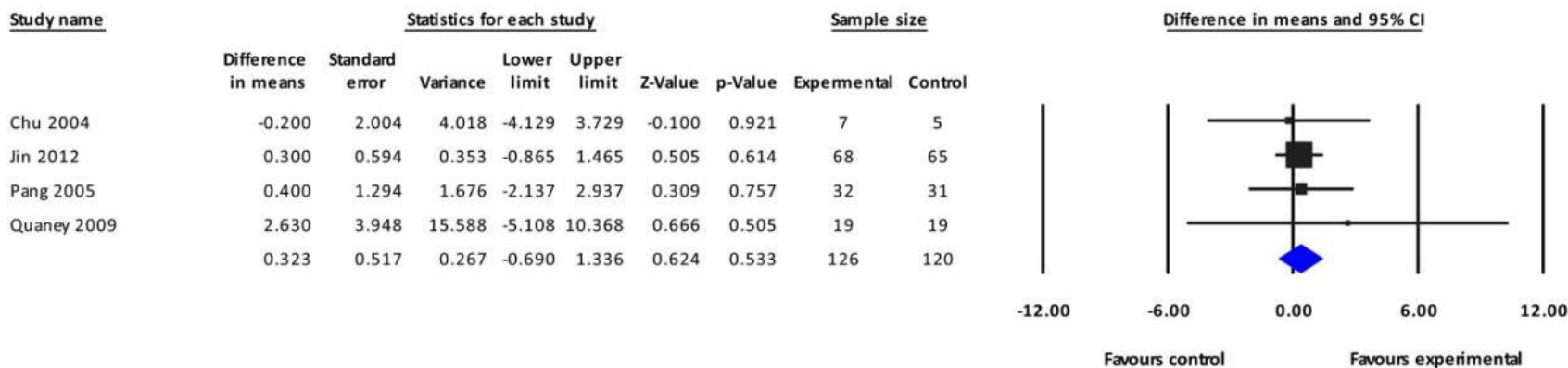


Exercise training in chronic stroke

BBS post intervention | experimental: multisensory training



BBS post intervention | experimental: aerobic training



Updated Cochrane review



Cochrane Database of Systematic Reviews

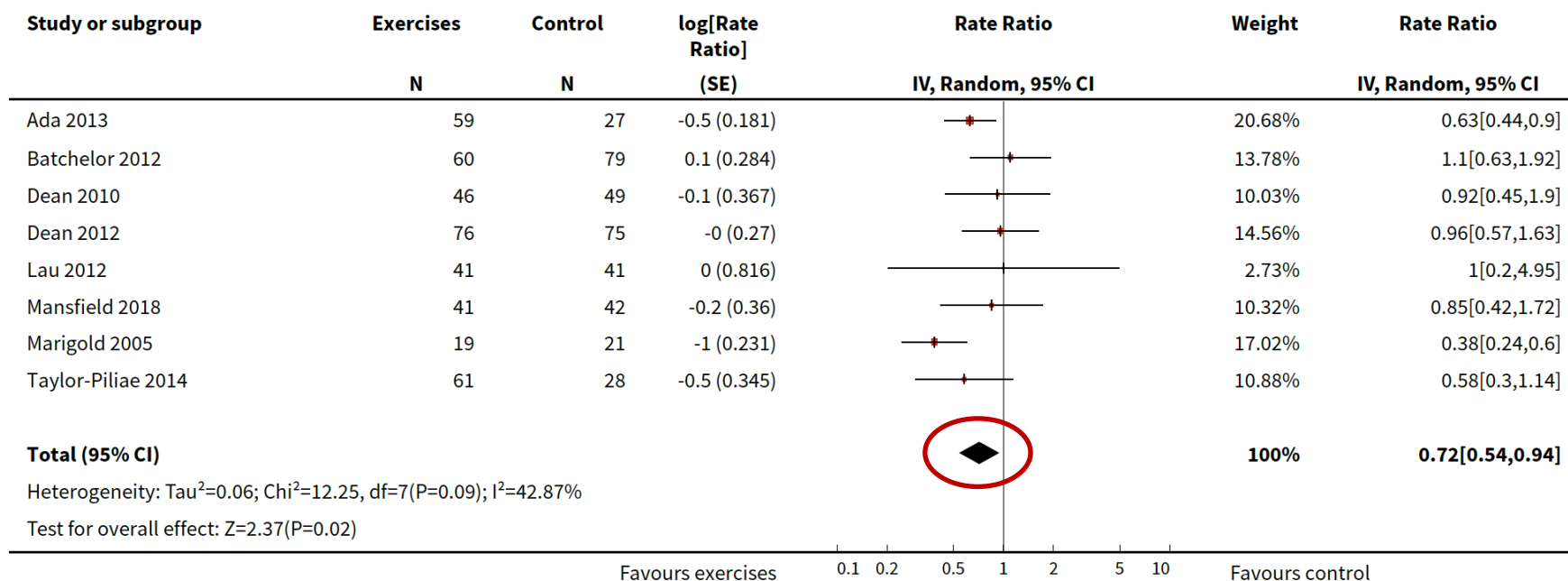
Interventions for preventing falls in people after stroke (Review)

Denissen S, Staring W, Kunkel D, Pickering RM, Lennon S, Geurts ACH, Weerdesteyn V, Verheyden GSAF

Denissen et al. Cochrane Database of Systematic Reviews 2019, Issue 10.
Art. No.: CD008728.

Updated Cochrane review

Analysis 1.1. Comparison 1 Exercise, Outcome 1 Rate of falls.

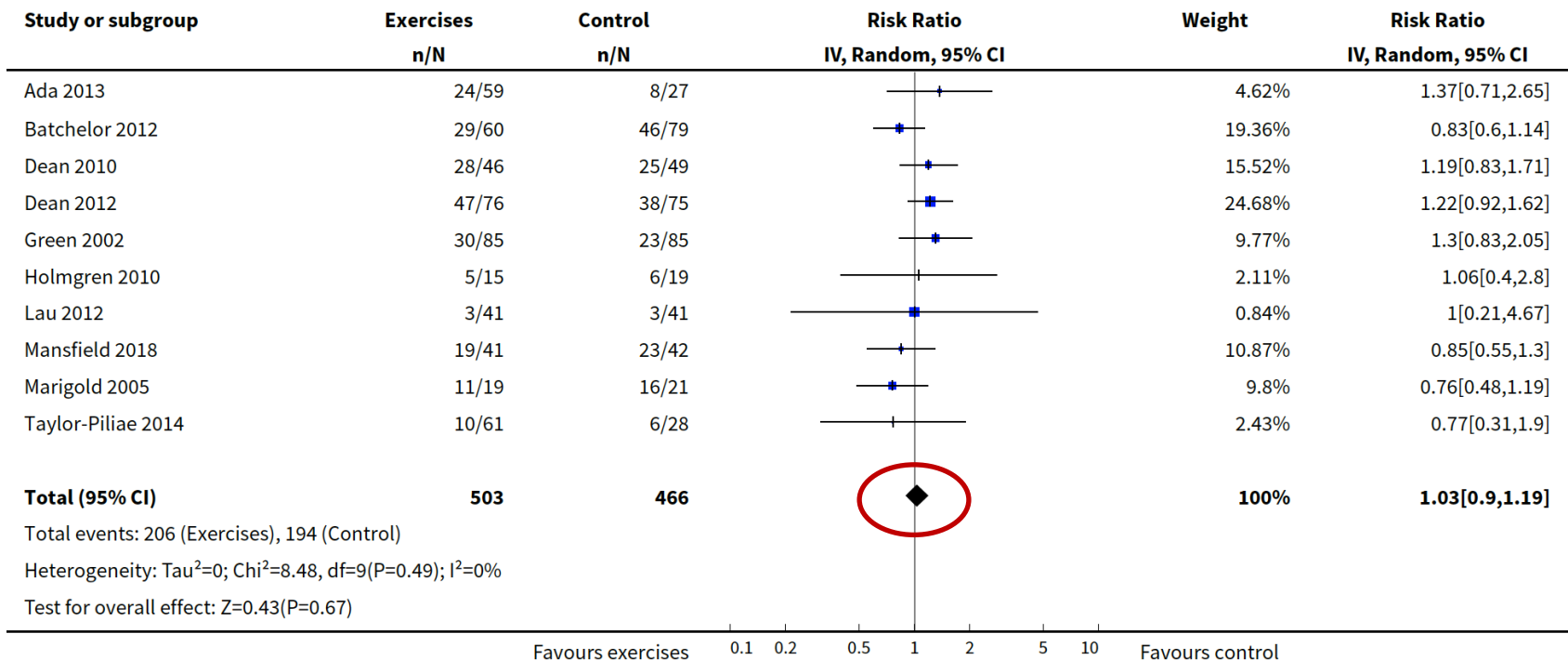


Significant reduction in rate of falls of 28%

8 studies: N=765 → RR=0.72 (95%CI: 0.54-0.94)

Updated Cochrane review

Analysis 1.2. Comparison 1 Exercise, Outcome 2 Number of fallers.



No significant reduction in number of fallers

10 studies: $N=969 \rightarrow RR=1.03$ (95%CI: 0.9-1.19)

What type of exercise works?



What type of exercise works?

Anticipatory control:
maintaining balance
during activities

Reactive control:
recovering from loss of
balance

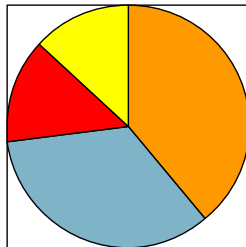
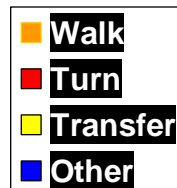
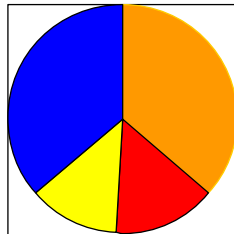
Damage control:
impact reducing
strategies



Overall program content:
Relatively few walking tasks



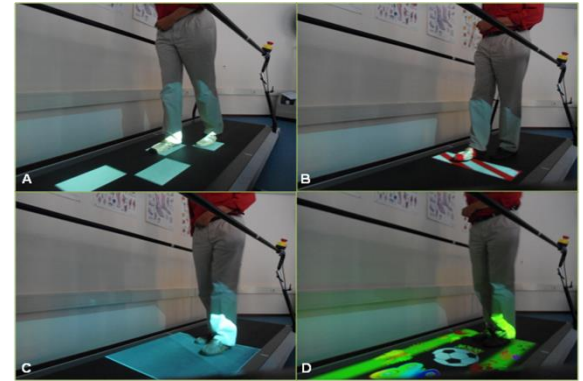
Fall circumstances:
39-90% of falls during walking



C-mill gait adaptability training



10 x 1 hour, 5 weeks

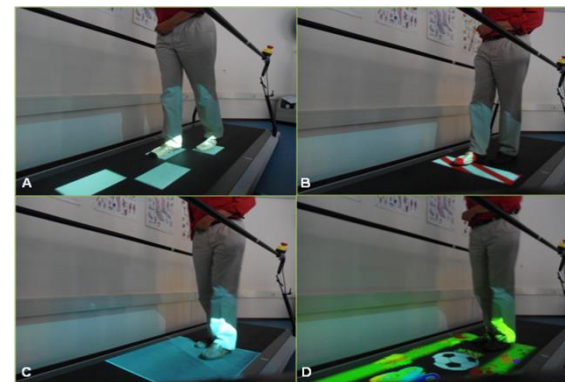


Pre-post design (n=16)

C-mill gait adaptability training

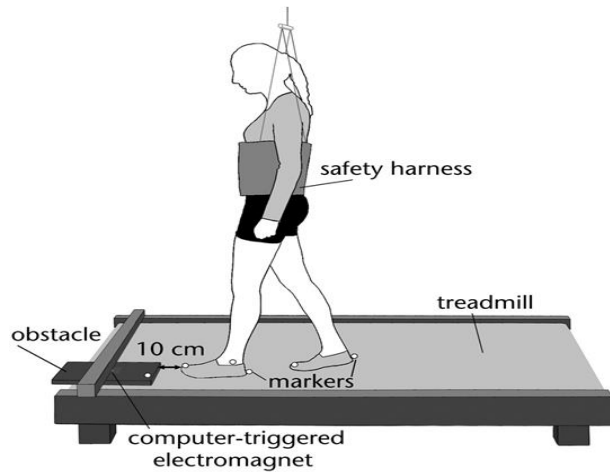


10 x 1 hour, 5 weeks



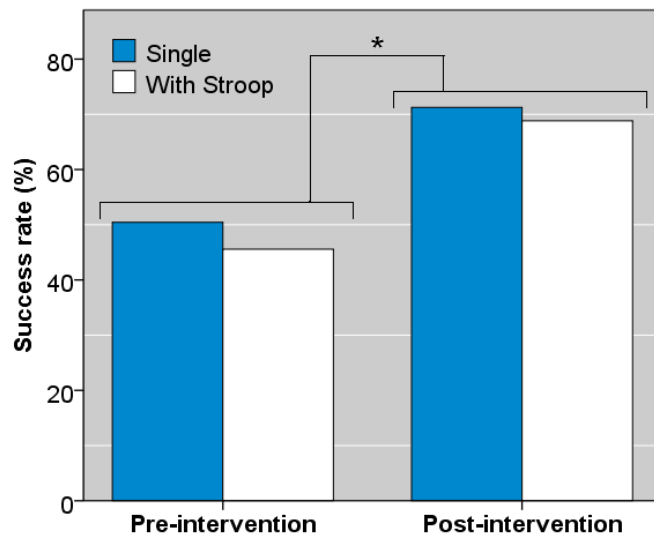
Clinimetrics	T1 (n=15)	T2 (n=15)	Pre-post design (n=16)
10MWT (seconds)	9.54 ± 1.72	8.45 ± 1.36	p=0.008
EFAP (seconds)	15.00 ± 3.19	13.10 ± 2.63*	p=0.016
TUG (seconds)	11.48 ± 1.6	9.8 ± 2.0**	p=0.006
TIS Total (points)	11.43 ± 3.1	11.93 ± 1.9	p=0.45
BBS (points)	53.6 ± 2.77	55.0 ± 1.41*	p=0.017
6 item ABC (%)	56.51 ± 24.39	63.08 ± 16.95	p=0.29
Pedometer (steps per day) ‡	5738 ± 1395	6864 ± 1645*	p=0.047

C-mill gait adaptability training

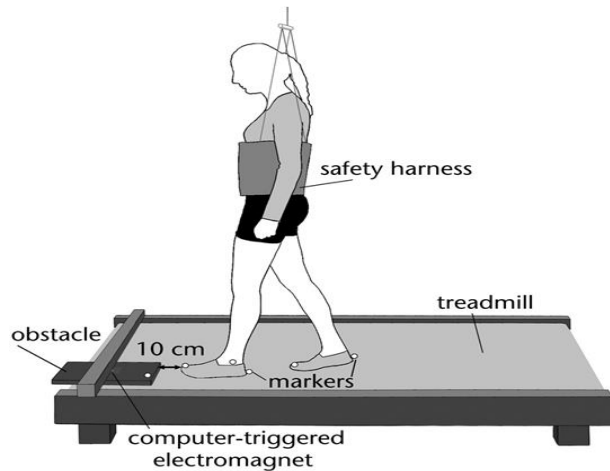


Obstacle avoidance performance

- Single task
- Dual task (concurrent auditory Stroop task)

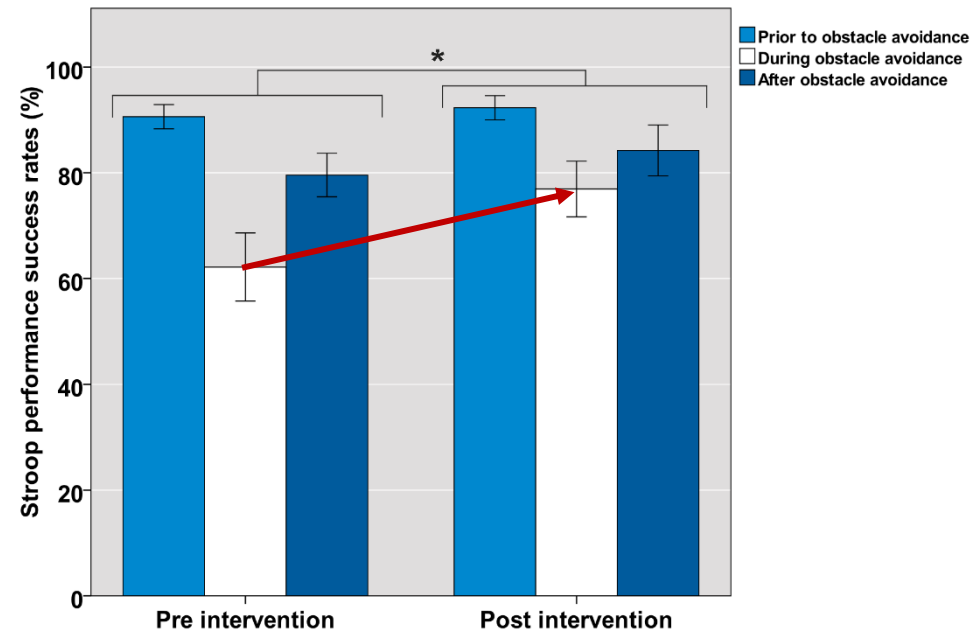
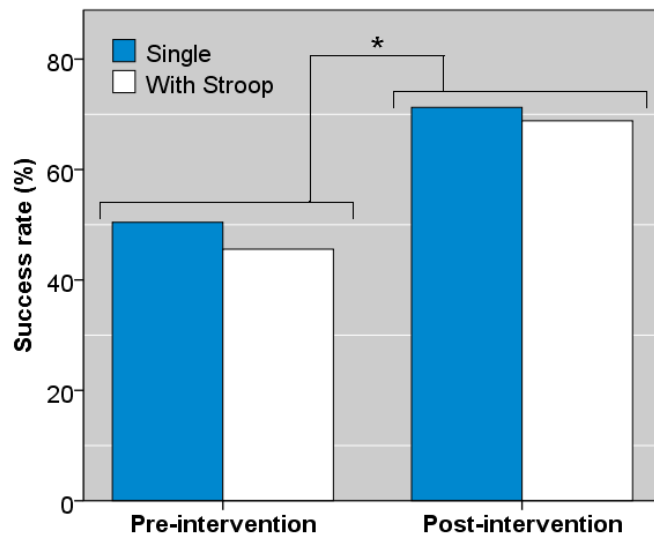


Obstacle avoidance training



Obstacle avoidance performance

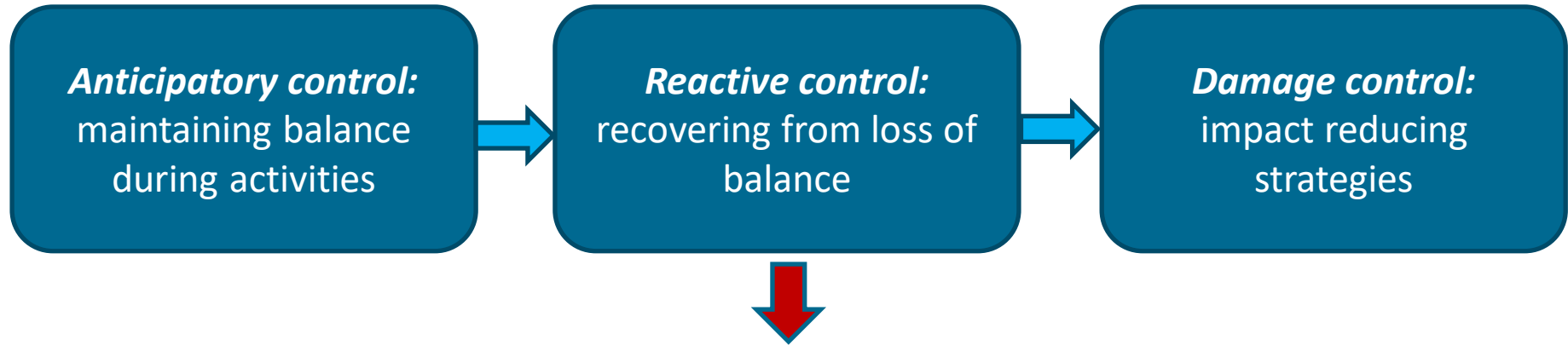
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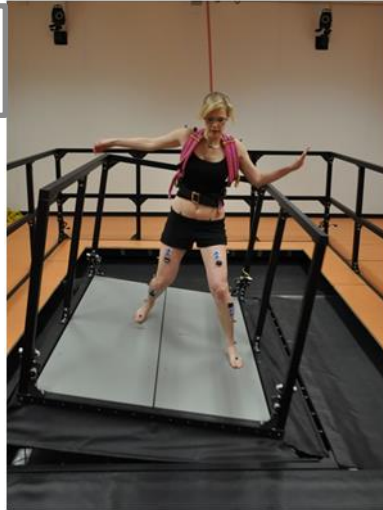


Perturbation-based training:

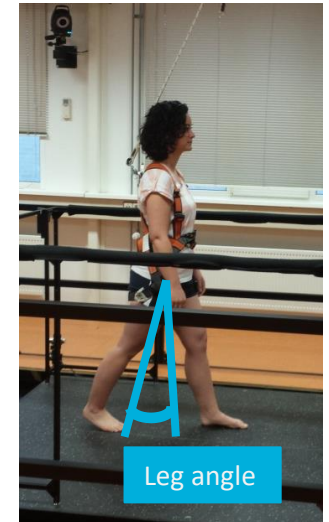
- Meta analysis of studies in (mainly) elderly people: **46% reduction** in fall rates
- Prospective cohort study after discharge from stroke rehab: **64% reduction** in fall rates
- RCT in chronic phase after stroke: reduction in fall rates **non significant**

Perturbation-based balance training

10 x 45 min, 5 weeks



Lean-and-release perturbations



Leg angle

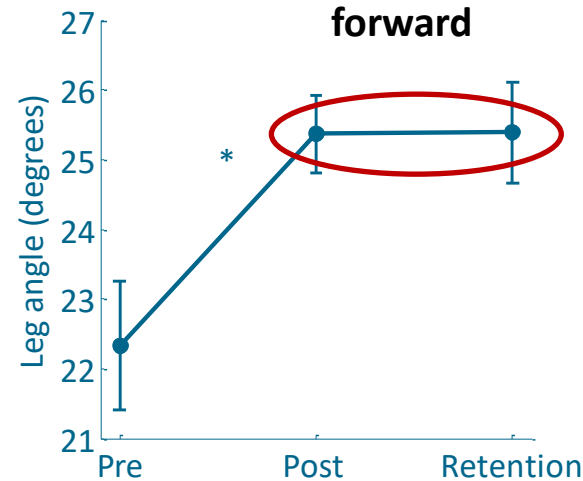
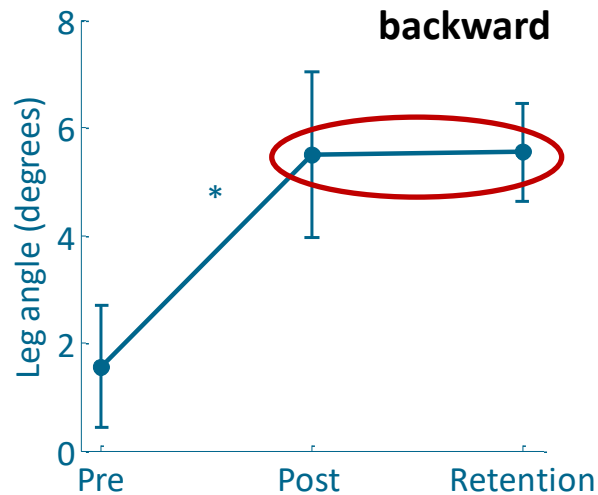
Strong
indicator of
step quality

Perturbation-based balance training

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Lean-and-release perturbations



Strong indicator of step quality

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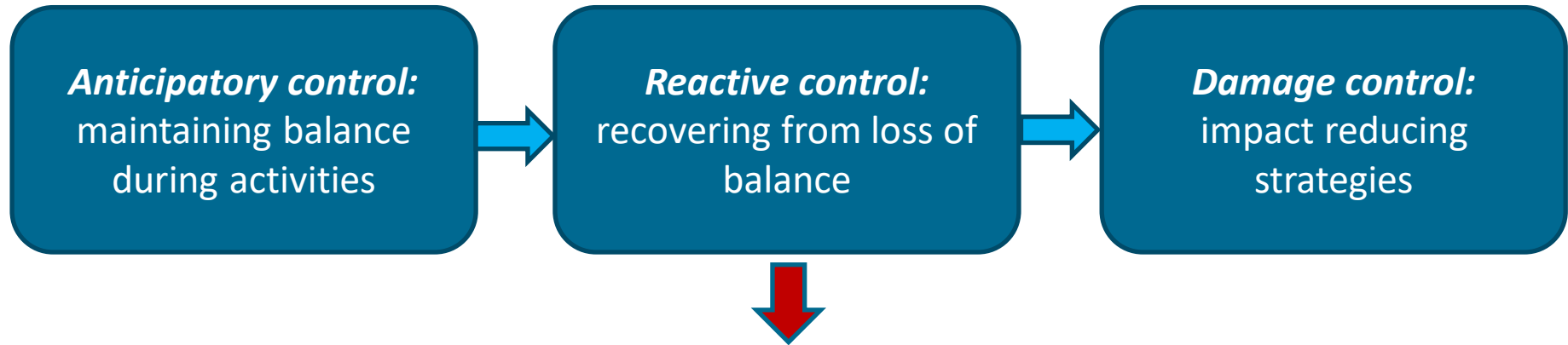


Reactive control:
recovering from loss of
balance



Damage control:
impact reducing
strategies

What type of exercise works?



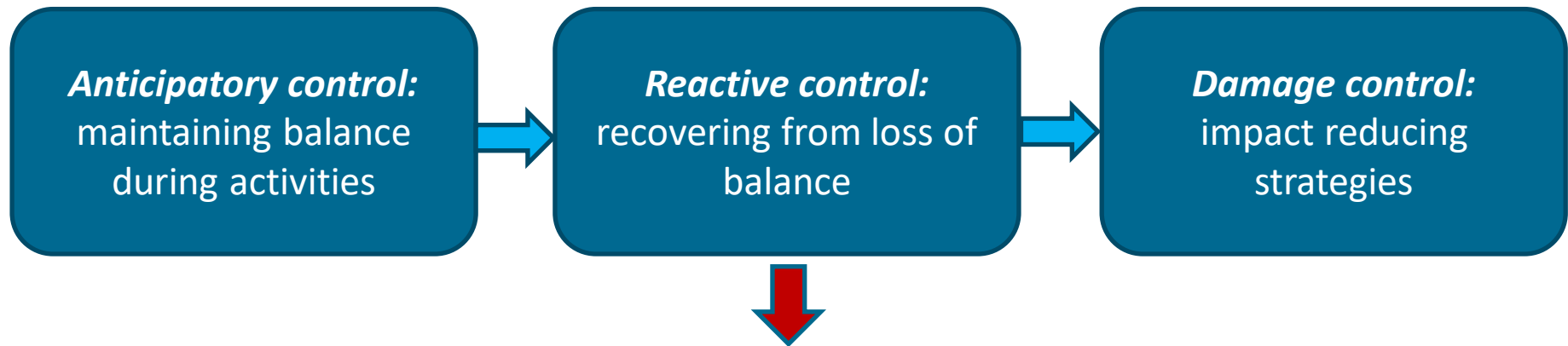
HEROES: Home-based ExeRgame fOr Enhancing resistance to falls after Stroke

- Exergaming at home (avatar & biofeedback → stepping responses based on action observation and imagery)
- One real RCT balance perturbation training (1 hour on GRAIL)
- RCT (n=60) (2022 – 2023)
- Two months daily exercises
- Control: Wii training
- Primary: quality of stepping response



Falls?

What type of exercise works?



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Academic participants: Radboudumc, VUMC, UT
Clinical participants: Revant, Klimmendaal, Maartenskliniek,
MRC, Beatrixoord
Industrial partner: Motek Medical

Falls?



Dutch
CardioVascular
Alliance



Hartstichting



ZonMw



Radboudumc

Summary

Dynamic balance deficits are important determinants of falls after stroke

First evidence for efficacy of **exercise training** for falls prevention: balance training & gait training (Cochrane review 2019)

- Combination of **feedforward and reactive** balance training
- Great emphasis on **gait adaptability** training



Summary

Dynamic balance deficits are important determinants of falls after stroke

First evidence for efficacy of **exercise training** for falls prevention: balance training & gait training (Cochrane review 2019)

- Combination of **feedforward and reactive** balance training
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Questions for future studies:

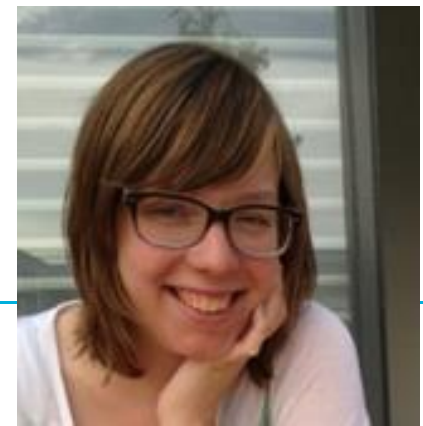
- Timing?
- Dosing?
- Tailoring?
- Working mechanisms?



Our team



Funding sources



Poll 1

Wat is de belangrijkste oorzaak van valincidenten na CVA?

1. (Externe) omgevingsomstandigheden
2. (Intrinsieke) balansproblemen
3. Sleepvoet / struikelen
4. Spasticiteit

Poll 2

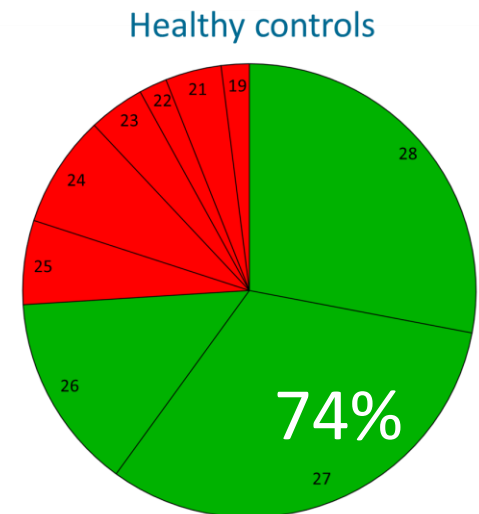
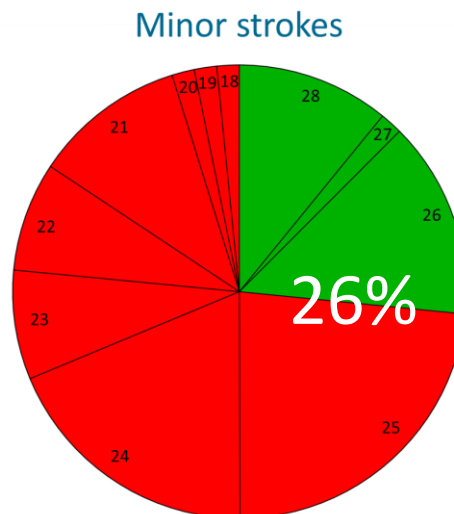
De volgende populaties tonen een verhoogde valincidentie t.o.v. gezonde controles:

1. 'Major' stroke (evidente tekenen van motorisch hemibeeld)
2. 'Minor' stroke (hooguit subtiele tekenen van motorisch hemibeeld)
3. Beide groepen

People with minor stroke

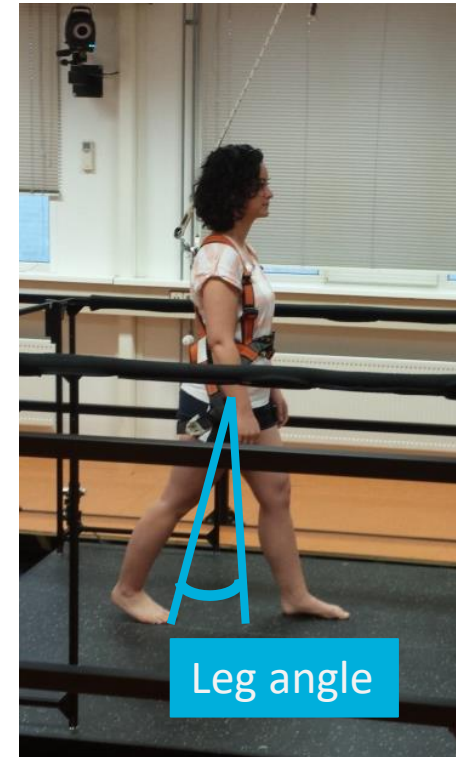
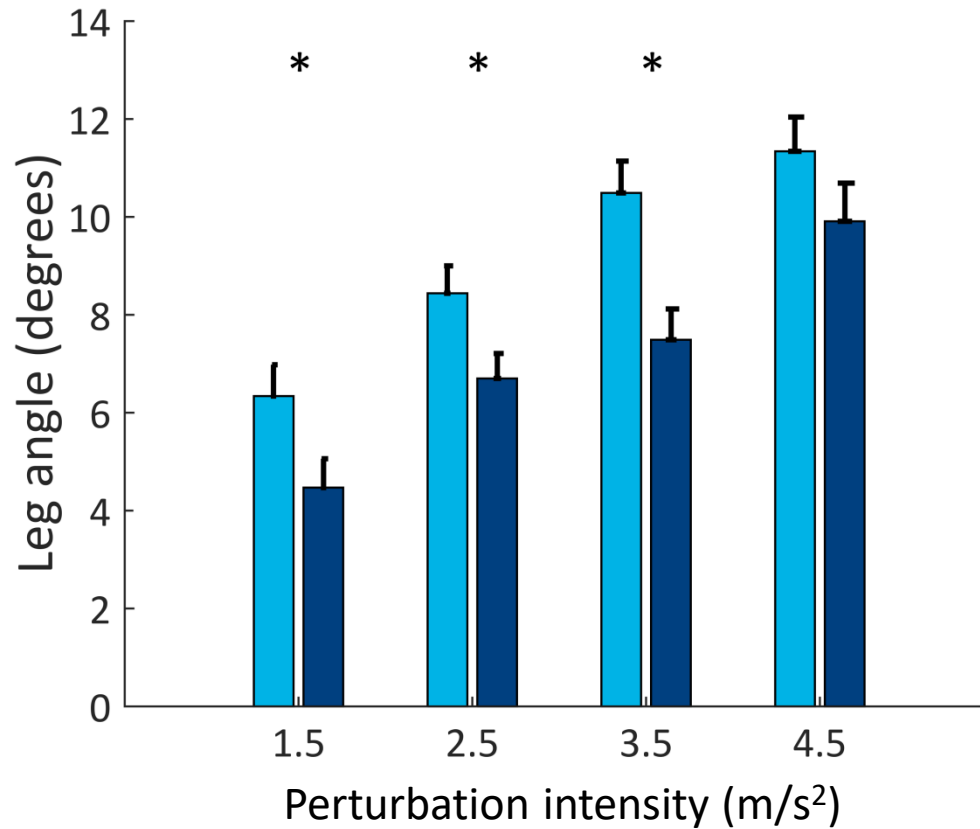
Participant characteristics	Minor strokes (n=64)	Controls (n=50)
Age (years); mean (range)	63.8 (40-85)	63.6 (42-82)
Montreal Cognitive Assessment; median (range)	27 (24-30)	29 (24-30)
Fugl-Meyer Assessment – LE; median (range)	28 (24-28)	

MiniBEST:
Few people with minor
stroke with (near-)
maximum scores (≥ 26 pt)



People with minor stroke

Control
Minor stroke



People with minor stroke

Minor strokes (n=62)



1.1 falls per person-year

vs.

Controls (n=47)



0.52 falls per person-year