

Exercise in Parkinson's: Why bother?



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<https://research.ncl.ac.uk/bam>



BAM_Research

- What is exercise
- Why do it
- Convince me!
- What should I do
- When should I start



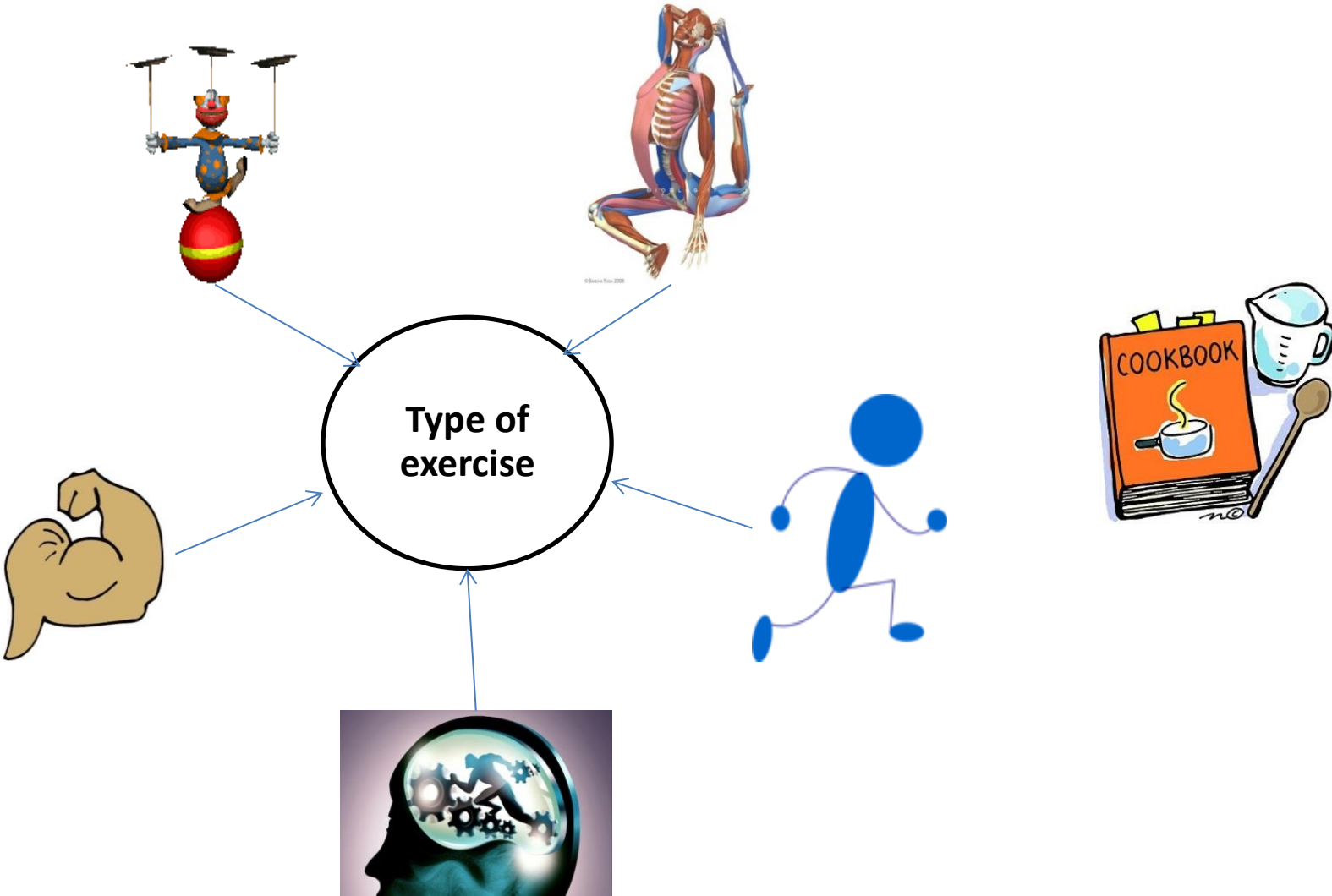
Definition of Exercise

a physical activity that is

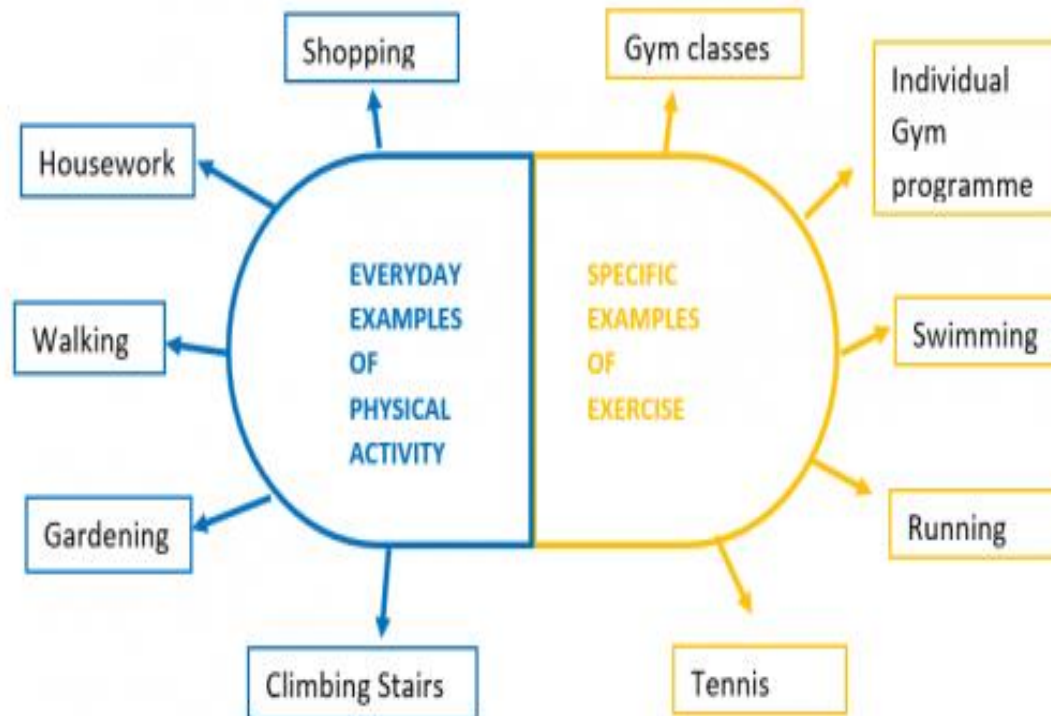
- planned, structured and repetitive
- goal of increasing or maintaining physical fitness
- purpose of conditioning any part of the body



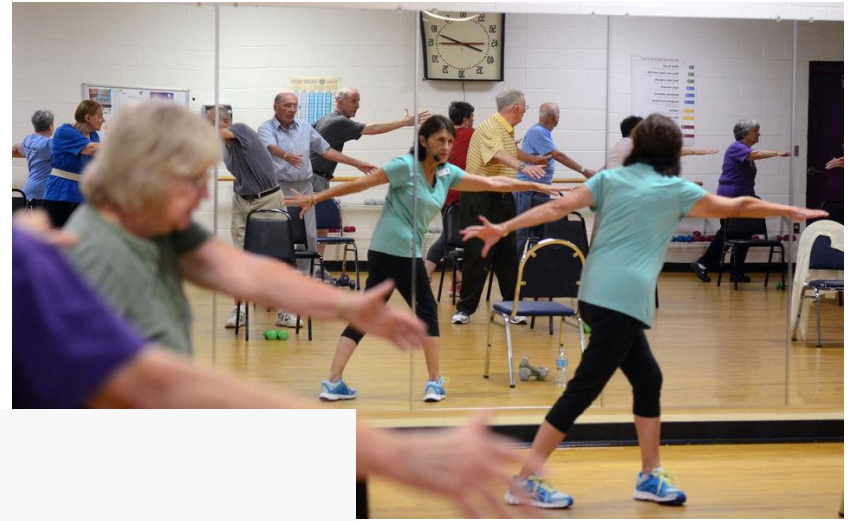
Types of exercise

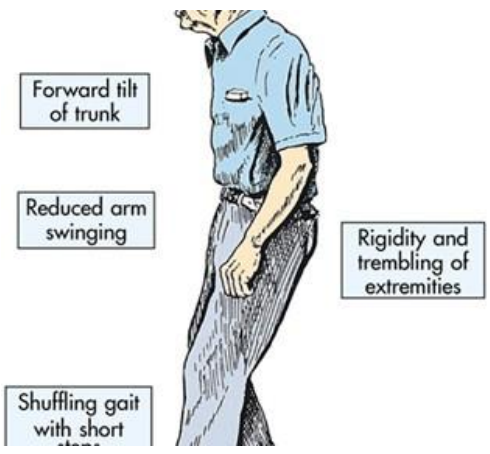


A broad approach



Why exercise?





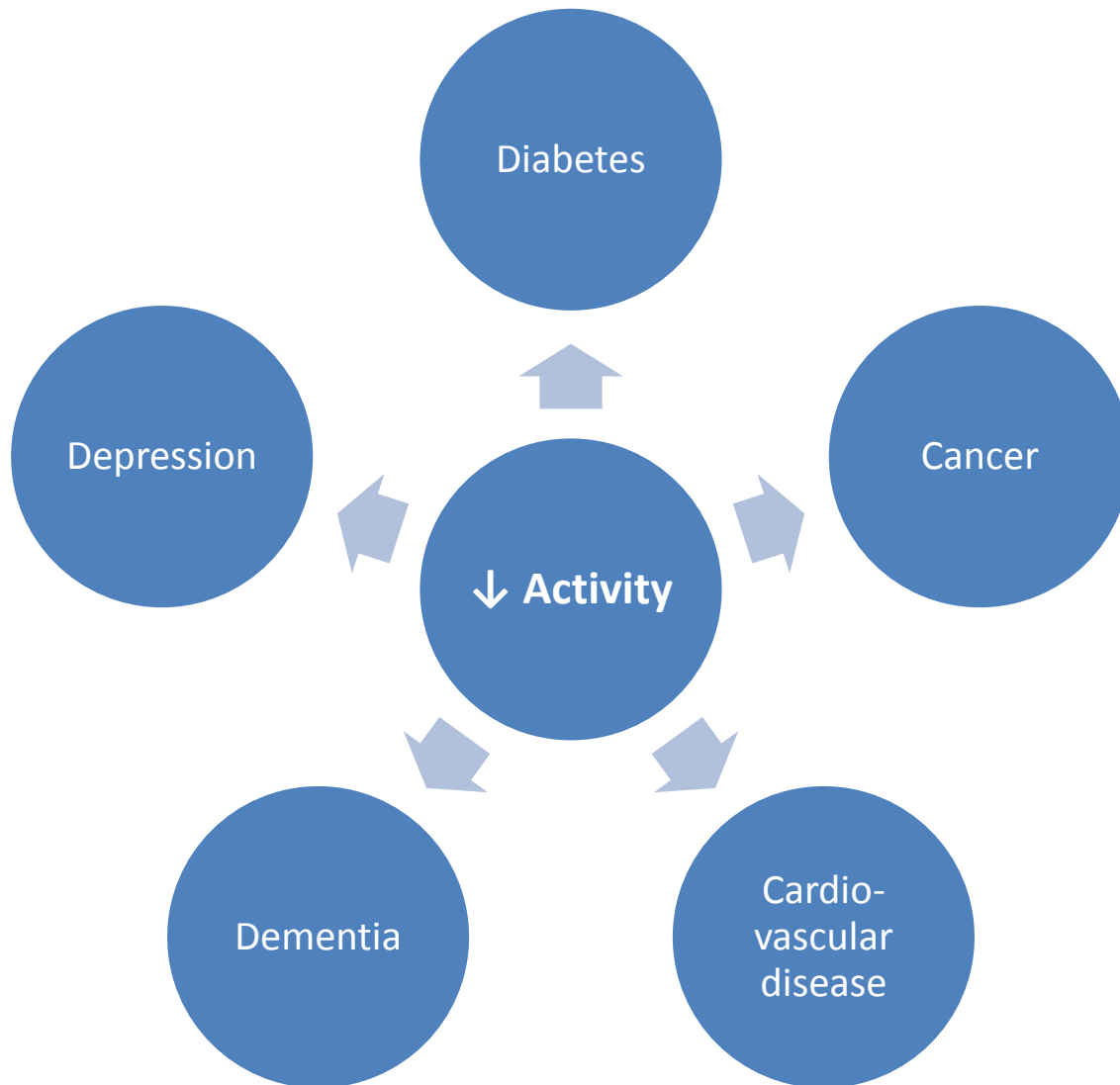
Protect and preserve function

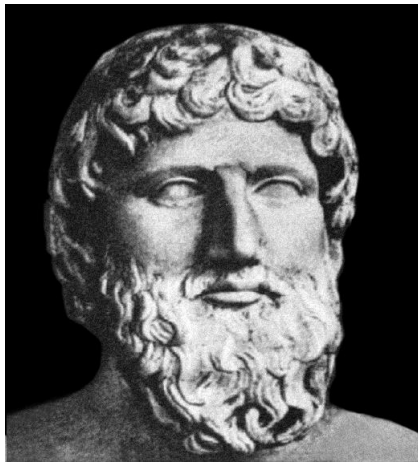
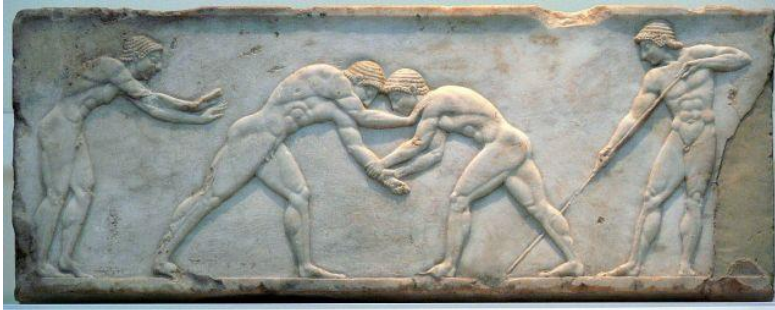
Modify progression of Parkinson's symptoms

Repair-restore brain function?



Activity in context of ageing





*Lack of activity
destroys the good
condition of every
human being, while
movement and
methodical physical
exercise save it and
preserve it*

Convince me!

Whats the evidence?

Gait

- Exercise (strength, endurance) + compensatory strategies^{1, 2, 3, 4}
- Gait speed, endurance, FOG
- Clinical benefits¹
- Effective on and off medication ⁵
- Cost effective?



Balance



- Balance & strength key components

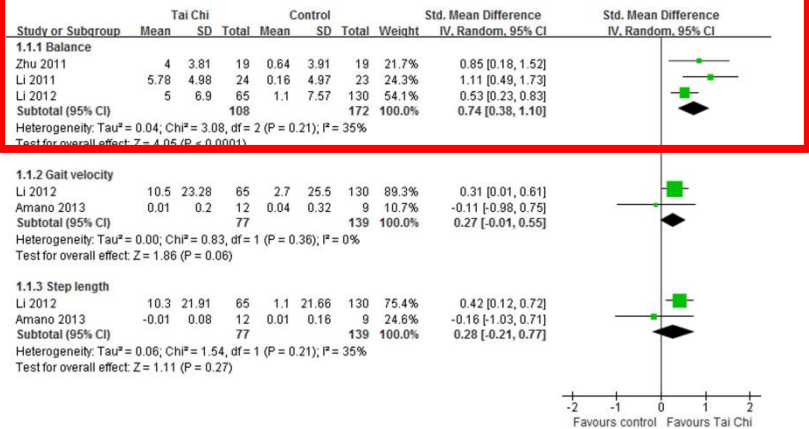
OPEN ACCESS Freely available online

PLOS ONE

Tai Chi for Improvement of Motor Function, Balance and Gait in Parkinson's Disease: A Systematic Review and Meta-Analysis

Yan Yang*, Xiang-Yuan Li, Li Gong, Yun-Liang Zhu, Yan-Lei Hao

Department of Neurology, Affiliated Hospital of Jining Medical University, Jining, Shandong, China



Tomlinson et al., 2012; Allen et al., 2011; Li et al., 2012

Yang et al., 2015

Falls

Study	N	Intervention	Dose	Duration (weeks)	Supervision	Sig
Goodwin (2011)	130	<ul style="list-style-type: none"> Balance & strength Control 	1x week group 2x home	10	33%	✗
Li (2012)	195	<ul style="list-style-type: none"> Tai Chi Strength Stretching 	2x week group	24	100%	✓
Morris (2015)	210	<ul style="list-style-type: none"> Strength Movement Strategies Control 	1x week group 1x home	8	50%	✓ ✓
Canning (2015)	231	<ul style="list-style-type: none"> Balance, strength, cueing Control 	1x month group 3x week home	26	13%	✗

- Strength & balance & movement strategy
- Combination best?

BUT!

- Low disease ✓
- High disease ✗
- Cost effective & cost saving (Farag et al., 2014)

Falls: One size does not fit all

Recommendations
for intervention
depend on severity

Goodwin et al. *BMC Neurology* (2015) 15:81
DOI 10.1186/s12883-015-0332-2



STUDY PROTOCOL

Open Access

A multi-centre, randomised controlled trial of the effectiveness of PDSAFE to prevent falls among people with Parkinson's: study protocol

Victoria A Goodwin¹, Ruth Pickering², Claire Ballinger², Helen Roberts², Emma McIntosh³, Sarah Lamb⁴, Alice Nieuwboer⁵, Lynn Rochester⁶, Ann Ashburn^{2*} and on behalf of the PDSAFE Protocol Development Group

Physical capacity



- Maintain & prevent deconditioning
- Improves fitness (VO_2 max; endurance)^{1,2,3}
- Low intensity as effective ^{1,2}

Motor symptoms

UPDRS-III



Journal of Parkinson's Disease 5 (2015) 21-41
 DOI: 10.3233/JPD-140425
 IOS Press

Review

Effects of Endurance Exercise Training on The Motor and Non-Motor Features of Parkinson's Disease: A Review

Guillaume Lamotte^{a,*}, Miriam R. Rafferty^{b,c}, Janey Prodoehl^d, Wendy M. Kohrt^e, Cynthia L. Comella^f, Tanya Simuni^g and Daniel M. Corcos^{c,f}

Study or Subgroup	UPDRS-III pre-exercise			UPDRS-III post-exercise			Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total			
Fisher 2008	27.6	10.3	10	24.8	9	10	5.8%	2.80 [-5.68, 11.28]	
Ridgell FE 2009	48.4	12.66	5	31.8	6.76	5	2.7%	16.60 [4.02, 29.18]	
Ridgell VE 2009	49	15.44	5	52.6	8.38	5	1.8%	-3.60 [-19.00, 11.80]	
Sage 2009	22.2	8.1	13	20.4	6.1	12	13.4%	1.80 [-3.79, 7.39]	
Schenkman 2012	24.4	9.1	41	21.9	1.8	31	51.5%	2.50 [-0.36, 5.36]	
Shulman HT 2013	30.3	9.59	23	30	10.55	23	12.4%	0.30 [-5.53, 5.13]	
Shulman LIT 2013	31.6	9.38	22	33.7	10.31	22	12.4%	-2.10 [-7.92, 3.72]	
Total (95% CI)			119			108	100.0%	1.85 [-0.20, 3.90]	
Heterogeneity: Chi ² = 8.05, df = 6 (P = 0.23); I ² = 25%									
Test for overall effect: Z = 1.77 (P = 0.08)									
Study or Subgroup	Change in UPDRS-III ex			Change in UPDRS-III C			Weight	Mean Difference IV, Fixed, 95% CI	Mean Difference IV, Fixed, 95% CI
	Mean	SD	Total	Mean	SD	Total			
Fisher 2008	-2.8	7.06	10	-2.7	5.97	10	11.6%	-0.10 [-5.83, 5.63]	
Sage 2009	-1.8	5.45	12	1.2	5.68	15	21.4%	-3.00 [-7.22, 1.22]	
Schenkman 2012	-2.5	7.86	31	-1.7	7.66	31	25.5%	-0.80 [-4.66, 3.06]	
Shulman HT 2013	2.09	9.85	22	-3.45	6.09	22	16.3%	5.54 [0.70, 10.38]	
Shulman LIT 2013	-0.26	7.19	23	-3.45	6.09	22	25.2%	3.19 [-0.70, 7.08]	
Total (95% CI)			98			100	100.0%	0.85 [-1.11, 2.80]	
Heterogeneity: Chi ² = 9.01, df = 4 (P = 0.06); I ² = 56%									
Test for overall effect: Z = 0.85 (P = 0.40)									

Control →


- type of intervention?
- combination optimal

Lamotte et al., 2015; Uhrbrand et al., 2015

Cognition and mood?



Murray et al. *Translational Neurodegeneration* 2014, 3:5
<http://www.translationalneurodegeneration.com/content/3/1/5>

 **Translational
Neurodegeneration**

REVIEW **Open Access**

The effects of exercise on cognition in Parkinson's disease: a systematic review

Danielle K Murray^{1*}, Matthew A Sacheli¹, Janice J Eng² and A Jon Stoessi¹

REVIEW

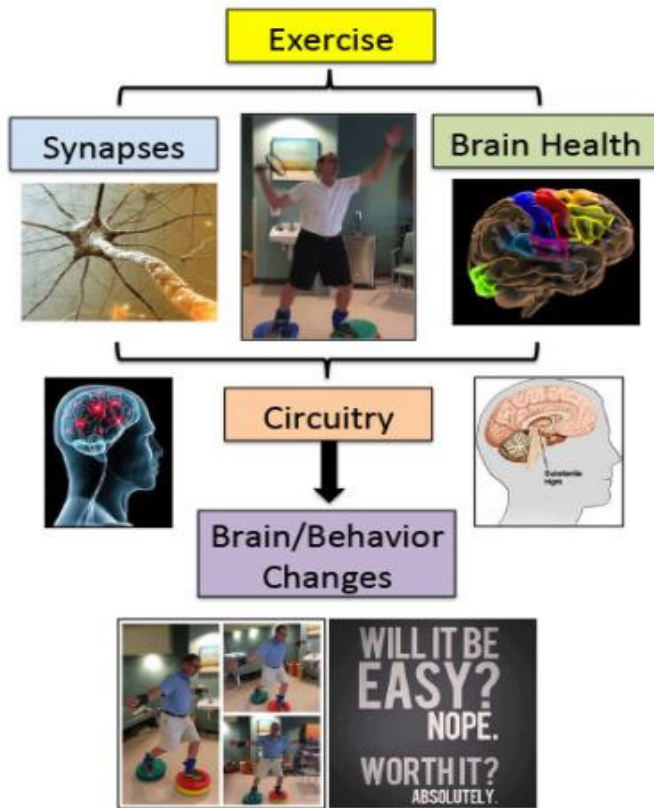
Nonpharmacological Enhancement of Cognitive Function in Parkinson's Disease: A Systematic Review

John V. Hindle, MBBS, FRCP, FRCPsych,^{1,2} Annette Petrelli, MSc,^{3,4} Linda Clare, MA, MSc, PhD,⁵ and Elke Kalbe, PhD^{3,4}

¹School of Medical Sciences, Bangor University, Bangor, United Kingdom
²Department of Care of the Elderly, Betsi Cadwaladr University Health Board, Llandudno Hospital, Conwy, United Kingdom
³Institute of Gerontology and Center for Neuropsychological Diagnostics and Intervention, University of Vechta, Vechta, Germany
⁴Department of Neurology, University Hospital Cologne, Cologne, Germany
⁵School of Psychology, Bangor University, Bangor, United Kingdom

- Limited evidence
- Executive function & attention
- Type of intervention?

Exercise and Neuroplasticity in Parkinson's



Drawing idea partly based on FIG 3 from Petzinger et al. (2013)

Treadmill exercise elevates striatal dopamine D2 receptor binding potential in patients with early Parkinson's disease

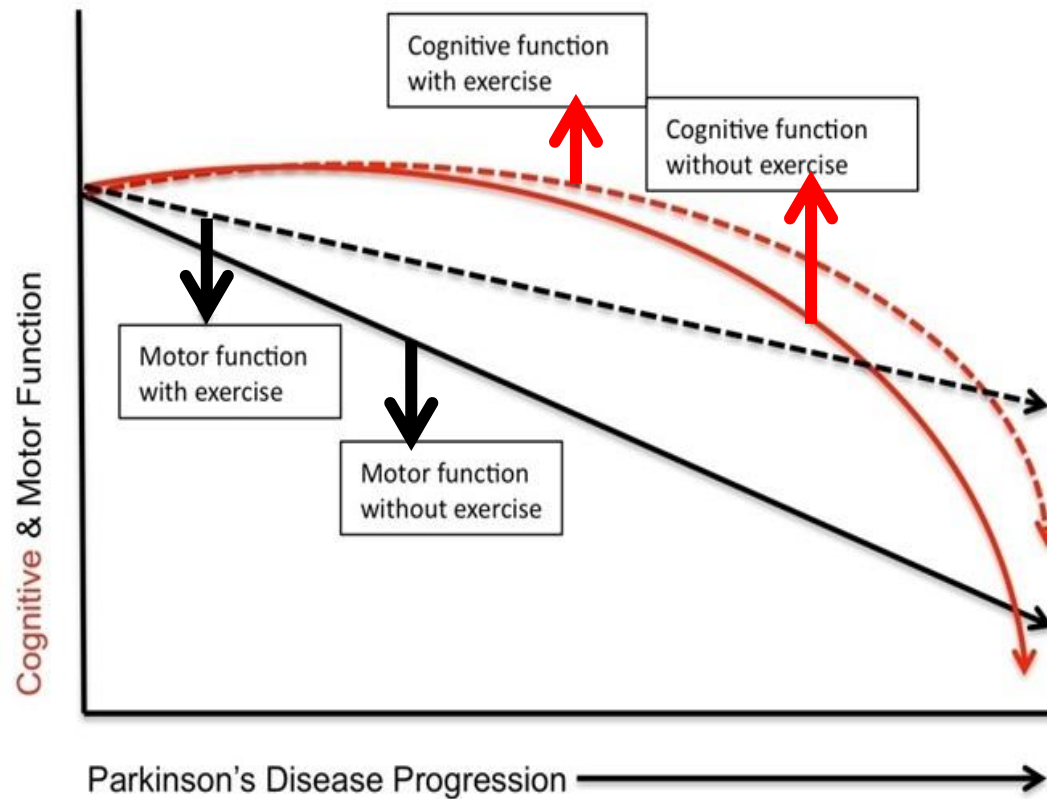
Beth E. Fisher^{a,d}, Quanzheng Li^b, Angelo Nacca^c, George J. Salem^{a,d}, Jooeun Song^a, Jeanine Yip^a, Jennifer S. Hui^d, Michael W. Jakowec^{a,d} and Giselle M. Petzinger^{a,d}

We have previously demonstrated changes in dopaminergic neurotransmission after intensive exercise in the 1-methyl-4-phenyl-1,2,3,6-tetrahydropyridine-lesioned mouse model of Parkinson's disease (PD), including an increase in the dopamine D₂ receptor (DA-D₂R), using noninvasive PET imaging with the radioligand [¹⁸F]fallypride. The purpose of this feasibility and translational study was to examine whether intensive exercise leads to similar alterations in DA-D₂R expression using PET imaging with [¹⁸F]fallypride in individuals with early-stage PD. In this pilot study, four patients with

exercise-induced increase in [¹⁸F]fallypride BP as well as improved postural control in patients with PD who exercised. Changes in DA-D₂R BP were not observed in patients with PD who did not exercise. These results suggest that exercise can lead to neuroplasticity in dopaminergic signaling and contribute to improved function that may be task specific (postural control) in early-stage PD. *NeuroReport* 24:509-514 © 2013 Wolters Kluwer Health | Lippincott Williams & Wilkins. *NeuroReport* 2013, 24:509-514

- Emerging evidence
- Paves the way for future neuro-protection trials?

One intervention: Twice the benefit





Games to do you good

Neuroscientists should help to develop compelling video games that boost brain function and improve well-being, say Daphne Bavelier and Richard J. Davidson.

Nature. 2013



Complex cognitive-motor training

Mielman et al. *BMC Neurology* 2013, 13:15
<http://www.biomedcentral.com/1471-2277/13/15>

BMC Neurology

STUDY PROTOCOL **Open Access**

V-TIME: a treadmill training program augmented by virtual reality to decrease fall risk in older adults: study design of a randomized controlled trial

Anat Mielman^{1,2*}, Lynn Rochester³, Miriam Reelick⁴, Freek Nieuwhof⁴, Elisa Pelosin⁵, Giovanni Abbruzzese⁶, Kim Doko⁴, Alice Nieuwboer⁴ and Jeffrey M Hausdorff^{1,2*}



Galna et al. *Journal of NeuroEngineering and Rehabilitation* 2014, 11:60
<http://www.jneuroengrehab.com/content/11/1/60>

JNER JOURNAL OF NEUROENGINEERING AND REHABILITATION

METHODOLOGY **Open Access**

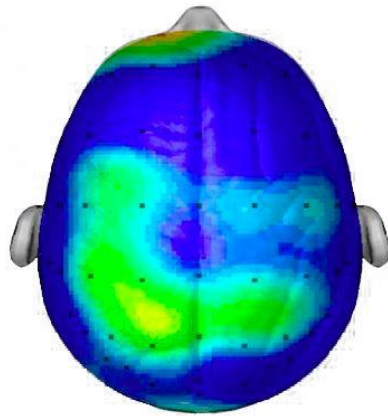
Retraining function in people with Parkinson's disease using the Microsoft Kinect: game design and pilot testing

Brook Galna¹, Dan Jackson², Guy Schofield², Roisin McNaney², Mary Webster², Gillian Barry¹, Dadirayi Mhiripiri¹, Madeline Balaam², Patrick Olivier² and Lynn Rochester^{1*}

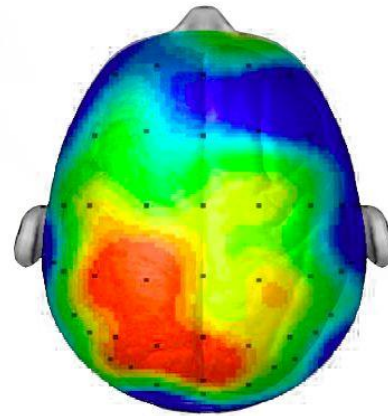


If that doesn't convince you!

Composite of 20 student brains taking the same test



After sitting quietly



After 20 minute walk

Research/Scan compliments of Dr. Chuck Hillman University of Illinois

What should I do?

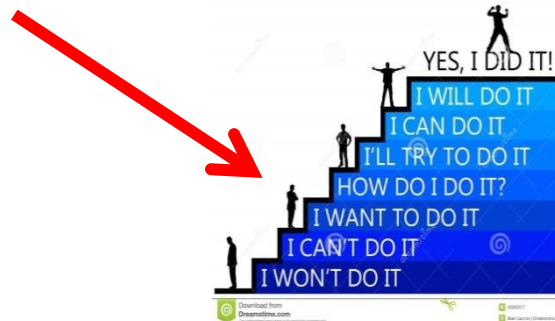
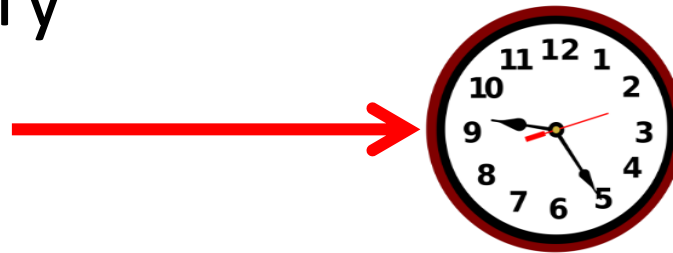




Barriers to exercise



- Fear of injury
- Time
- Confidence



How to get started?

- Local groups
- Buddy
- Physio
- Personal trainer
- Diary
- Start small and build up

Adherence and implementation


BMJ

BMJ 2013;346:f576 doi: 10.1136/bmj.f576 (Published 1 March 2013)

Page 1 of 11

RESEARCH

Promotion of physical activity and fitness in sedentary patients with Parkinson's disease: randomised controlled trial

 OPEN ACCESS

Marlies van Nimwegen *physiotherapist and research scientist*¹, Arlene D Speelman *physiotherapist and research scientist*¹, Sebastiaan Overeem *research scientist*², Bart P van de Warrenburg *medical doctor*², Katrijn Smulders *research scientist*^{2,3}, Manon I Dontie *research scientist*^{4,5}, Geertr F Rom

- 12% increase activity using accelerometer

Target self-efficacy
Behavioural change

What should I do?

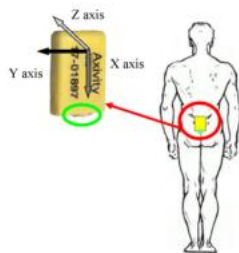
Domain	Traditional Examples	Other examples
Strength	Weight training Resistance exercise	Gardening Computer games
Endurance	Treadmill Bike Walking at pace Swimming	Dancing Computer games
Balance & co-ordination	Home exercises	Tai Chi Gardening Dancing Computer games
Flexibility	Stretching Home exercises	Yoga Pilates Computer games



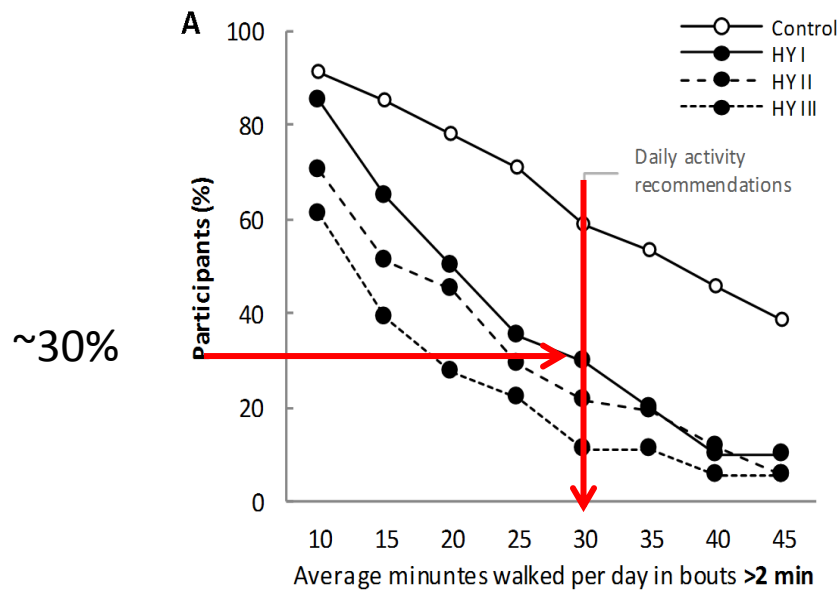
When should I start?

Ambulatory activity in incident Parkinson's: more than meets the eye?

Sue Lord · Alan Godfrey · Brook Galna ·
Dadirayi Mhiripiri · David Burn · Lynn Rochester



Inactivity and PD



The relationship between real world ambulatory activity and falls in incident Parkinson's disease: Influence of classification scheme

Karen Mactier, Sue Lord, Alan Godfrey, David Burn, Lynn Rochester*
 Institute of Neuroscience, Newcastle University, NE4 5PL, UK

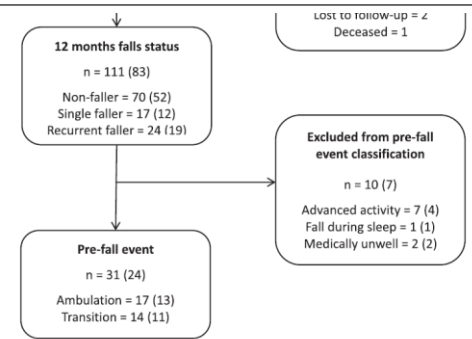
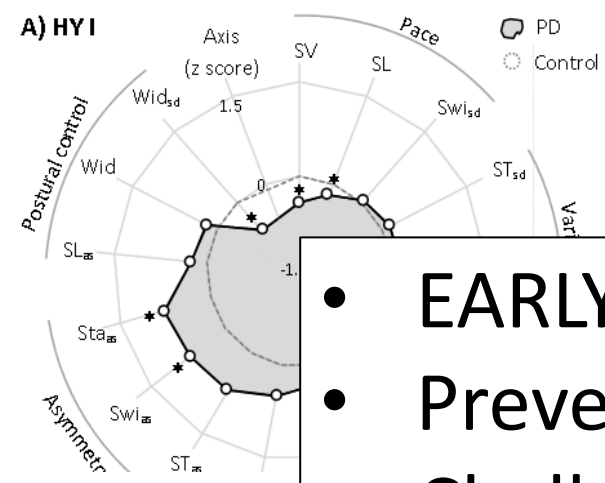
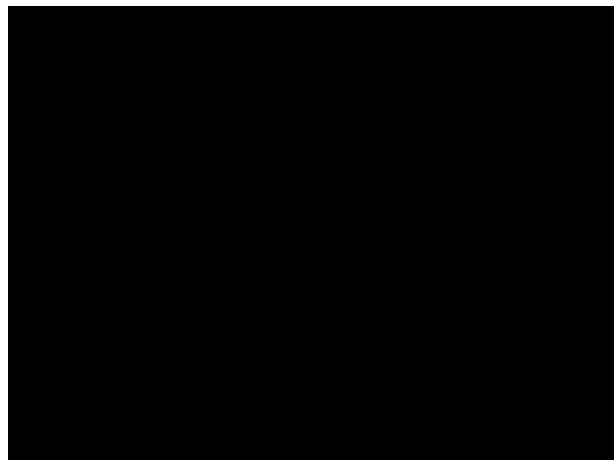


Fig. 1. Participant flow and classification. Falls status over 12 months for total cohort and for participants with ambulatory data (denoted by brackets). Falls classified according to fall frequency and pre-fall event.



- EARLY referral
- Prevention
- Challenging balance exercise

Subtle gait
appear early

or early



- Continuum
- Prevention
- Maintenance



- What is exercise → Anything to get you moving
- Why do it → Multiple benefits
- Convince me! → Research supports it
- What should I do → Something you like
- When should I start → Now

Acknowledgements



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- Heather Hunter
- Philip Brown
- Annette Pantall

Collaborators:

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Alison Yarnall
Gillian Barry


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FOX** | **FOUNDATION FOR
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UK NIHR Biomedical Research Unit for Lewy Body
Dementia award to the Newcastle upon Tyne
Hospitals NHS Foundation Trust

Newcastle

Biomedical Research Centre & Unit