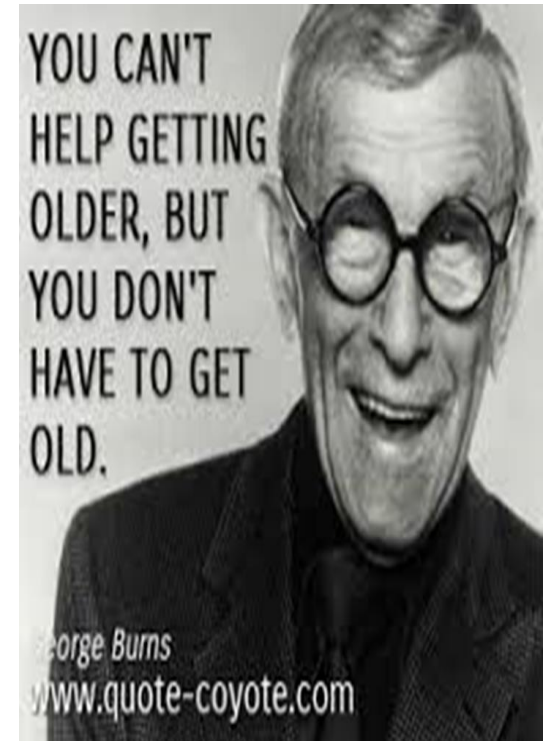
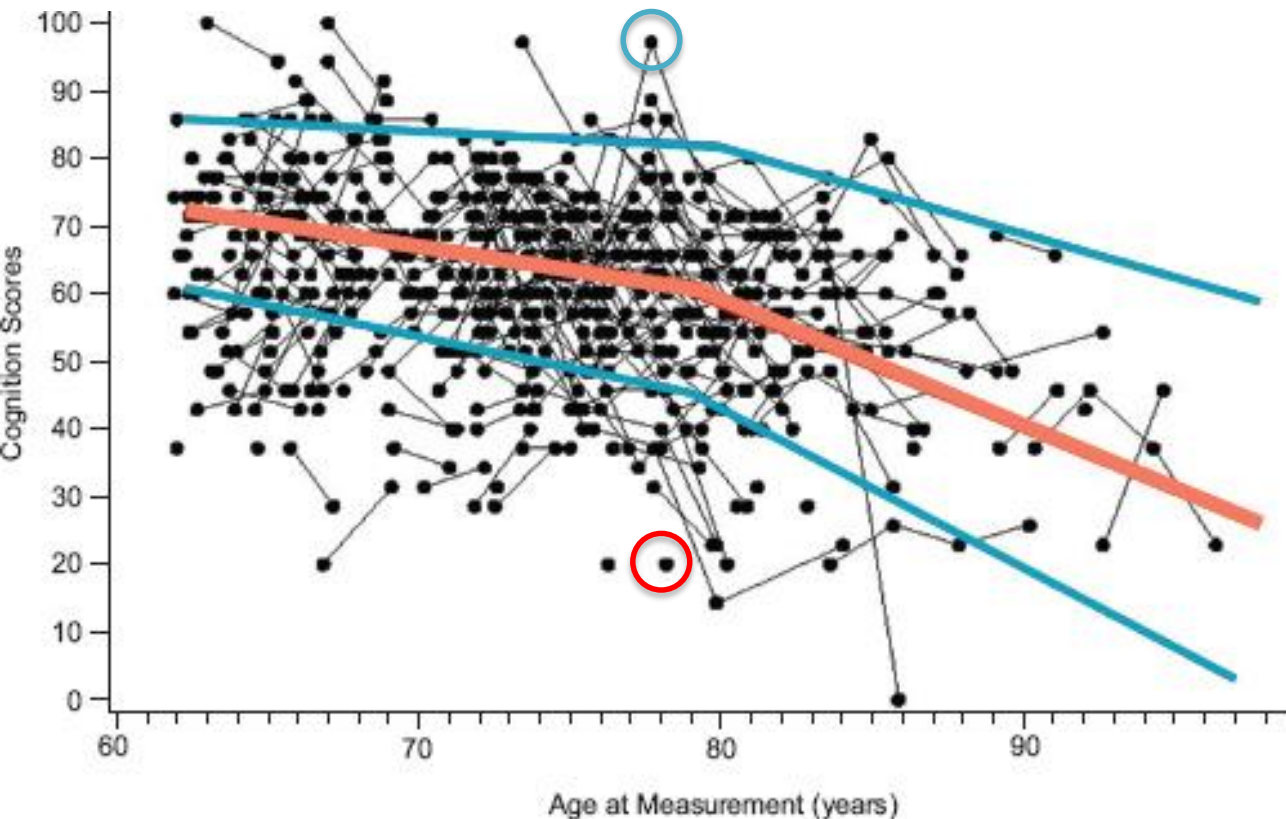


Physical Exercise & Cognitive Health

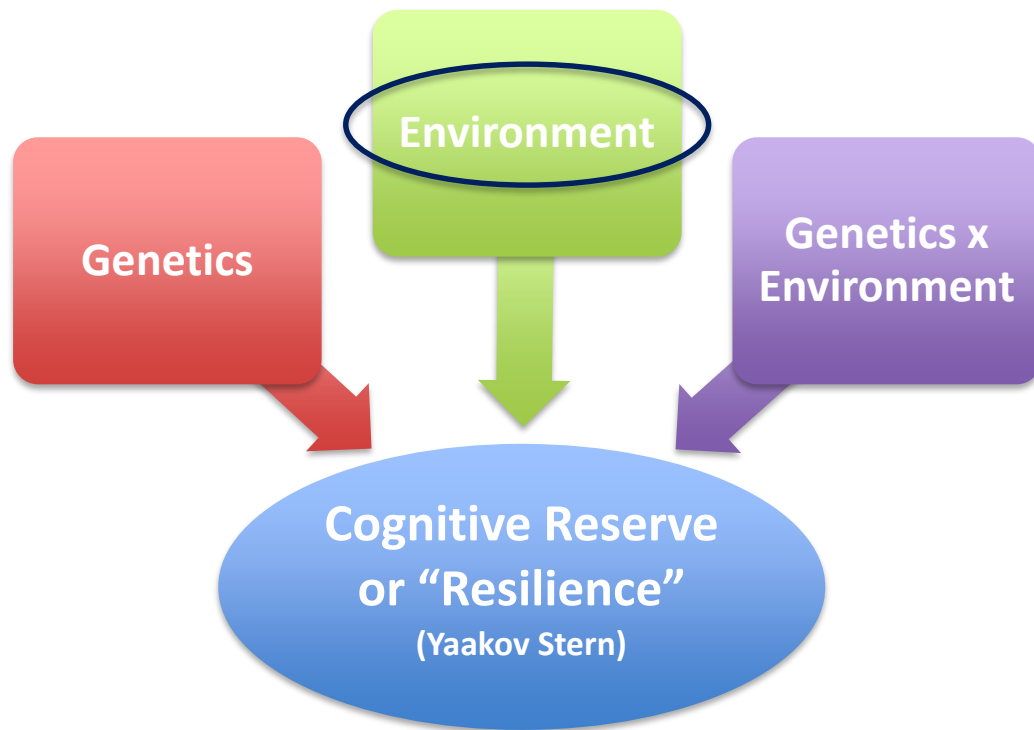
Teresa Liu-Ambrose, PhD, PT, Professor
Canada Research Chair
University of British Columbia
Department of Physical Therapy
Djavad Mowafaghian Centre for Brain Health
Centre for Hip Health and Mobility
teresa.ambrose@ubc.ca

Cognitive Aging: Much Variability Observed



McArdle, *Advances in Statistical Analysis*, 2011

What Contributes to Variability?



- Environment
 - Education/Intellectual Engagement
 - Social Network
 - Physical Activity
 - Nutrition
 - Sleep

Global Council on Brain Health Releases Consensus Report on Exercise and Brain Health

Research shows exercise causes positive changes in brain structure and function and lowers risk of cognitive decline.



NEWS PROVIDED BY

AARP →

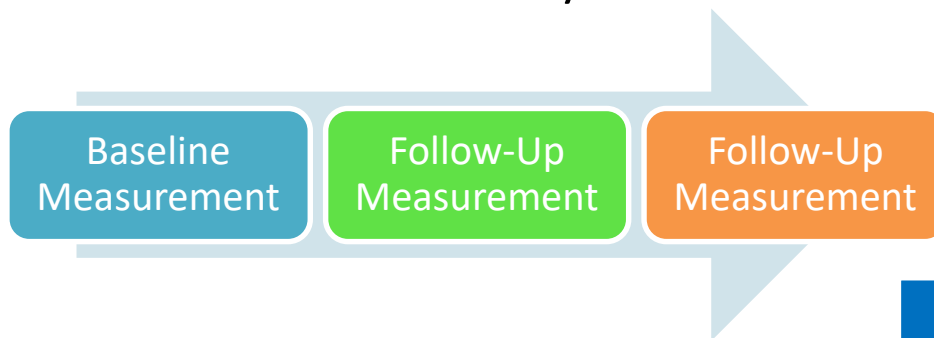
Jul 21, 2016, 08:00 ET

GCBH experts agree that brain health is positively affected by physical activity. Purposeful exercise is proven to benefit brain structure and functioning, while an active lifestyle is proven to lower risk of cognitive decline.

Physical Activity for Brain Health

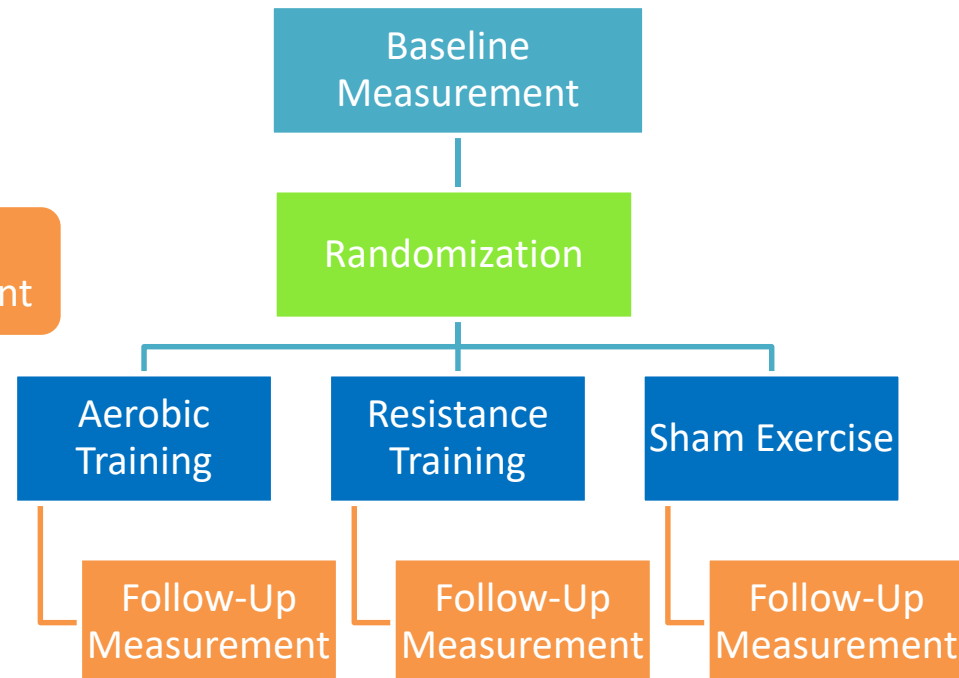
- “Cohort”

- No prescribed treatment/intervention
- **Physical activity level**
 - Questionnaires
 - Accelerometry data

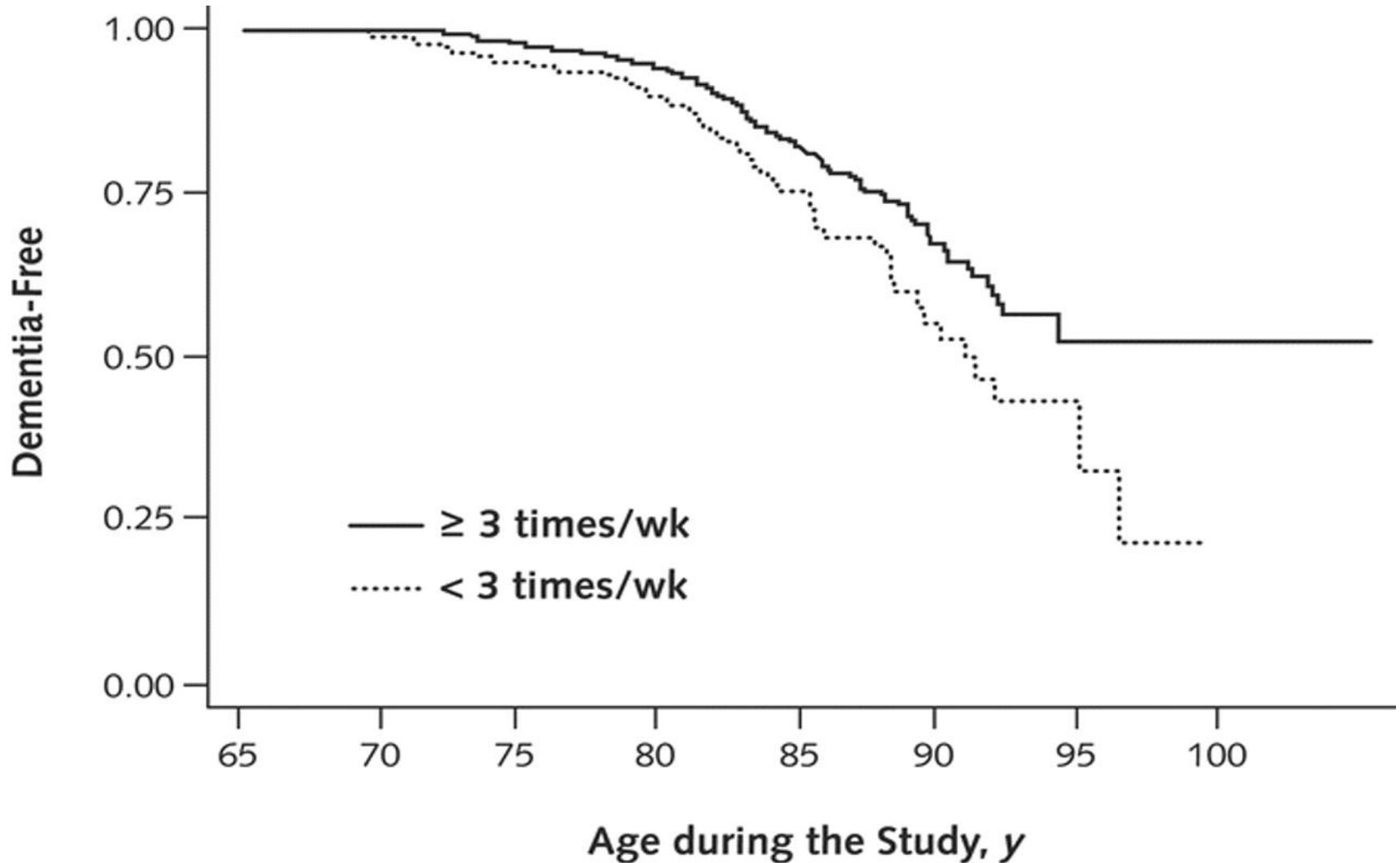


- “Randomized Trials ” (RCT)

- Treatments/interventions are randomly prescribed
- **Purposeful exercise**



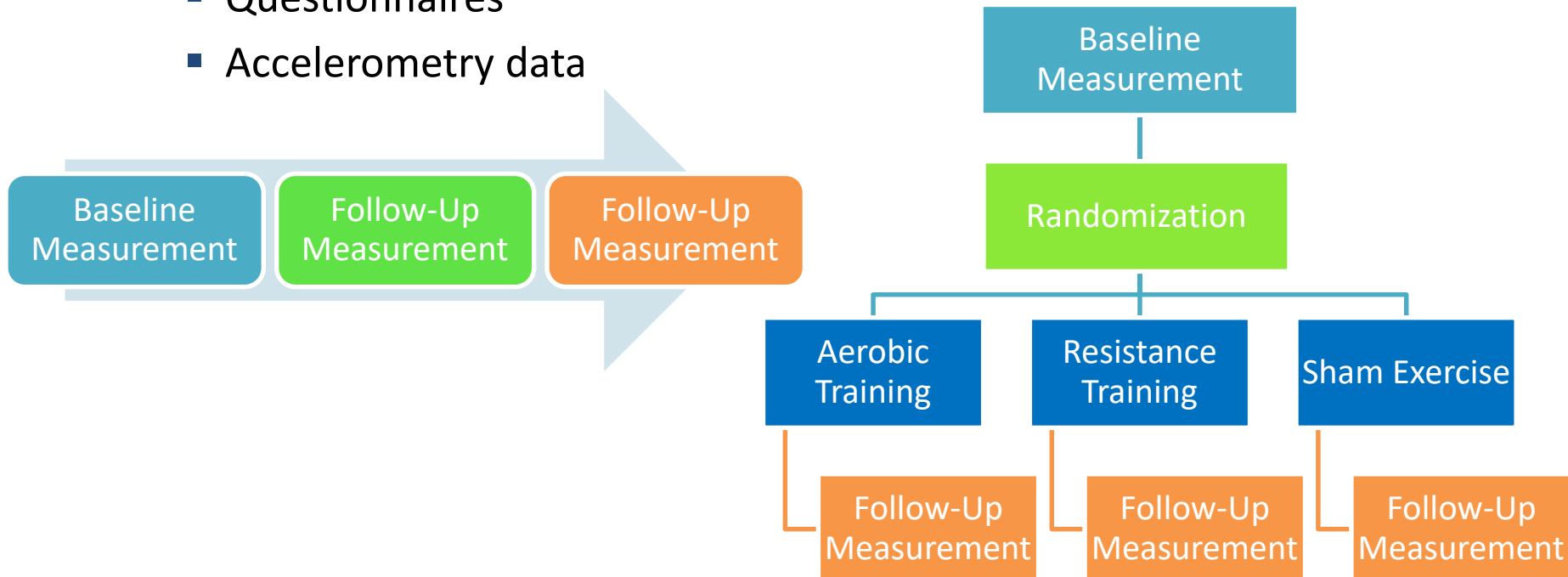
Active Lifestyle & Dementia Risk



Larson *et al.*, Annals of Internal Medicine, 2006

Physical Activity for Brain Health

- “Cohort”
 - No prescribed treatment/intervention
 - **Physical activity level**
 - Questionnaires
 - Accelerometry data
- “Randomized Trials ” (RCT)
 - Treatments/interventions are randomly prescribed
 - **Purposeful exercise**



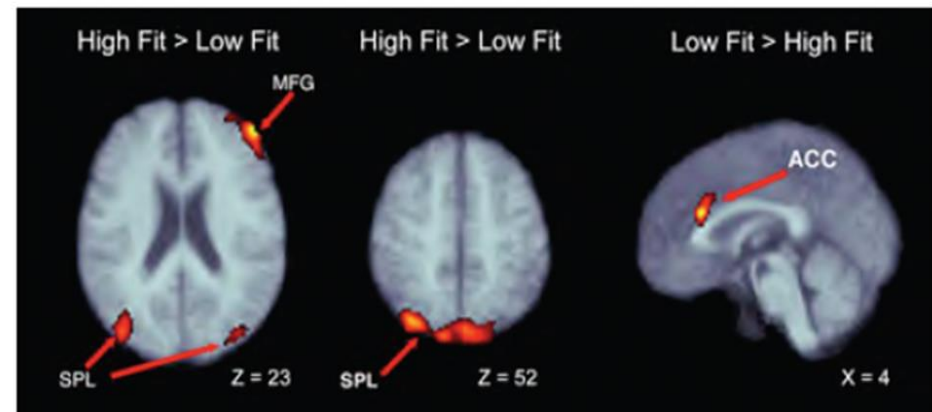
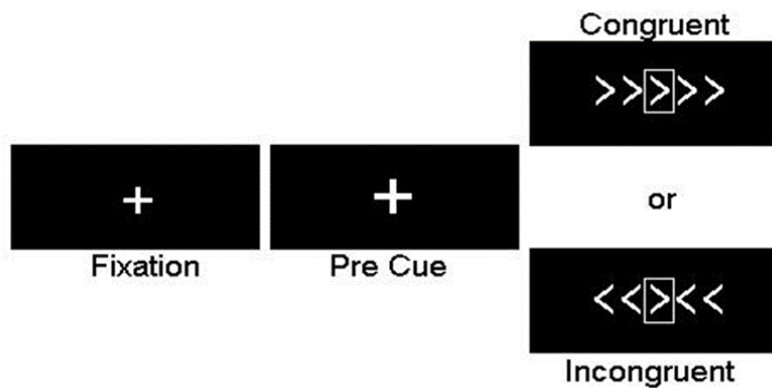
Exercise is Medicine

- Exercise
 - Subcategory of PA
- Types of Exercise
 - **Aerobic Training**
 - **Resistance Training**
 - Anaerobic Training
 - Balance/Agility Training
 - Others: Yoga, Tai Chi, dance
 - Multimodal



Aerobic Training Improves Executive Functions and Associated Functional Plasticity

- A 6-month, 3x/week (moderate-intensity) walking program improved:



- Selective attention and response inhibition (Ericksen Flanker Task)
 - » Colcombe *et al.*, PNAS, 2004
- Functional plasticity associated with Flanker Task performance
- Neural efficiency

Aerobic Training Improves Memory and Increases Hippocampal Volume

- A 12-month, 3x/week (moderate-intensity) walking program improved/increased:
 - Cognitive performance of spatial memory
 - Hippocampus volume by 2%
 - Reversing age-related loss in volume by 1-2 years
 - » Erickson *et al.*, PNAS, 2011



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CENTRE FOR BRAIN HEALTH

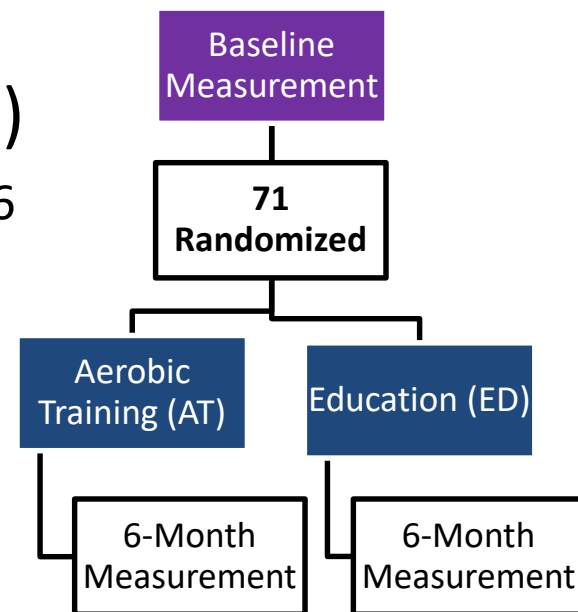


Aerobic Training and Mild VCI*

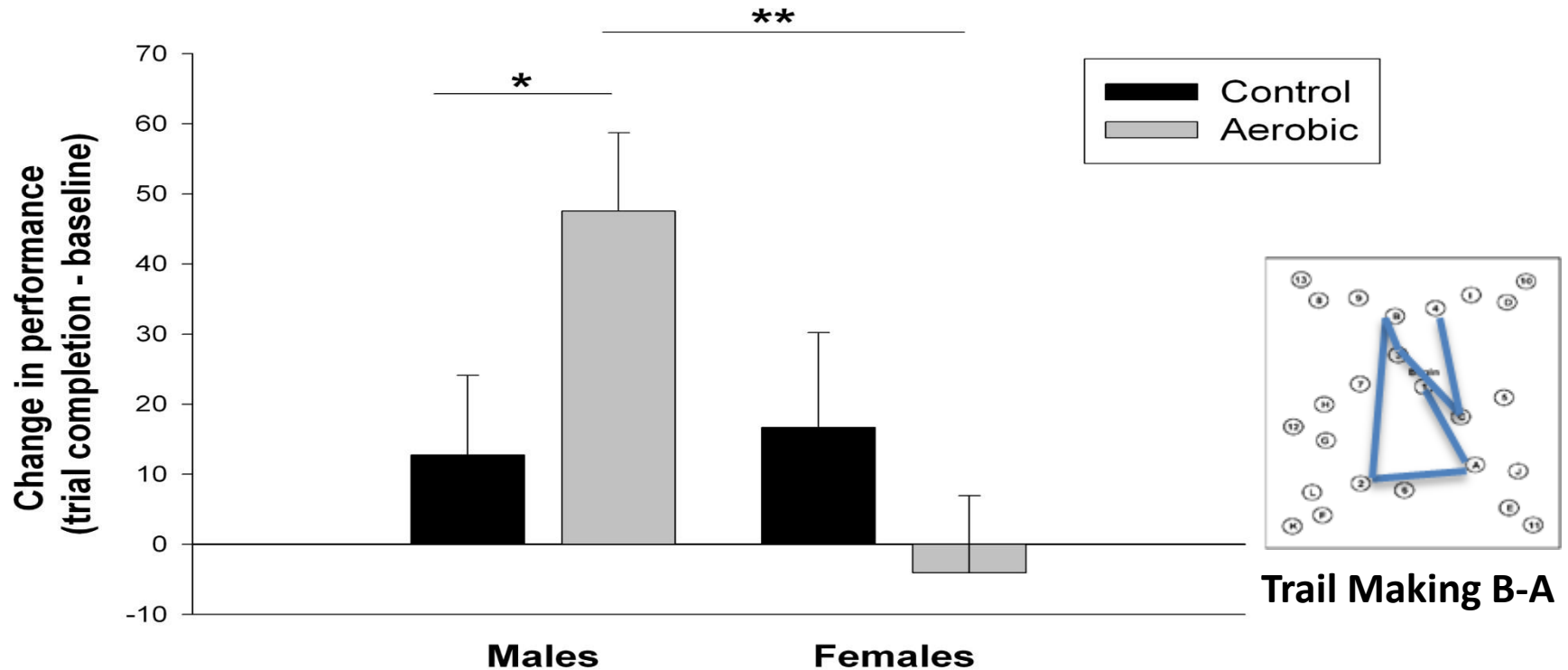
- A 6-month, 3x/week (moderate-intensity) walking program improved/increased:
 - Cognitive performance
 - Neural efficiency (task-based fMRI)
 - » Liu-Ambrose *et al.*, Neurology, 2016
 - » Hsu *et al.*, BJSM, 2017

* VCI = Vascular Cognitive Impairment

- Neuroimaging evidence of cerebral small vessel disease
- MoCA < 26/30
- No impairment in iADLs



Aerobic Training may be Particularly Beneficial for Females



Barha *et al.*, JAD, 2017



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What about **resistance training**?



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Lifting Weights is a Good Option!



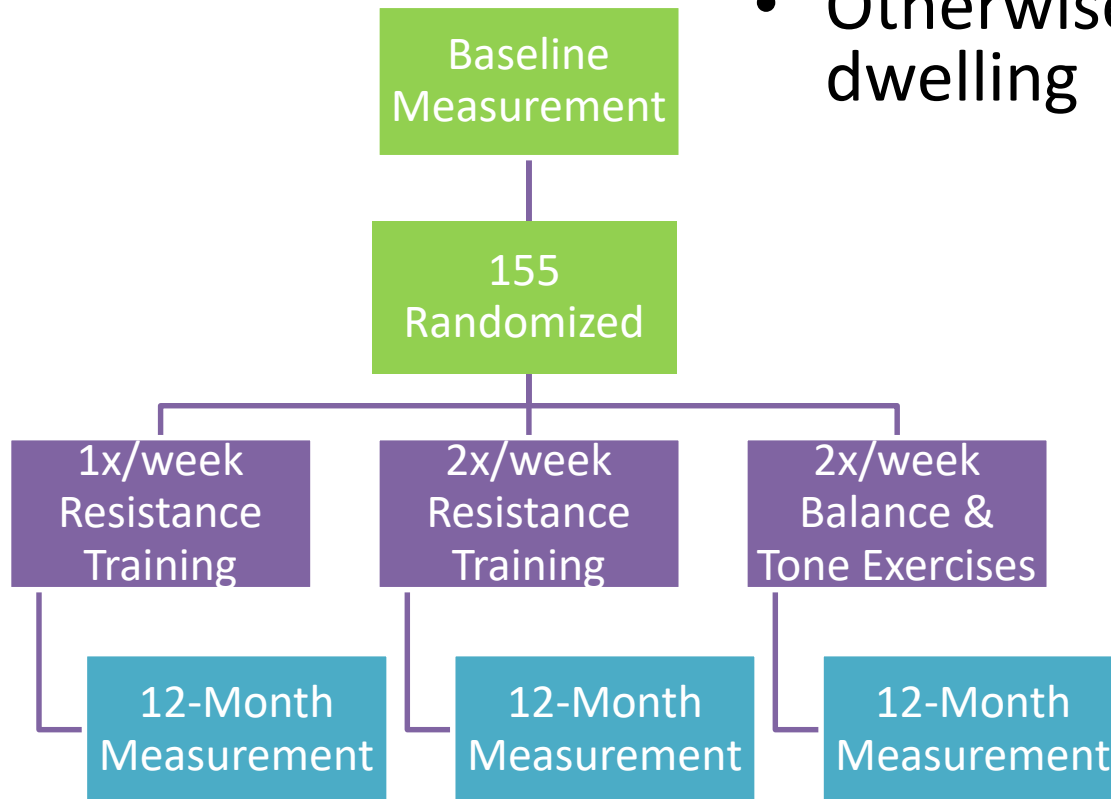
Liu-Ambrose *et al.*, 2010 & 2011
Nagamatsu *et al.*, 2012 & 2013
Bolanzadeh *et al.*, 2015



Resistance Training for Brain Health

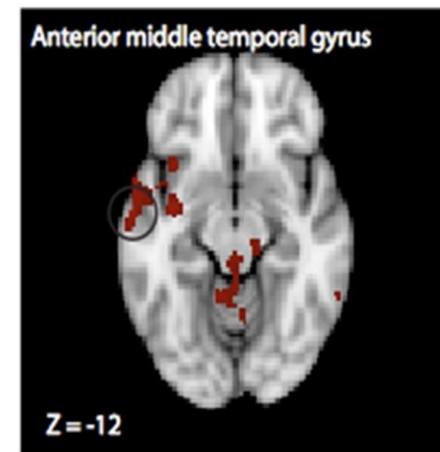
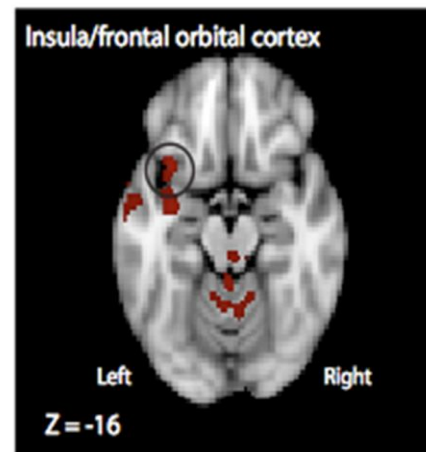
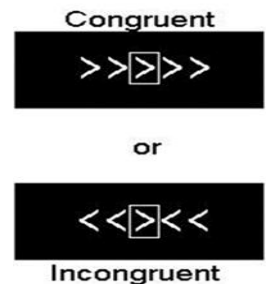
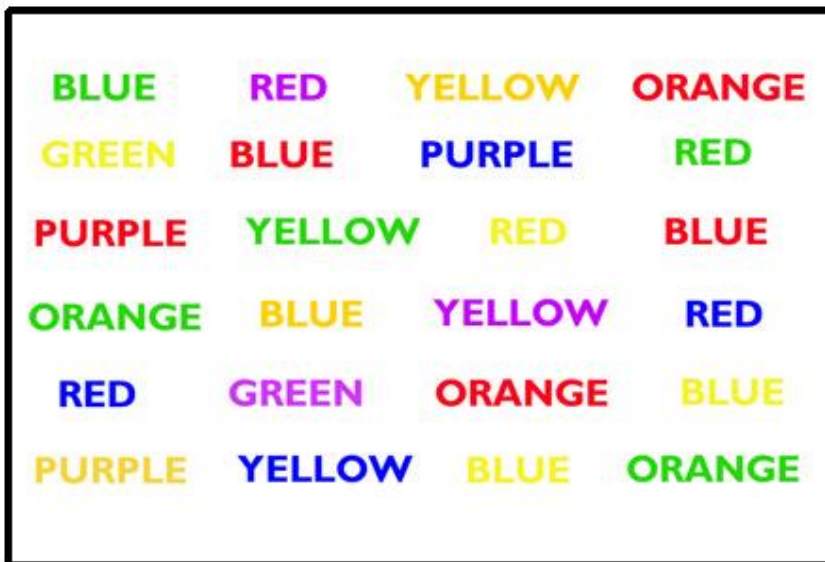
- Women aged 65 to 75 years
- Otherwise healthy & community-dwelling

» Liu-Ambrose *et al.*, 2010 & 2011

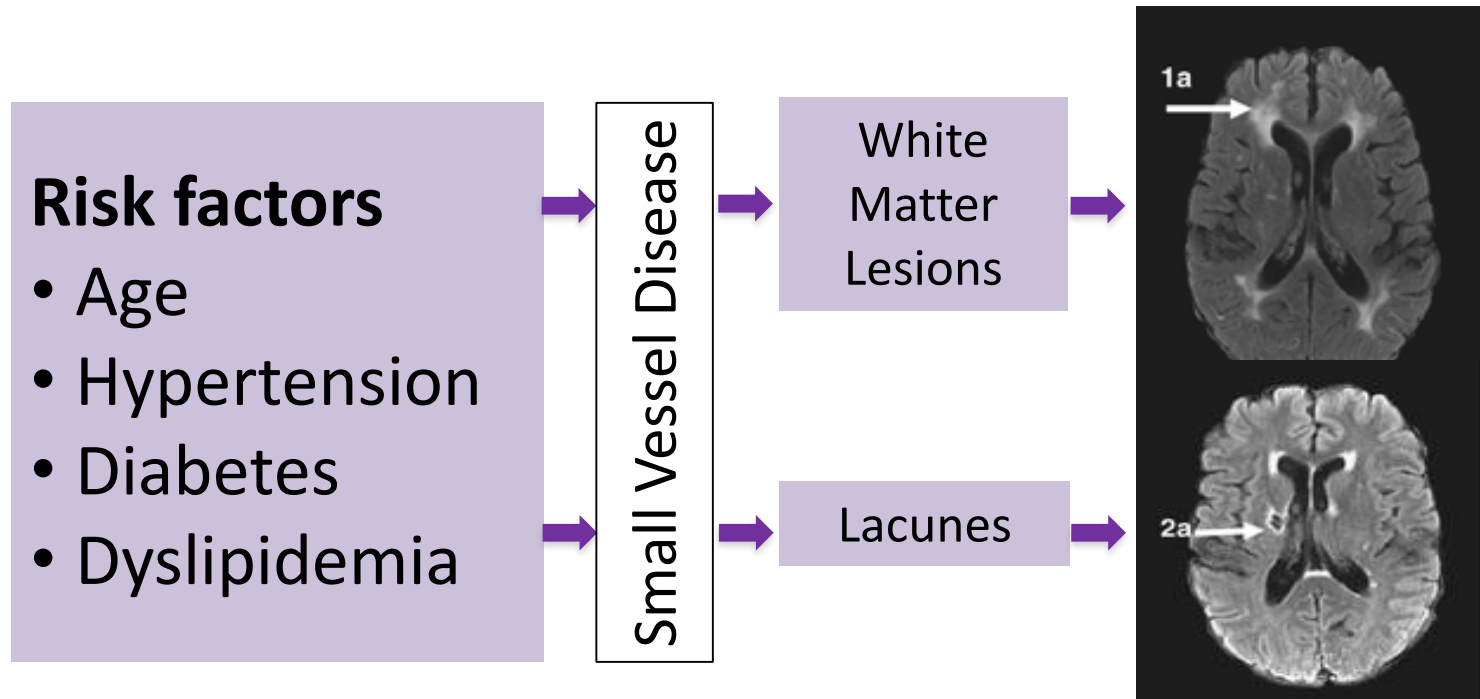


Resistance Training Improves Executive Functions and Functional Plasticity

- Lifting weights 1x/week or 2x/week significantly improved executive functions.
- Lifting weights 2x/week induced functional plasticity during the Flanker task



Resistance Training Moderated Disease Progression



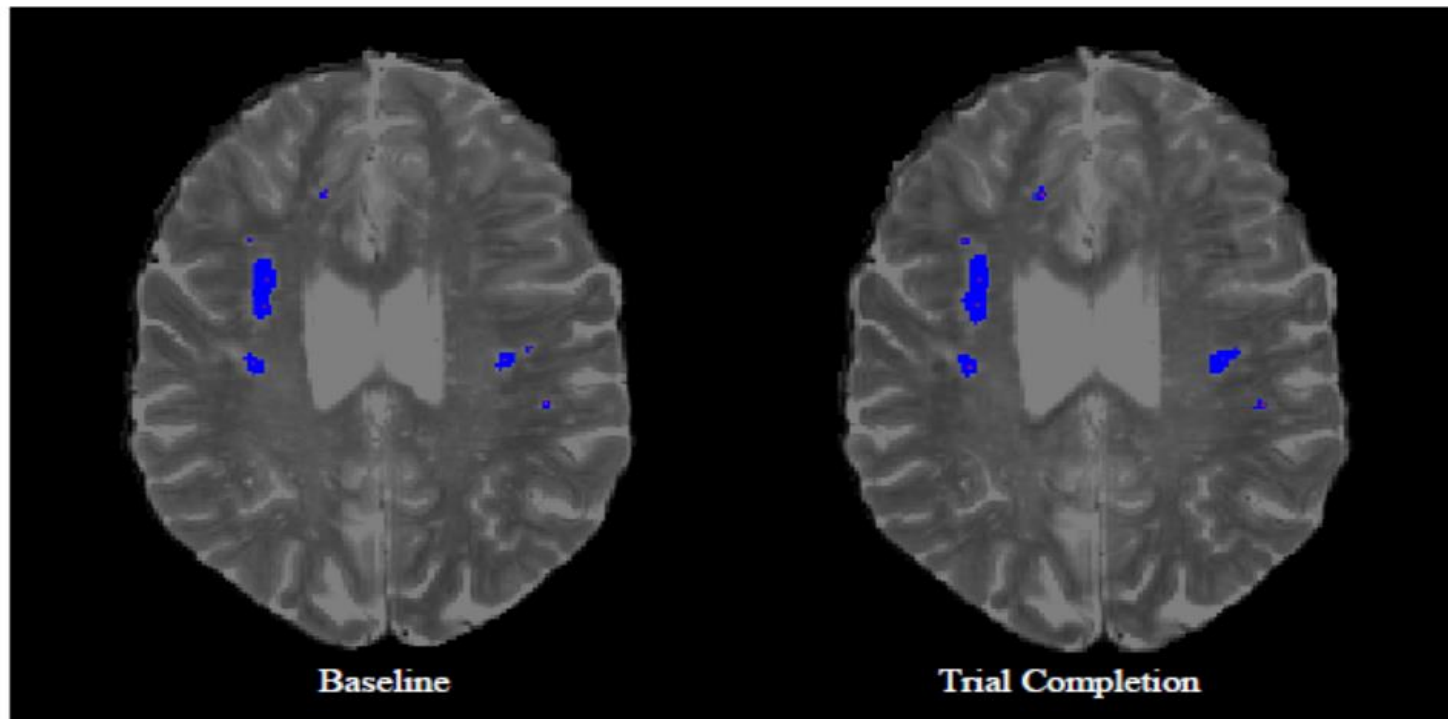
Images from Patel *et al.*, *International Journal of Stroke*, 2011

These “silent” lesions are associated with increased risk of stroke, slow gait, falls, and dementia.

Resistance Training Moderated Disease Progression

Lifting weights 2x/week significantly reduced progression of white matter lesions.

» Bolandzadeh *et al.*, JAGS, 2015

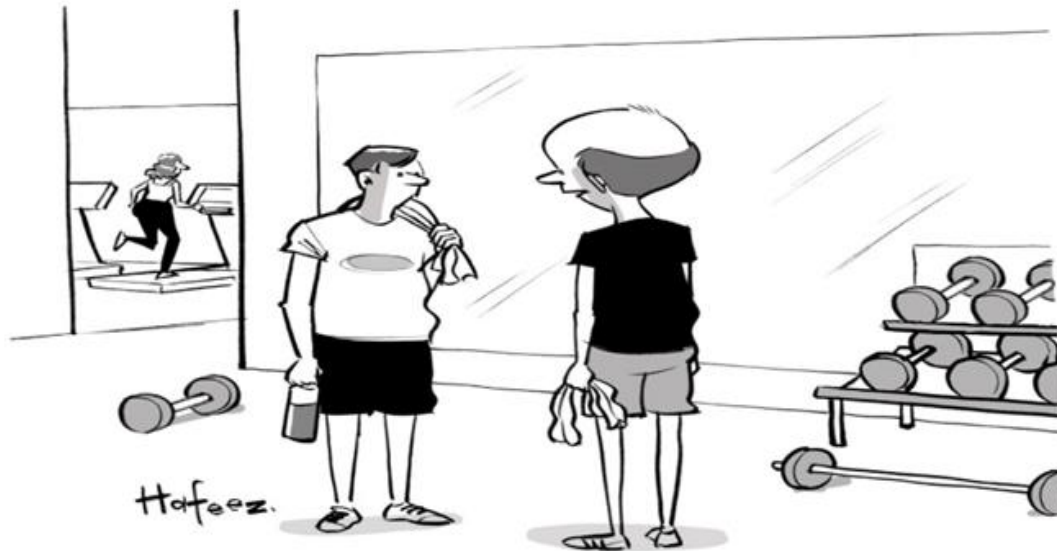




THE NEW YORKER

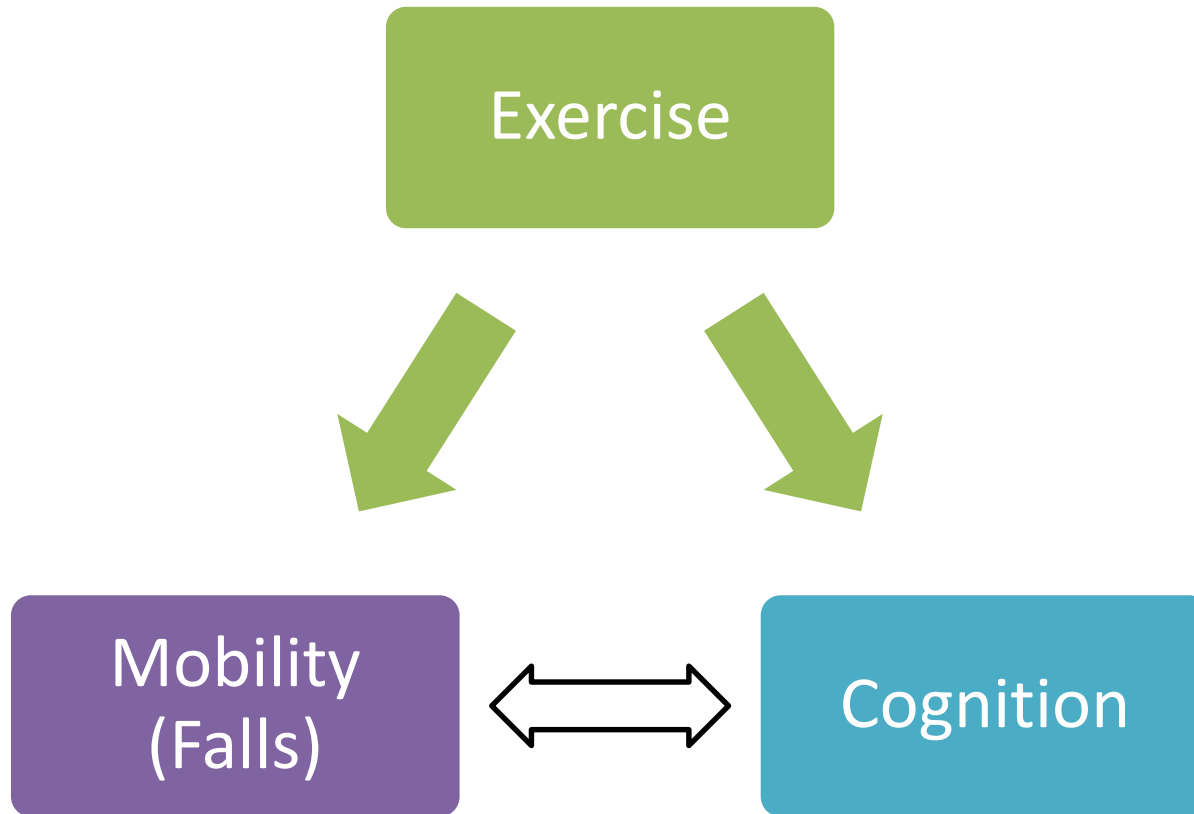


BY KAAMRAN HAFEEZ

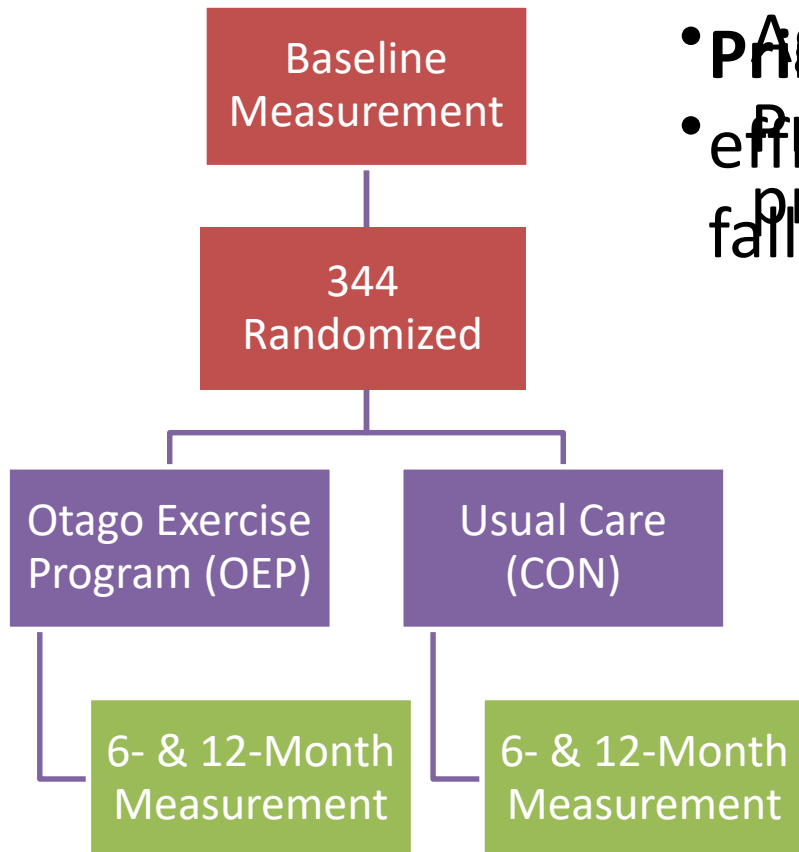


"I've been working out for six months, but all my gains have been in cognitive function."

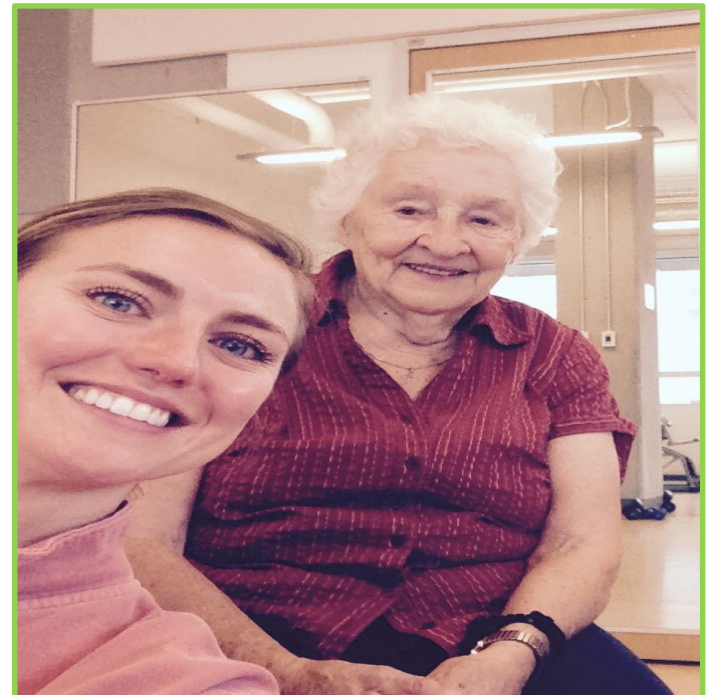
Cognition and Mobility



Action! Seniors



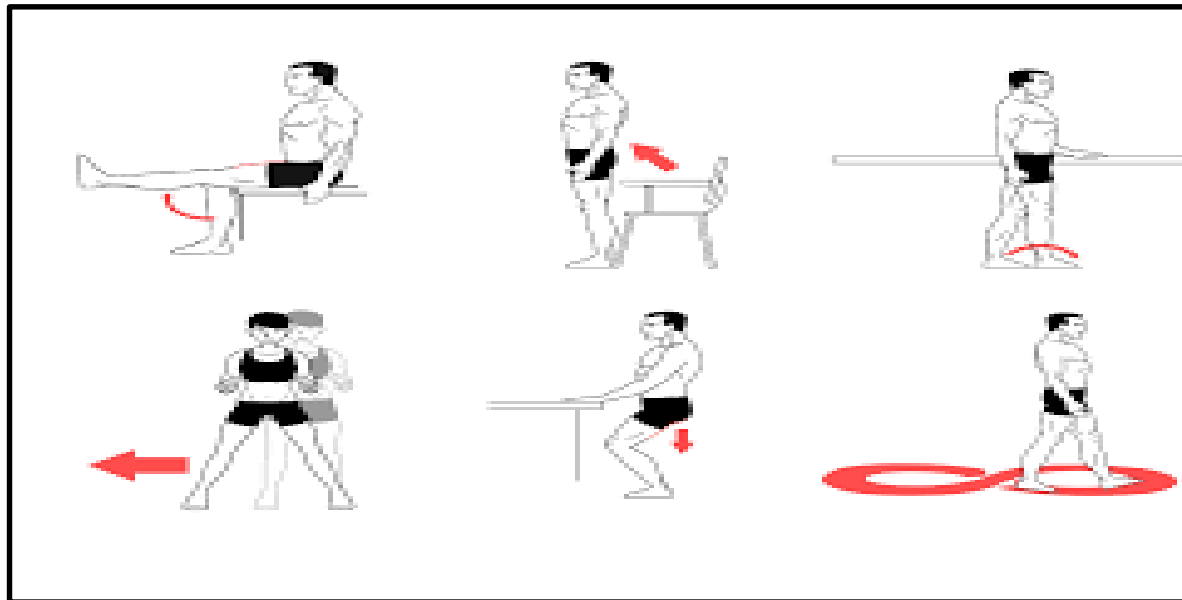
- Aged 70 years and older
- **Primary Aim:** To assess the efficacy of exercise as a secondary falls prevention strategy.
- Presented to a health care provider (ED or GP) due to a fall
 - » Liu-Ambrose *et al.*, JAMA, 2019
 - » Liu-Ambrose *et al.*, JAGS, 2008



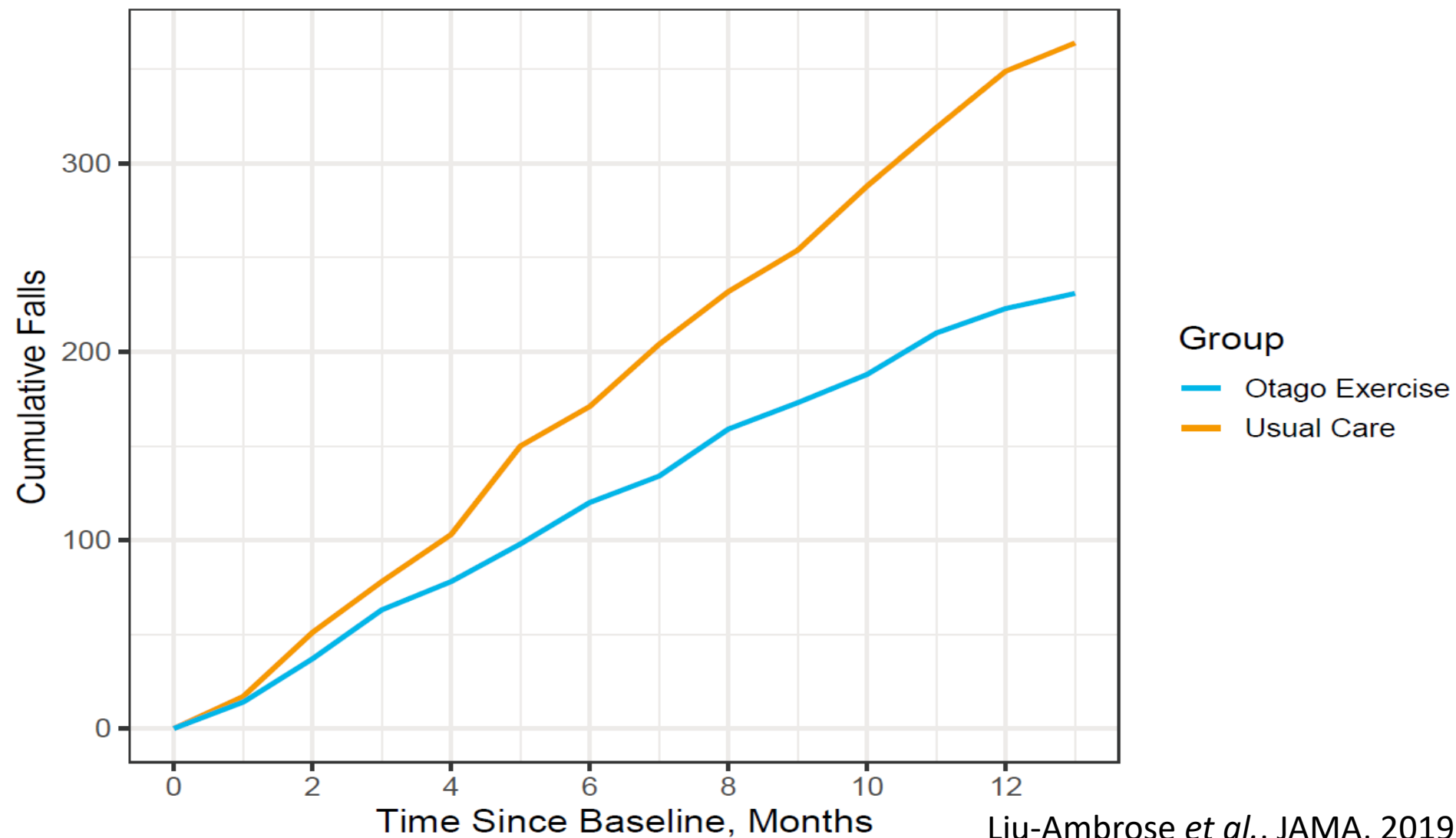
Otago Exercise Program (OEP)

- Home-based, delivered by PT
 - Strength and balance retraining (3x/week)
 - Walking (2x/week)

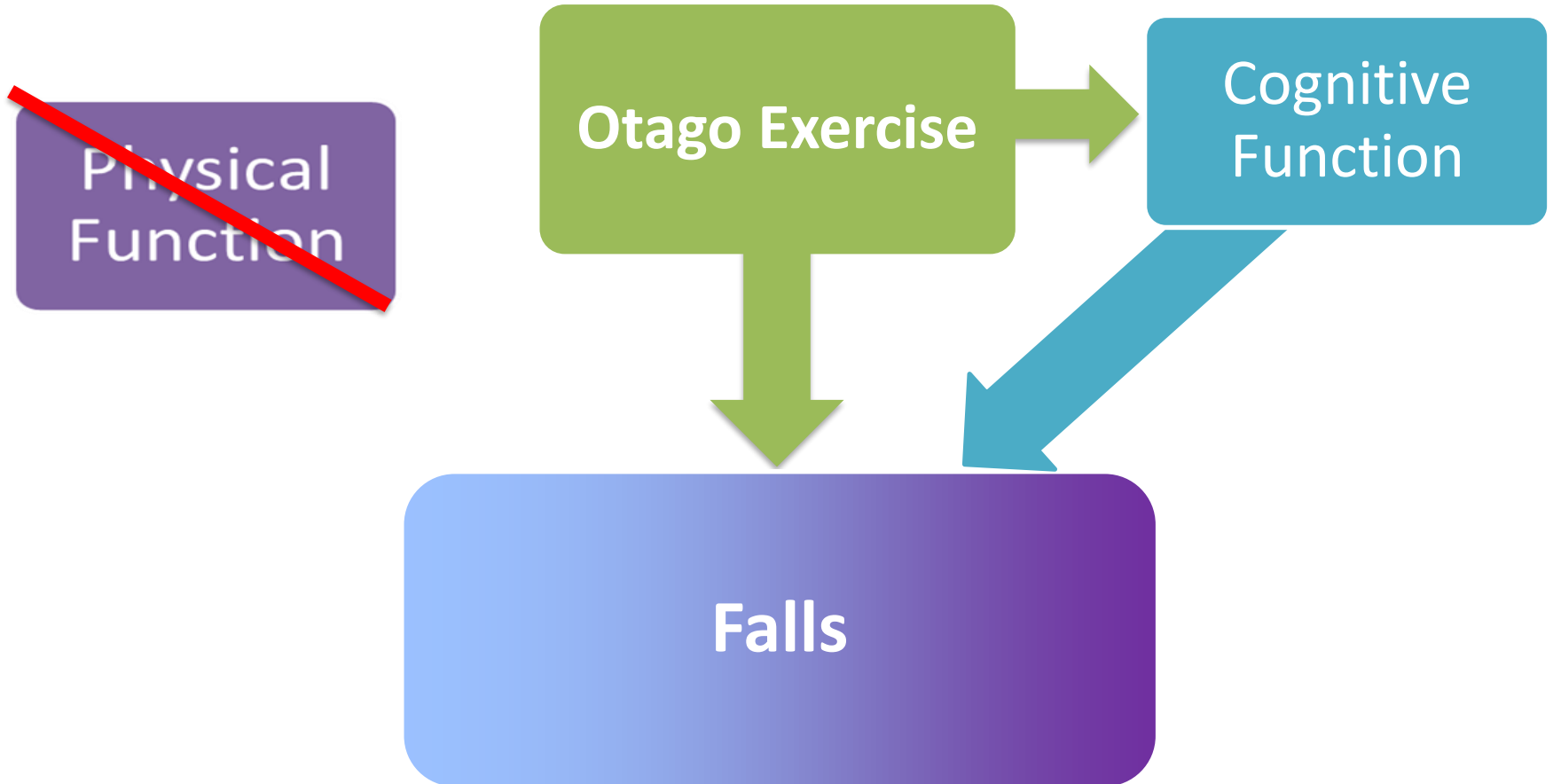
» Campbell *et al.*, BMJ, 1997 & 1999



OEP Reduced the Rate of Falls



Underlying Mechanism: Improved Cognitive Function?



Conclusions & Considerations

- Sufficient evidence for exercise to be included in practice guideline on mild cognitive impairment

SPECIAL ARTICLE LEVEL OF RECOMMENDATION

Practice guideline update summary: Mild cognitive impairment

Report of the Guideline Development, Dissemination, and Implementation Subcommittee of the American Academy of Neurology

Ronald C. Petersen, MD, PhD, Oscar Lopez, MD, Melissa J. Armstrong, MD, MSc, Thomas S.D. Getchius, Mary Ganguli, MD, MPH, David Gloss, MD, MPH&TM, Gary S. Gronseth, MD, Daniel Marson, JD, PhD, Tamara Pringsheim, MD, Gregory S. Day, MD, MSc, Mark Sager, MD, James Stevens, MD, and Alexander Rae-Grant, MD

Neurology® 2018;90:1-10. doi:10.1212/WNL.0000000000004826

Correspondence
American Academy of
Neurology
guidelines@aan.com

Abstract

Objective

To update the 2001 American Academy of Neurology (AAN) guideline on mild cognitive impairment (MCI).

Methods

The guideline panel systematically reviewed MCI prevalence, prognosis, and treatment articles according to AAN evidence classification criteria, and based recommendations on evidence and modified Delphi consensus.

Results

MCI prevalence was 6.7% for ages 60–64, 8.4% for 65–69, 10.1% for 70–74, 14.8% for 75–79, and 25.2% for 80–84. Cumulative dementia incidence was 14.9% in individuals with MCI older than age 65 years followed for 2 years. No high-quality evidence exists to support pharmacologic treatments for MCI. **In patients with MCI, exercise training (6 months) is likely to improve cognitive measures and cognitive training may improve cognitive measures.**

Major recommendations

Clinicians should assess for MCI with validated tools in appropriate scenarios (Level B). Clinicians should evaluate patients with MCI for modifiable risk factors, assess for functional impairment, and assess for and treat behavioral/neuropsychiatric symptoms (Level B). Clinicians should monitor cognitive status of patients with MCI over time (Level B). Cognitively impairing medications should be discontinued where possible and behavioral symptoms treated (Level B). Clinicians may choose not to offer cholinesterase inhibitors (Level B); if offering, they must first discuss lack of evidence (Level A). **Clinicians should recommend regular exercise (Level B). Clinicians may recommend cognitive training (Level C).** Clinicians should discuss diagnosis, prognosis, long-term planning, and the lack of effective medicine options (Level B), and may discuss biomarker research with patients with MCI and families (Level C).

MORE ONLINE

Podcast

Dr. Jeff Burns talks with Dr. Ronald Petersen about the updated AAN guideline on mild cognitive impairment.
Npub.org/ojn0w9

Conclusions & Considerations

- Multimodal training likely provides the most benefit

Exercise interventions for cognitive function in adults older than 50: a systematic review with meta-analysis

Joseph Michael Northey,^{1,2} Nicolas Cherbuin,³ Kate Louise Pumpa,^{1,2} Disa Jane Smees,² Ben Rattray^{1,2}

Table 1 Results of moderator analysis		
Moderator	No. of effect sizes	Estimate Mean (95% CI)
Exercise moderators		
Mode		
Aerobic	153	0.24 (0.10 to 0.37)
Resistance training	80	0.29 (0.13 to 0.44)
Multicomponent training	47	0.33 (0.14 to 0.53)
Tai chi	25	0.52 (0.32 to 0.71)
Yoga	28	0.13 (−0.10 to 0.36)

Conclusions & Considerations

- Physical activity is a legitimate medical therapy for promoting cognitive health
 - Degree of benefit equal or exceeds that of pharmaceutical agents
 - Minimal adverse effects
- Reducing physical inactivity by 25% could prevent one million cases of dementia worldwide

» Barnes and Yaffe, Lancet Neurol, 2011

Sedentary Behaviour

Limiting our daily sitting/lying to just 23.5 hours: too ambitious?

Karim Khan

Thank you to *BJSM* guest editor Steven Blair* and all our January and February authors (<http://bjsm.bmj.com/content/>

up the freeway embankment, stepping over the steel barriers, dashing hopefully across breaks in eight lanes of Hummers



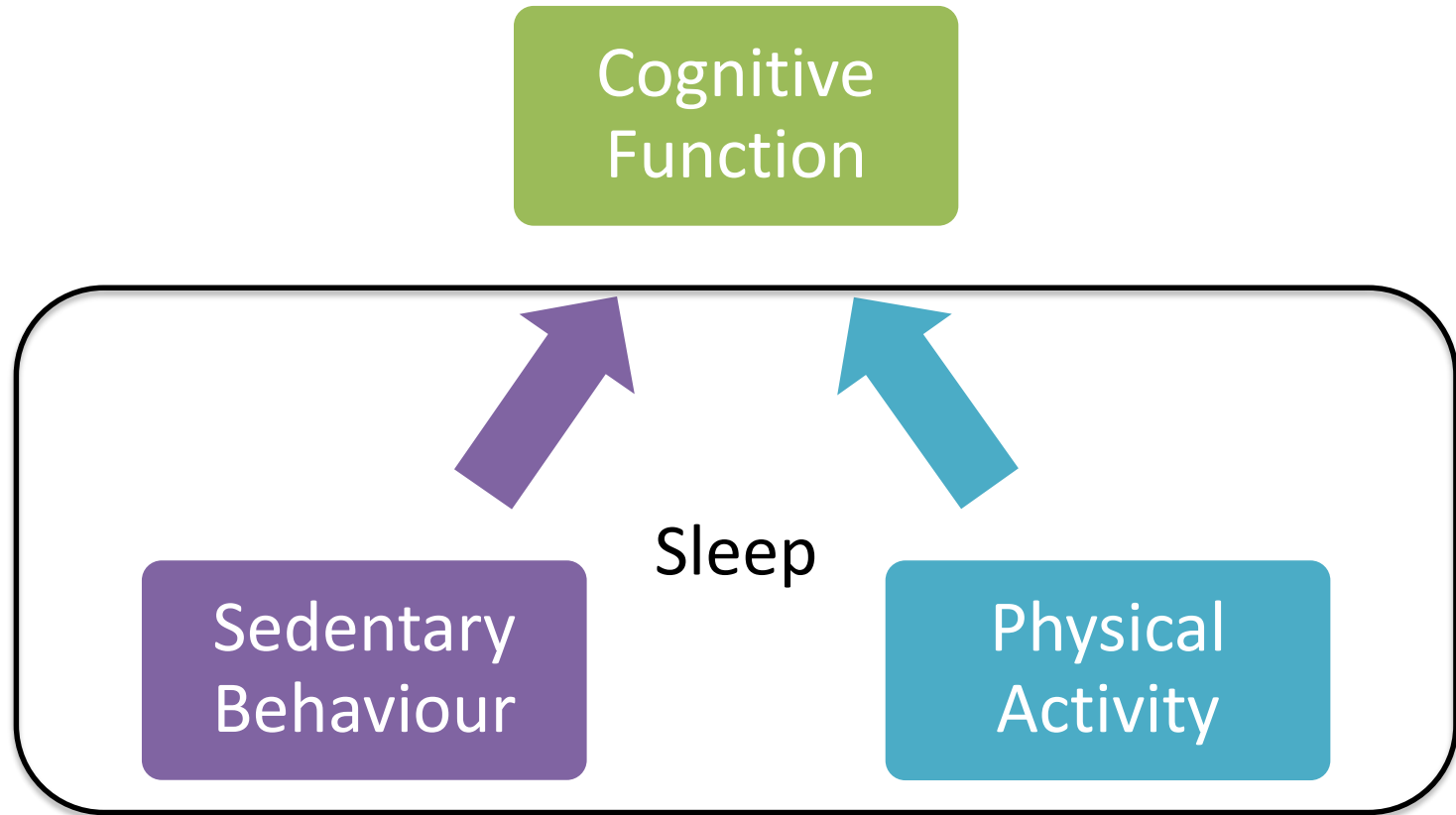
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Djavad Mowafaghian
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CLSA Project



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- Winnie Cheung, BA
- Wency Chan, BSc
- Cheyenne Ghag, BSc

Collaborators

- Jennifer Davis, PhD
- Caterina Rosano, MD, MPH
- Robin Hsiung, MD
- Lindsay Nagamatsu, PhD
- Kirk Erickson, PhD
- Roger Tam, PhD
- Michelle Voss, PhD
- Art Kramer, PhD
- Todd Handy, PhD
- Peter Graf, PhD
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