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# The Role of Exercise in Integrated Care for Frailty and Dementia

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# Optimal Ageing = Resilience

- PHYSICAL FITNESS
- COGNITIVE FITNESS
- PSYCHOLOGICAL WELL-BEING
- GOOD NUTRITION
- SOCIAL INTEGRATION
- PURPOSE IN LIFE
- EMPATHY/ALTRUISM


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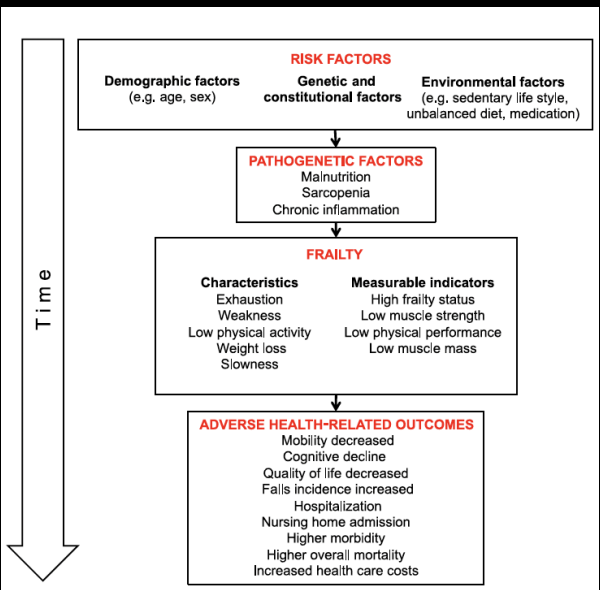
# Where does exercise fit?




- Attainment of peak physiologic/ genetic potential
- Prevention of risk factors for frailty/dementia
- Prevention of diseases leading to frailty/dementia
- Treatment of pre-frailty/MCI
- Treatment of frailty/dementia
- Treatment of co-morbidities

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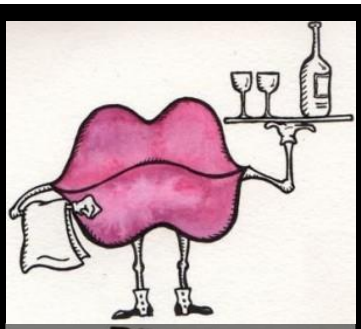

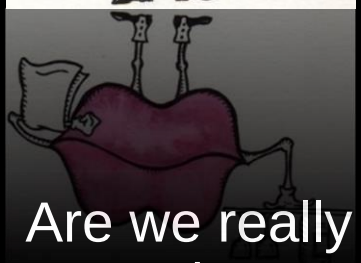


Are we really just paying lip service to the idea that "Exercise is Medicine"?

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## How to actually use exercise as medicine…

- Prevent or treat diseases, syndromes or symptoms for which we have no other medical treatment
- Substitute for less effective or more hazardous forms of treatment
- Augment the effects of other available preventive or treatment strategies
- Offset the side effects of current treatments
- Counter age-related changes in physiology which pose risk factors for morbidity and mortality

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## Frailty and Cognitive Impairment

- Syndromes often coexist
- Shared risk factors
- Prevention and treatment require multidisciplinary approach to care
- Exercise, nutrition, medication management, social contact critical

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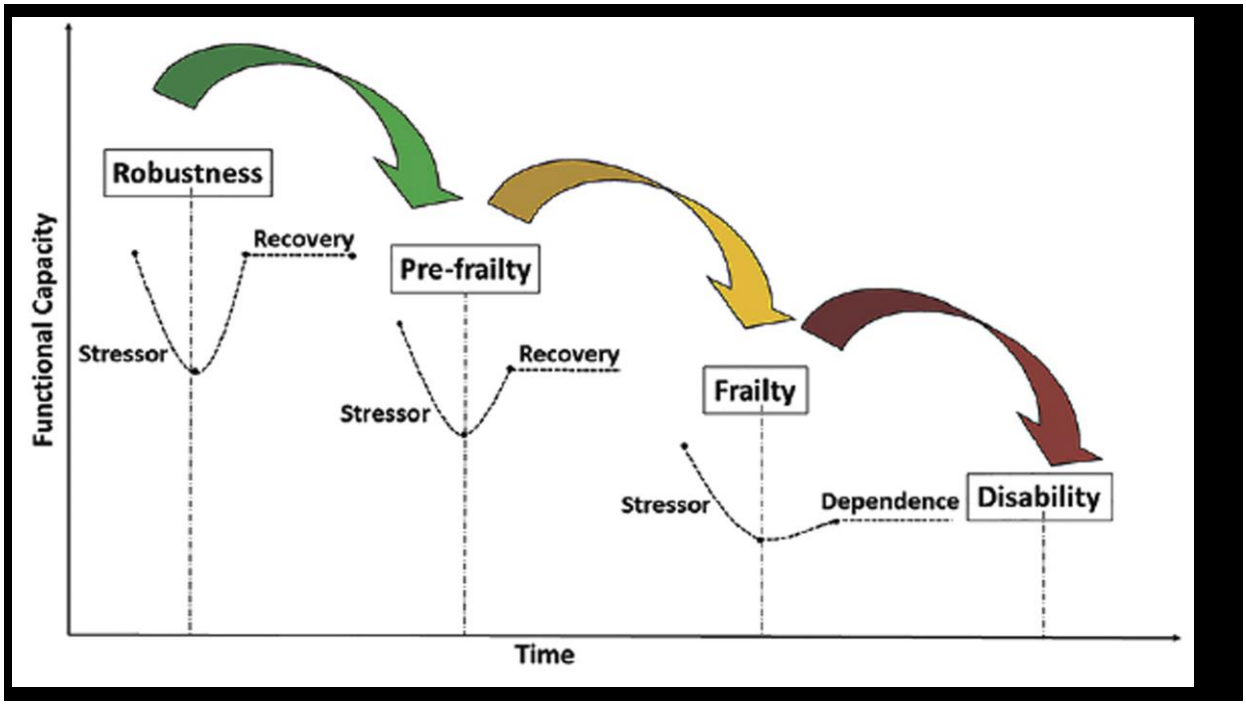
Functional Capacity
Robustness
Recovery
Stressor
Pre-frailty
Recovery
Stressor
Frailty
Stressor
Dependence
Disability
Time

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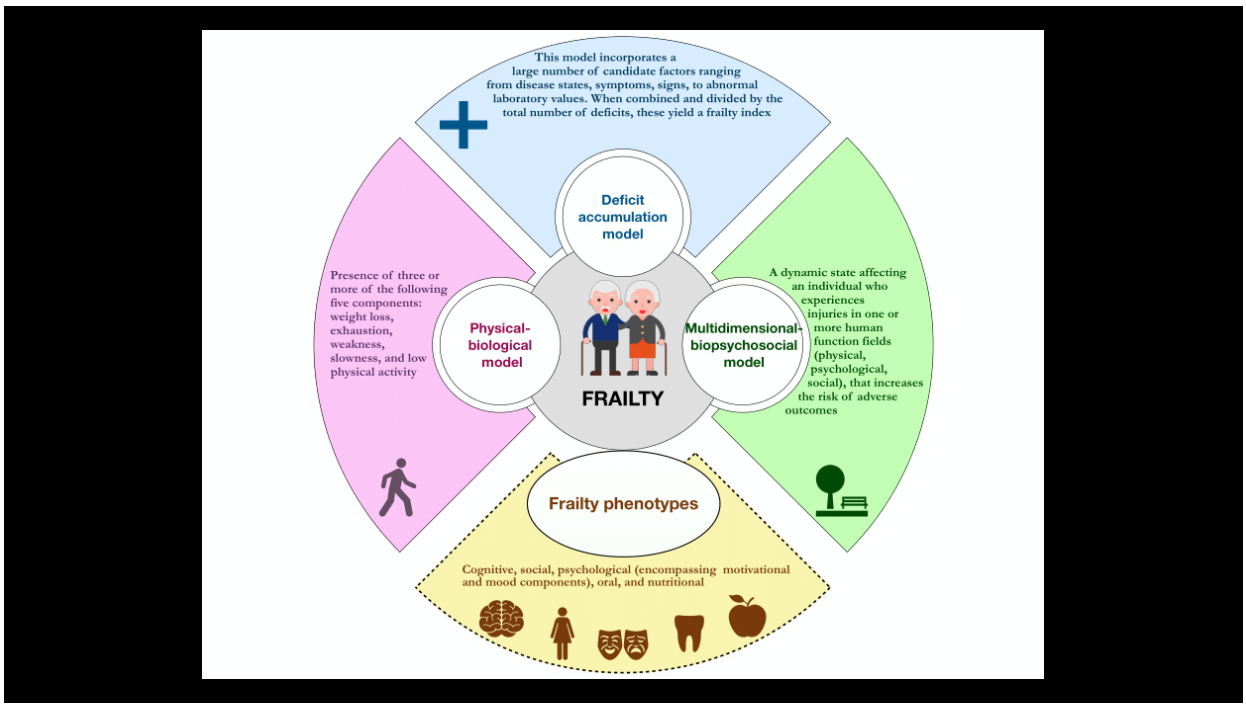
This model incorporates a large number of candidate factors ranging from disease states, symptoms, signs, to abnormal laboratory values. When combined and divided by the total number of deficits, these yield a frailty index
Deficit accumulation model
Presence of three or more of the following five components: weight loss, exhaustion, weakness, slowness, and low physical activity
Physical-biological model
FRAILTY
Multidimensional-biopsychosocial model
A dynamic state affecting an individual who experiences injuries in one or more human function fields (physical, psychological, social), that increases the risk of adverse outcomes
Frailty phenotypes
Cognitive, social, psychological (encompassing motivational and mood components), oral, and nutritional

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# What is frailty?

- Shrinkage (weight/LBM loss)
- Slowness
- Strength loss
- Sedentariness
- Sleepiness (fatigue)

**Physical Frailty Phenotype (PFP)**
(Fried et al 2001)

- Weight loss (more than 10lbs)
- Weakness (grip strength)
- Exhaustion (self-report)
- Walking Speed (15 feet)
- Physical Activity (Kcals/week)

- Not Frail: 0
- Intermediate: 1-2
- Frail: ≥3

*Fried LP, Tangen CM, Walston J, Newman, AB, Hirsch, C, Gottdiener, J, Seeman, T, Tracy, R, Kop, WJ, Burke, G, McBurnie, MA (Mar 2001). "Frailty in older adults: evidence for a phenotype". The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences.* ***56*** *(3): M146–56.*

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**Table 1**
Clinical Practice Guidelines for the Management of Frailty

| Clinical Practice Guidelines for the Management of Frailty |
|---|
| Strong Recommendations |
| 1. We strongly recommend that frailty be identified using a validated measurement tool. |
| 2. We strongly recommend that older adults with frailty be referred to a progressive, individualized physical activity program that contains a resistance training component. |
| 3. We strongly recommend that polypharmacy be addressed by reducing or deprescribing any inappropriate/superfluous medications. |
| Conditional Recommendations |
| 4. We conditionally recommend that persons with frailty are screened for causes of fatigue. |
| 5. We conditionally recommend that older adults with frailty who exhibit unintentional weight loss should be screened for reversible causes and considered for food fortification/protein and caloric supplementation. |
| 6. We conditionally recommend that vitamin D be prescribed for persons found to be deficient in Vitamin D. |
| No Recommendation |
| 7. We have no recommendation for the provision of an individualized support and education plan for older adults with frailty. |

*JAMDA 18 (2017) 564e575*

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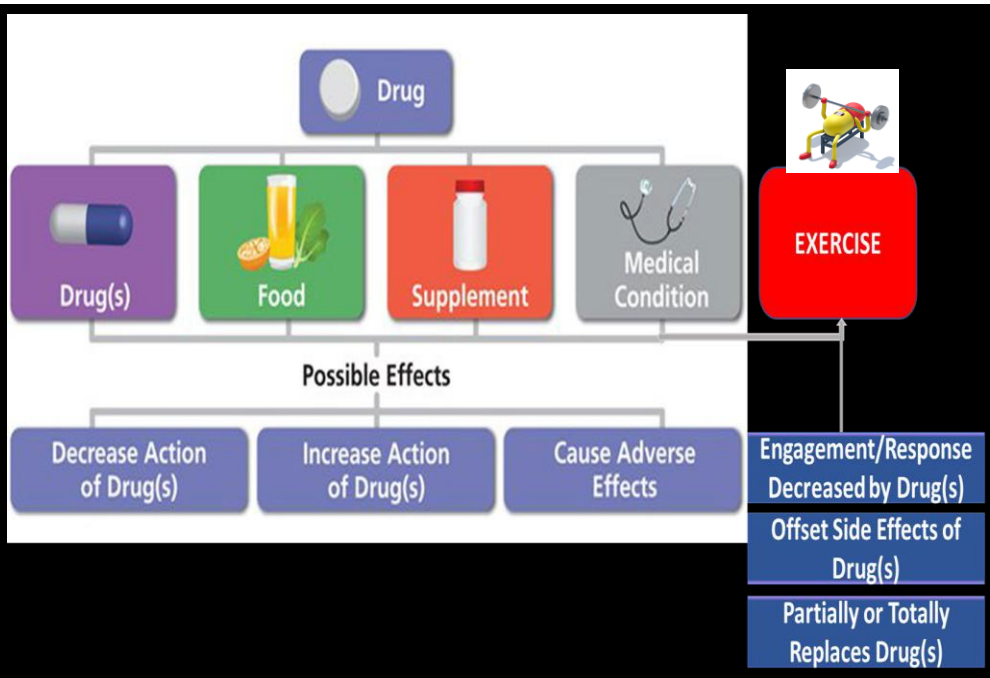
Many different kinds of medication interactions to consider when addressing polypharmacy

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The Lancet Commissions

**Dementia prevention, intervention, and care: 2024 report of the *Lancet* standing Commission**

*Gill Livingston, Jonathan Huntley, Kathy Y Liu, Sergi G Costafreda, Geir Selbæk, Suvarna Alladi, David Ames, Sube Banerjee, Alistair Burns, Carol Brayne, Nick C Fox, Cleusa P Ferri, Laura N Gitlin, Robert Howard, Helen C Kales, Mika Kivimäki, Eric B Larson, Noeline Nakasujja, Kenneth Rockwood, Quincy Samus, Kokoro Shirai, Archana Singh-Manoux, Lon S Schneider, Sebastian Walsh, Yao Yao, Andrew Sommerlad*, Naaheed Mukadam**

New evidence suggests that reducing the risk of dementia increases the number of healthy years of life and compresses the duration of ill health for people who develop dementia.

The potential for prevention is high and, overall, nearly half of dementias could theoretically be prevented by eliminating 14 risk factors

***Lancet* 2024; 404: 572–628**

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# Two new modifiable risk factors for dementia added in 2024

- High LDL
- Untreated vision loss

Added to 2020 Lancet Commission on dementia prevention, intervention, and care life-course model of 12:

- Lower education
- Hypertension
- Hearing impairment
- Smoking
- Obesity
- Excess Alcohol
- Traumatic brain injury
- Air pollution
- Depression
- Low physical activity
- Diabetes
- Social Isolation

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# Dementia: A Lifecourse Perspective

- Dementia research is in crisis. After billions of dollars of research, we still have no effective disease-modifying pharmaceutical, and as our populations age, the global number of people with dementia is expected to triple to 150 million people by 2050.
- This raises an interesting dilemma. Is a single pathological model of disease for dementia obsolete?
- In early-onset dementia, there is a high probability of a single disease entity (e.g., Alzheimer's disease, frontotemporal dementia), but with increasing age, a multiplicity of causes including multiple neurodegenerative processes, co-morbidities and frailty will become the norm.

***Lancet* 2024; 404: 572–628**

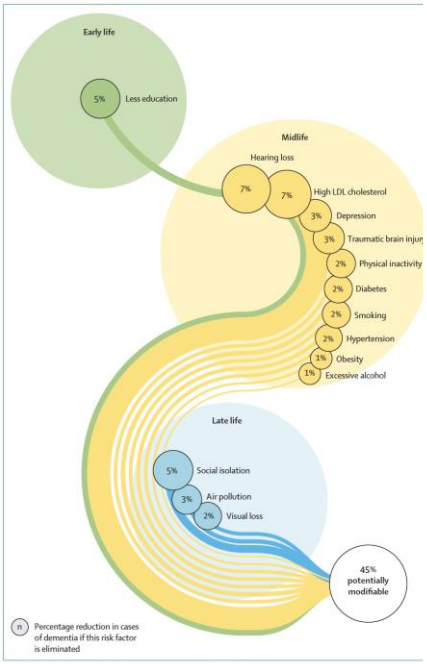


*Figure 9:* Population attributable fraction of potentially modifiable risk factors for dementia

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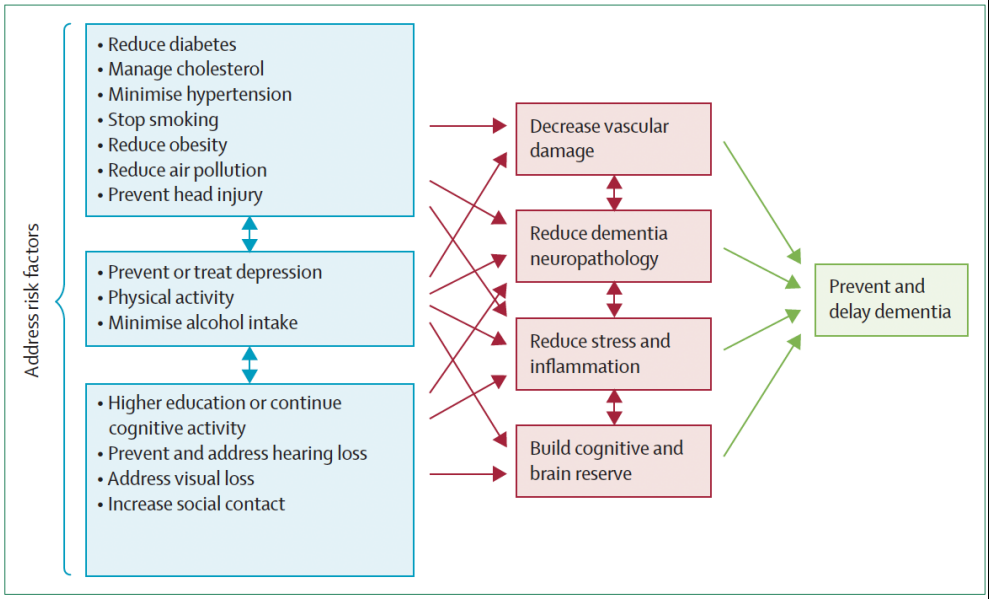


*Figure 2:* **Possible brain mechanisms for enhancing or maintaining cognitive reserve and risk reduction of potentially modifiable risk factors in dementia**

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# Emerging Risk Factors for Dementia

- Poor Sleep
- Anxiety
- Stress
- Sedentary behaviour
- Frailty
- Malnutrition
- Sarcopenia
- Low gut microbiome diversity


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# Exercise for psychological resilience benefits and prevention of dementia

- Depression
- Anxiety
- Stress
- Insomnia
- PTSD
- Chronic Pain
- ADHD
- Substance use disorders

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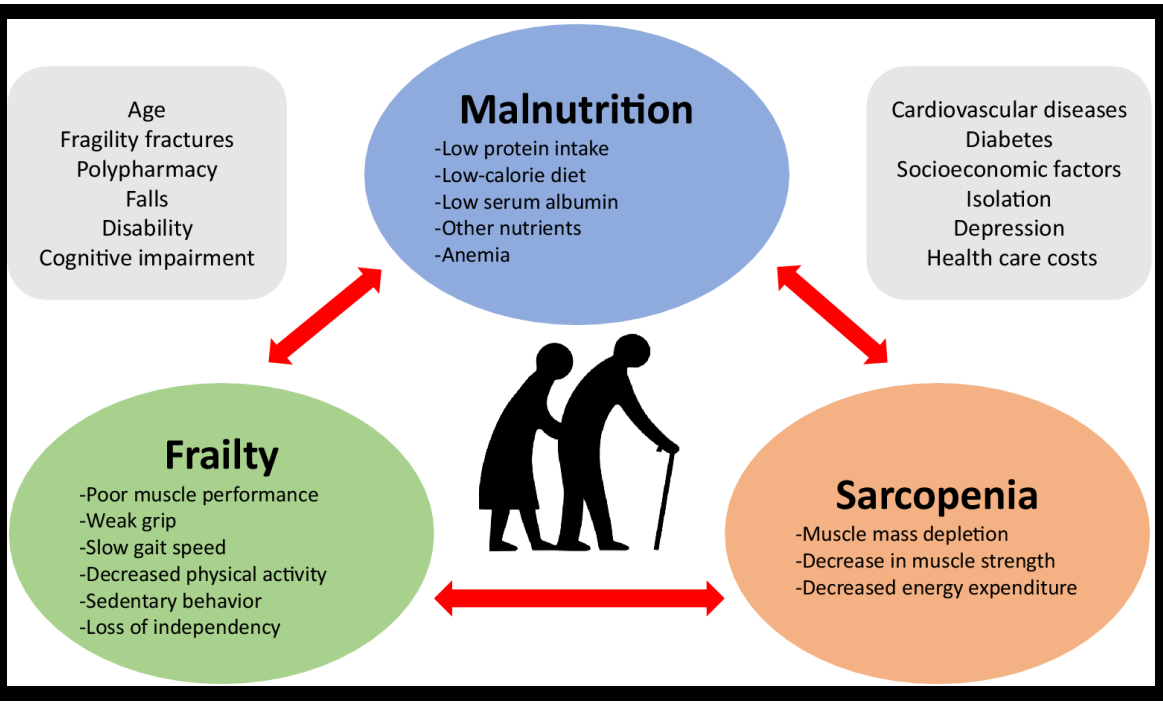


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We have no safe or effective drugs for ageing, frailty, mobility impairment and many of its co-morbidities and risk factors…or to optimise RESILIENCE

- Poor balance
- Slow gait speed
- Sedentariness
- Sarcopenia
- Wasting/anorexia
- Fatigue
- Poor endurance
- Inflammation
- Adipose accumulation?
- Injurious Falls
- Low self-efficacy
- Poor sleep quality/quantity
- Poor quality of life/loneliness
- Anxiety/Stress
- Cognitive impairment?
- Functional dependency

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Elderly people icons


Elderly Assistance Icon - Iconic Series

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More than 1 in 2 adults aged 50 and over said that they would rather die than live in a long-term care facility, according to a recent survey from US Nationwide Retirement Institute.

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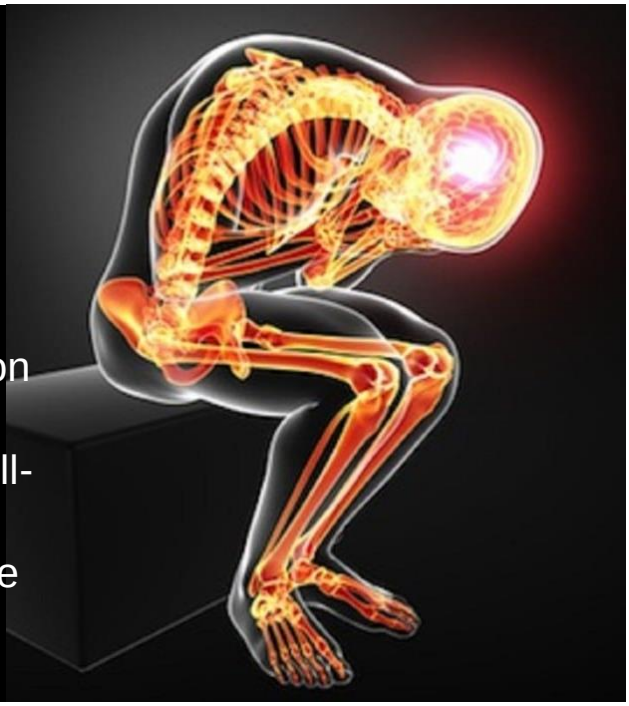
## The Central Role of Lifestyle for Optimal Ageing:

## Exercise and Nutrition

- Preventing and Treating Physical Frailty
- Attenuating Body Composition Changes of Ageing
- Promoting Psychological Well-being
- Optimising Cognitive Reserve and Capacity across the Lifespan



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The Journal of Nutrition, Health and Aging 29 (2025) 100401

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The Journal of Nutrition, Health and Aging

journal homepage: www.elsevier.com/locate/jnha

Review

### Global consensus on optimal exercise recommendations for enhancing healthy longevity in older adults (ICFSR)

Mikel Izquierdo [a,b,*], Philipe de Souto Barreto [c,d], Hidenori Arai [e], Heike A. Bischoff-Ferrari [f], Eduardo L. Cadore [g], Matteo Cesari [h], Liang-Kung Chen [i], Paul M. Coen [j], Kerry S. Courneya [k], Gustavo Duque [l], Luigi Ferrucci [m], Roger A. Fielding [n], Antonio García-Hermoso [a,b], Luis Miguel Gutiérrez-Robledo [o], Stephen D.R. Harridge [p], Ben Kirk [q], Stephen Kritchevsky [r], Francesco Landi [s,t], Norman Lazarus [p], Teresa Liu-Ambrose [u], Emanuele Marzetti [s,t], Reshma A. Merchant [v,w], John E. Morley [x], Kaisu H. Pitkälä [y], Robinson Ramírez-Vélez [a,b], Leocadio Rodriguez-Mañas [b,z], Yves Rolland [c,d], Jorge G. Ruiz [A], Mikel L. Sáez de Asteasu [a,b], Dennis T. Villareal [B], Debra L. Waters [C,D], Chang Won Won [E], Bruno Vellas [c,d], Maria A. Fiatarone Singh [F]

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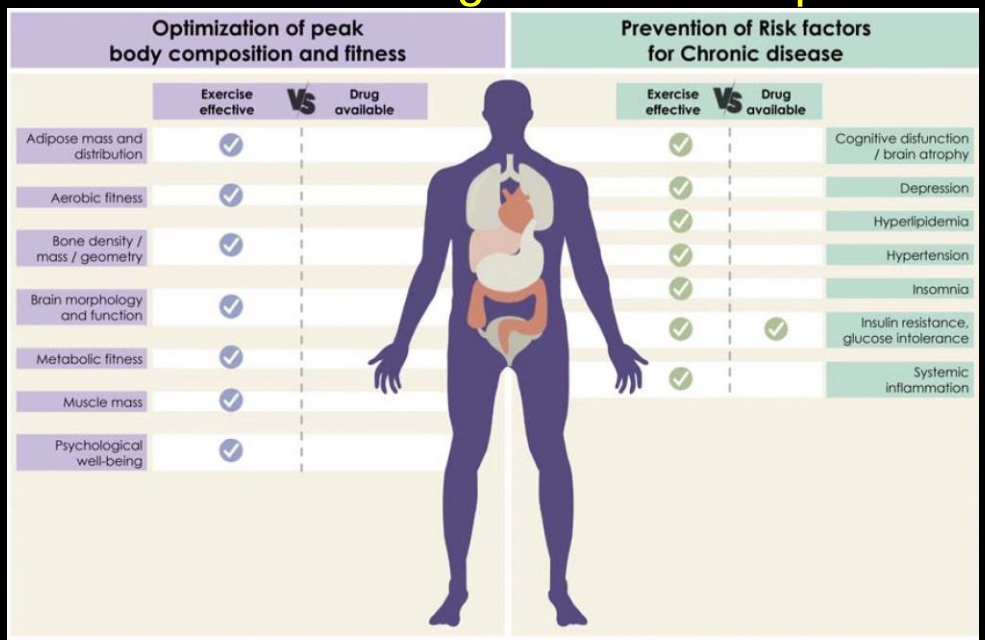
# Exercise throughout the Lifespan

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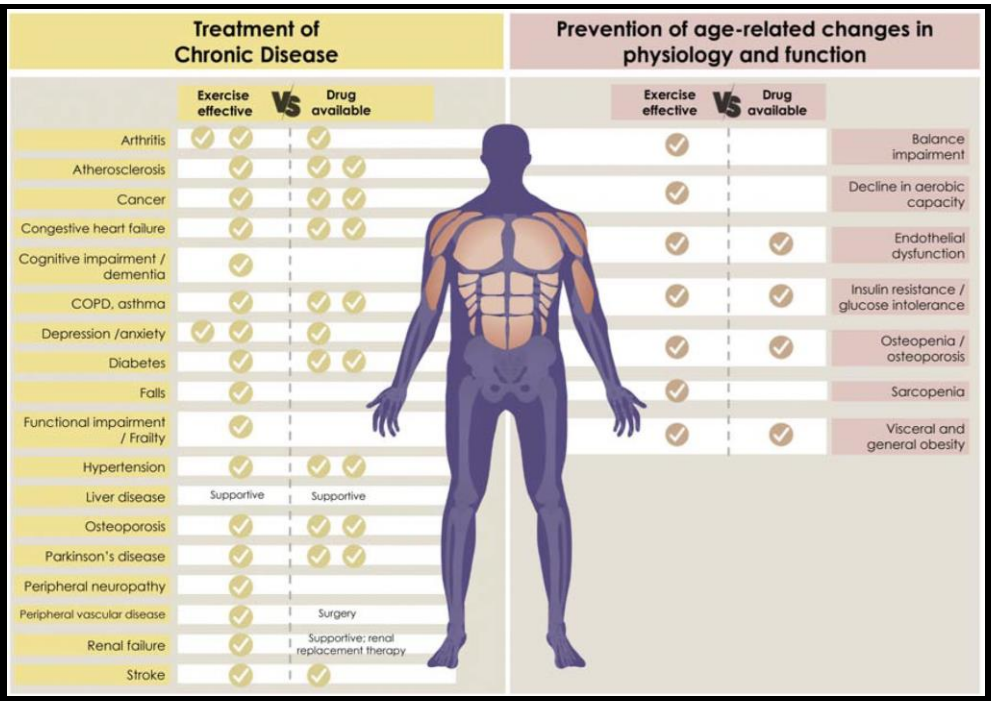


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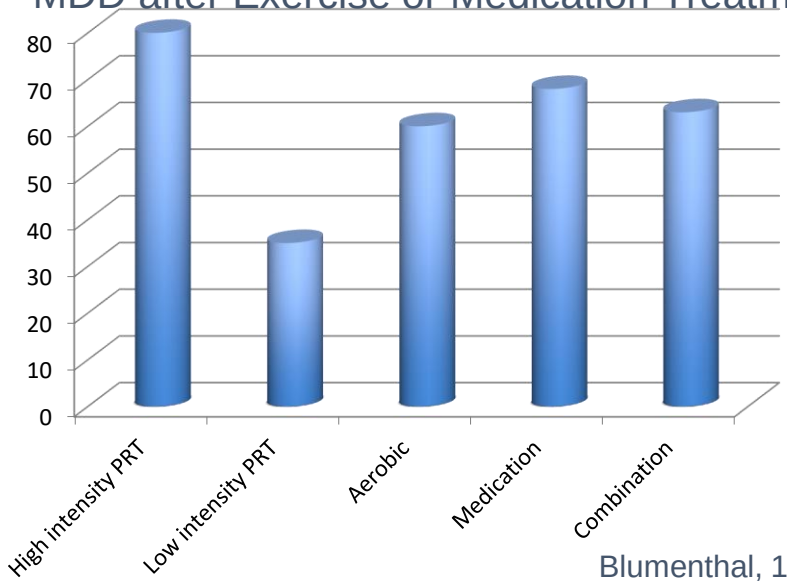
## Relative Change in Depressive Symptoms in Older Adults with MDD after Exercise or Medication Treatment




Blumenthal, 1999; Singh 2005

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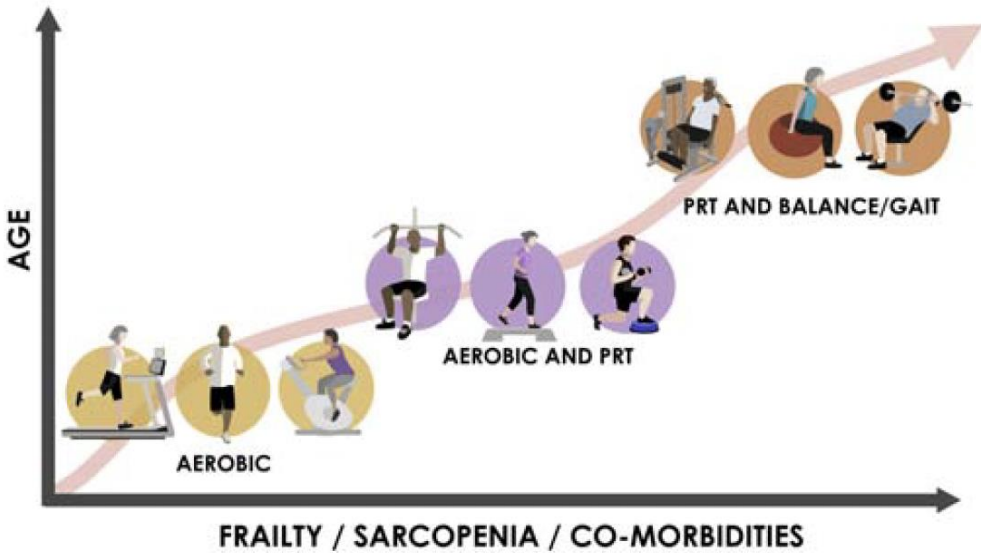
## Optimal Exercise Prescription Changes over Time

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# Exercise for Common Geriatric Syndromes

**Table 4.** Exercise and geriatric syndromes

| Geriatric syndromes | Considerations for the prescription | Recommended exercise modality |
|---|---|---|
| Frailty and Sarcopenia | • Resistance and power training: 2 to 3 sessions per week, combining slower and faster (power training) muscle actions at intensities of 40 – 80 % of 1RM.<br>• Functional exercises e.g., standing from a chair with progressive increases in loading/speed<br>• Balance and gait exercises progressing in complexity: line walking, tandem foot standing, standing on one leg, heel-toe walking. | • Resistance training<br>• Power training<br>• Balance exercises<br>• Gait retraining<br>• Multicomponent exercise |
| Falls/Mobility impairments | • Resistance training aimed to improve muscle strength and power.<br>• Balance and gait exercises progressing in complexity: line walking, tandem foot standing, standing on one leg, heel-toe walking.<br>• Dual task exercises including dual task gait and resistance exercises (serial numbers, naming animals, etc).<br>• Adapted Tai Chi exercises progressing in complexity.<br>• Dance interventions may improve adherence. | • Resistance training<br>• Balance exercises<br>• Gait retraining/dual task training<br>• Multicomponent exercise<br>• Dance interventions<br>• Tai Chi exercises |
| Cognitive impairment | • High-intensity resistance training combined with power training aimed to improve cognitive and functional abilities.<br>• Walking may reduce the risk of dementia.<br>• Dual task exercises may be beneficial to cognitive function.<br>• Use of mirror techniques rather than complex oral instructions. Use of haptic support.<br>• Considerations of emotional aspects such as reassurance, respect, and empathy. | • Walking<br>• Aerobic training<br>• Resistance training<br>• Dual-task training |

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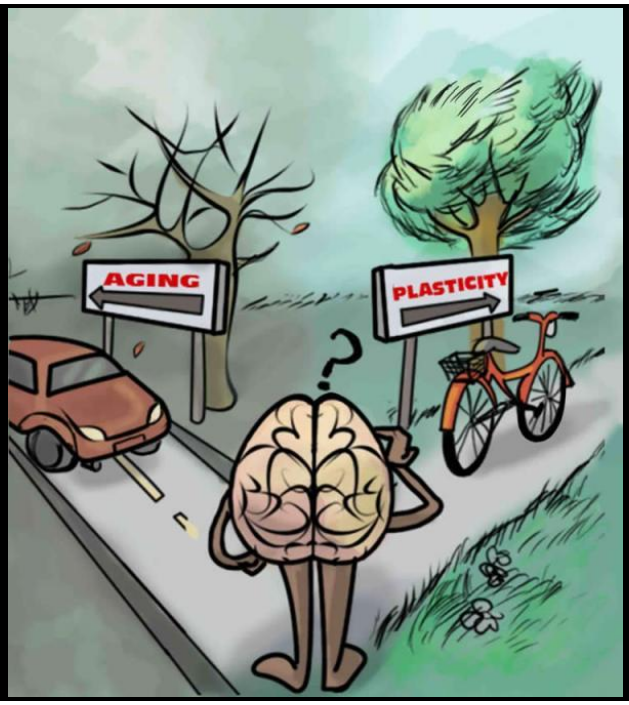
# How does exercise work to improve cognition?

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# Pathways to Cognitive Resilience

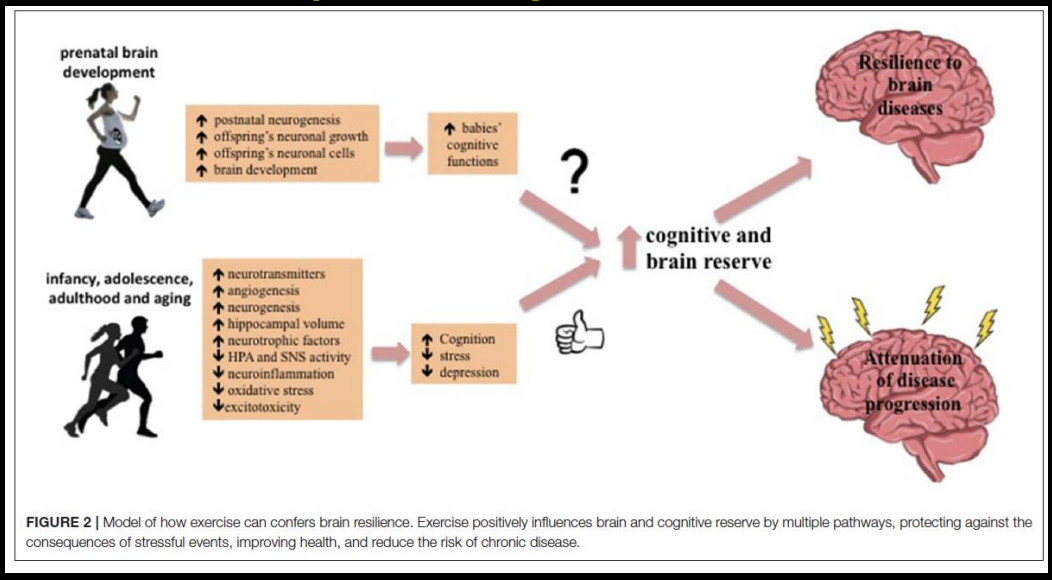


**FIGURE 2 |** Model of how exercise can confers brain resilience. Exercise positively influences brain and cognitive reserve by multiple pathways, protecting against the consequences of stressful events, improving health, and reduce the risk of chronic disease.

Frontiers in Behavioral Neuroscience | www.frontiersin.org 3 January 2021 | Volume 14 | Article 626769

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# Does brain size change with exercise?



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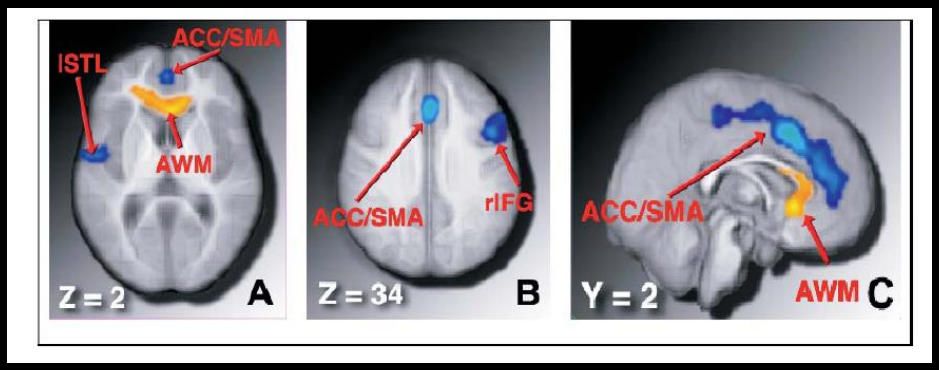


Aerobic Exercise Training Increases Brain Volume in Aging Humans

Stanley J. Colcombe,[1] Kirk I. Erickson,[1] Paige E. Scalf,[1] Jenny S. Kim,[1] Ruchika Prakash,[1] Edward McAuley,[2] Steriani Elavsky,[2] David X. Marquez,[2] Liang Hu,[2] and Arthur F. Kramer[1]

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# Significant benefit of aerobic exercise: attenuates *left* hippocampal volume decline over time

| Outcome | Study name | Hedges's g | Standard error | Variance | Lower limit | Upper limit | Z-Value | p-Value | Total |
|---|---|---|---|---|---|---|---|---|---|
| | | Statistics for each study | | | | | | | |
| left | Brinke et al 2015 | 0.458 | 0.425 | 0.181 | -0.376 | 1.291 | 1.076 | 0.282 | 21 |
| left | Burzynska et al 2017 | 0.343 | 0.185 | 0.034 | -0.018 | 0.705 | 1.861 | 0.063 | 124 |
| left | Erickson et al 2011 | 0.331 | 0.183 | 0.033 | -0.027 | 0.689 | 1.809 | 0.070 | 120 |
| left | Krogh et al 2014 | 0.073 | 0.223 | 0.050 | -0.364 | 0.511 | 0.329 | 0.742 | 79 |
| left | Lin et al 2015 | 0.071 | 0.359 | 0.129 | -0.632 | 0.774 | 0.198 | 0.843 | 30 |
| left | Maas et al 2015 | 0.177 | 0.346 | 0.120 | -0.501 | 0.856 | 0.513 | 0.608 | 32 |
| left | Malchow et al 2015 | -0.026 | 0.314 | 0.098 | -0.641 | 0.589 | -0.082 | 0.935 | 39 |
| left | Niemann et al 2014 | 0.239 | 0.360 | 0.129 | -0.466 | 0.944 | 0.664 | 0.507 | 30 |
| left | Rosano et al 2016 | 0.937 | 0.411 | 0.169 | 0.131 | 1.743 | 2.277 | 0.023 | 26 |
| | | 0.265 | 0.089 | 0.008 | 0.090 | 0.441 | 2.966 | 0.003 | 501 |
| right | Brinke et al 2015 | 0.514 | 0.427 | 0.182 | -0.323 | 1.350 | 1.204 | 0.229 | 21 |
| right | Burzynska et al 2017 | 0.143 | 0.183 | 0.034 | -0.216 | 0.503 | 0.781 | 0.435 | 124 |
| right | Erickson et al 2011 | 0.320 | 0.183 | 0.033 | -0.038 | 0.678 | 1.754 | 0.079 | 120 |
| right | Krogh et al 2014 | -0.031 | 0.223 | 0.050 | -0.468 | 0.406 | -0.140 | 0.888 | 79 |
| right | Lin et al 2015 | -0.022 | 0.358 | 0.129 | -0.724 | 0.681 | -0.061 | 0.951 | 30 |
| right | Maas et al 2015 | 0.003 | 0.345 | 0.119 | -0.673 | 0.680 | 0.010 | 0.992 | 32 |
| right | Malchow et al 2015 | -0.081 | 0.314 | 0.099 | -0.696 | 0.535 | -0.257 | 0.798 | 39 |
| right | Niemann et al 2014 | 0.183 | 0.359 | 0.129 | -0.521 | 0.887 | 0.510 | 0.610 | 30 |
| right | Rosano et al 2016 | 0.667 | 0.401 | 0.161 | -0.119 | 1.453 | 1.663 | 0.096 | 26 |
| | | 0.164 | 0.089 | 0.008 | -0.010 | 0.339 | 1.843 | 0.065 | 501 |

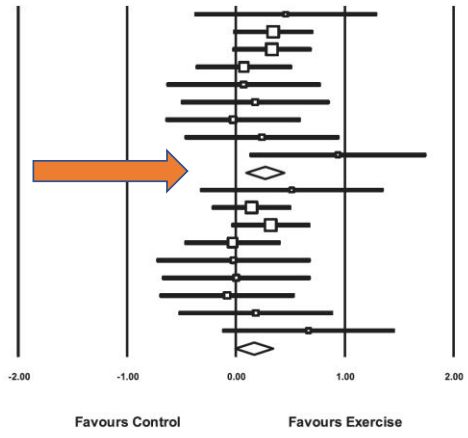


**Fig. 3.** Meta-analyses of unilateral measures across 9 studies with, showing effects of exercise on left and right hippocampal volumes separately. Box size represents study weighting. Diamond represents overall effect size and 95% confidence intervals.

J. Firth et al. NeuroImage 166 (2018) 230–238

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*Arch Neurol*. 2009 November ; 66(11): 1339–1344. doi:10.1001/archneurol.2009.240.

**Association of Muscle Strength with the Risk of Alzheimer's Disease and the Rate of Cognitive Decline in Community-Dwelling Older Persons**

Patricia A. Boyle, PhD[1,2], Aron S. Buchman, MD[1,3], Robert S. Wilson, PhD[1,2,3], Sue E. Leurgans, PhD[1,3], and David A. Bennett, MD[1,3]

## Rush Ageing Study

61% lower risk of dementia over age 80-86 in those with better preservation of muscle strength




**Figure 1.**
Cumulative hazard of developing AD for participants with low (10th percentile, dotted line) versus high muscle strength (90th percentile, solid line).

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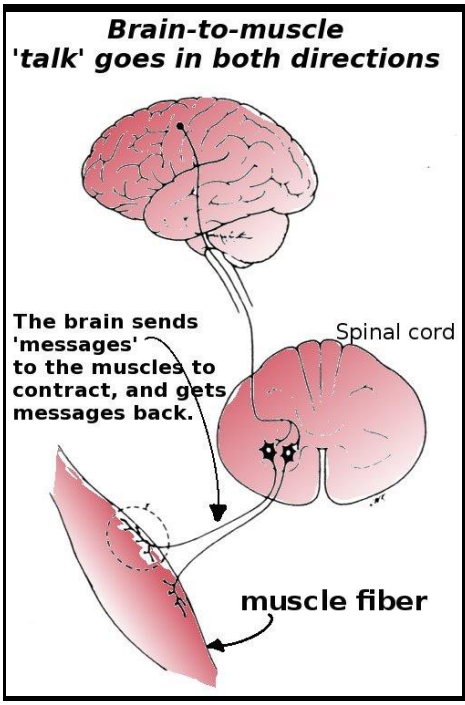
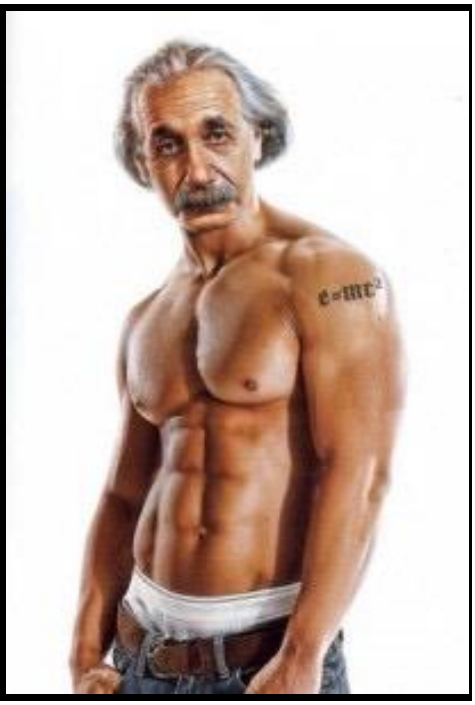



## Cognitive Resilience



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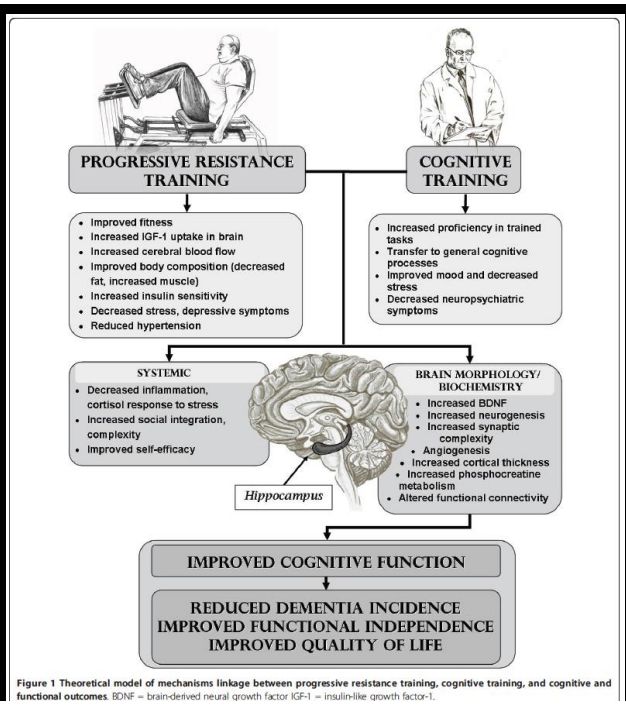
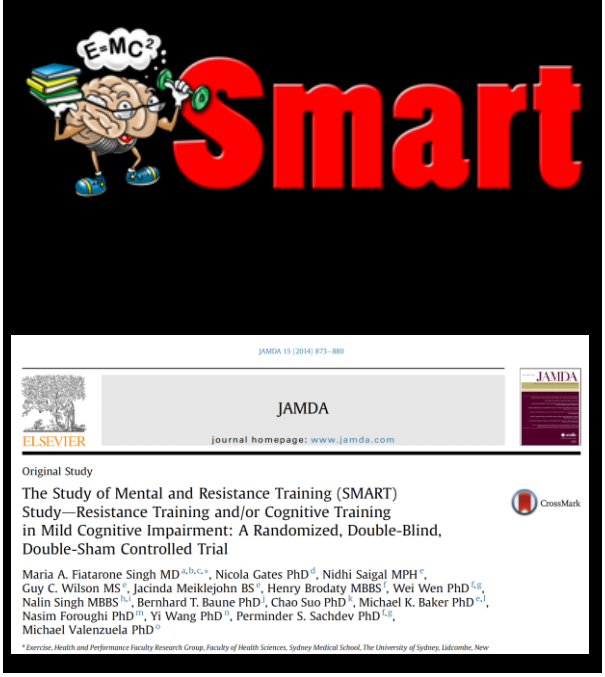



Figure 1 Theoretical model of mechanisms linkage between progressive resistance training, cognitive training, and cognitive and functional outcomes. BDNF = brain-derived neural growth factor IGF-1 = insulin-like growth factor-1.

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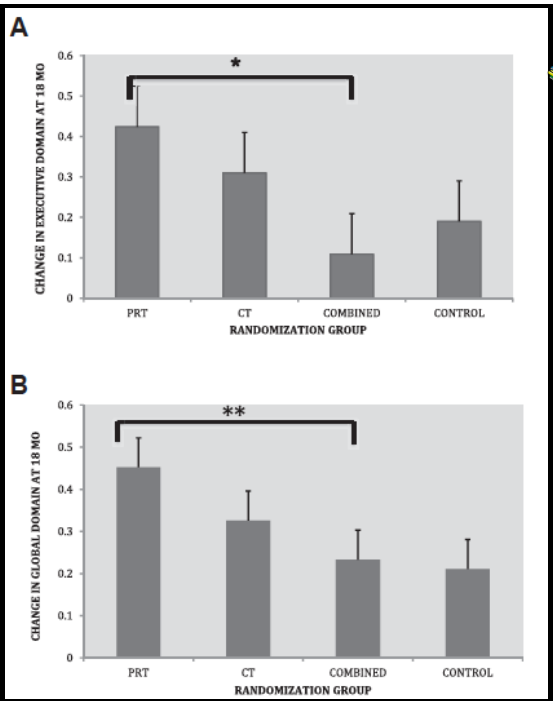



Isolated PRT superior to combined PRT and Cognitive Training or Cog alone for Executive and Global Cognitive Function over 18 months in mild cognitive impairment (MCI)

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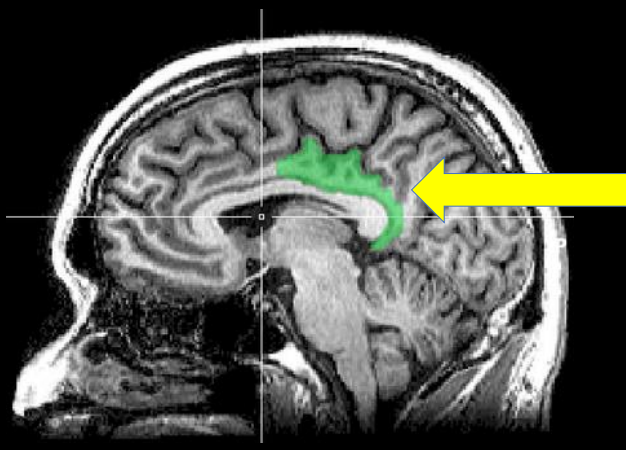
# Posterior Cingulate Cortex

Reduced Function of the PCC is an early sign of dementia, and is often present before a clinical diagnosis is made.

- Neural substrate for empathy, forgiveness, emotional memory retrieval, awareness of self.
- Decreased size of posterior cingulate cortex related to new memory performance decline.



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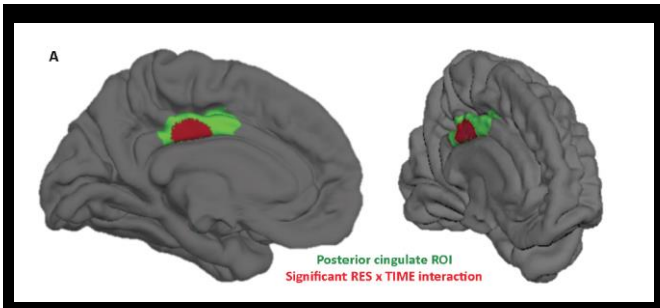
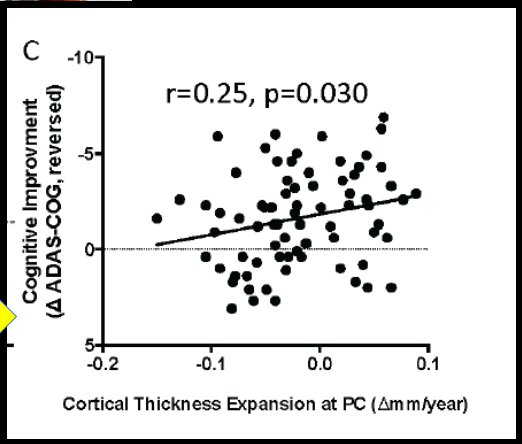




- PCC expansion after PRT compared to sham exercise
- Related to improvement in Global cognition: ADAS-Cog




Suo. C, Molecular Psychiatry 2016

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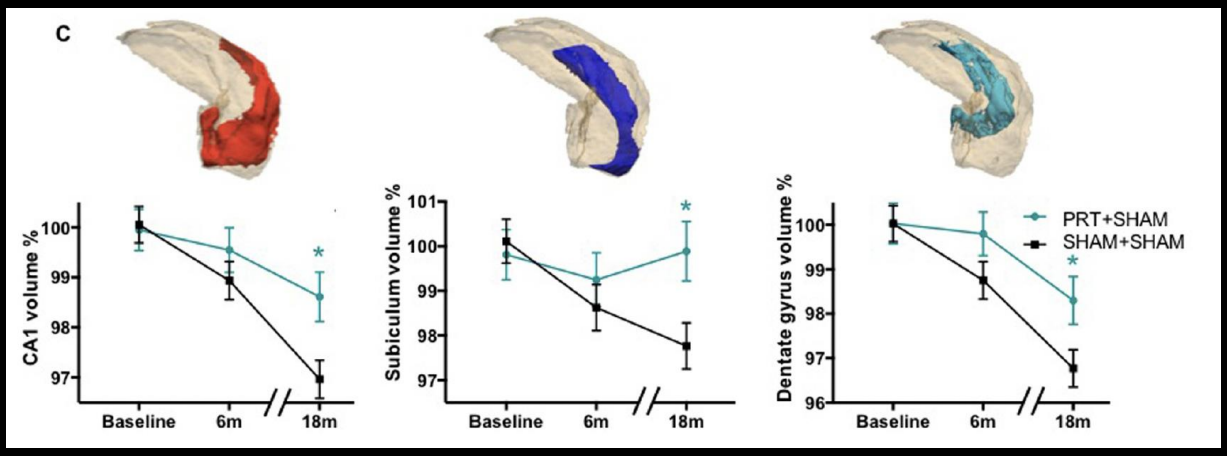
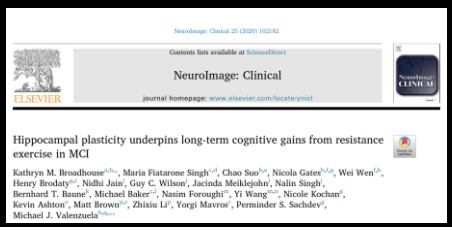


NeuroImage: Clinical 25 (2020) 102182

Contents lists available at ScienceDirect

NeuroImage: Clinical

journal homepage: www.elsevier.com/locate/ynicl

Hippocampal plasticity underpins long-term cognitive gains from resistance exercise in MCI

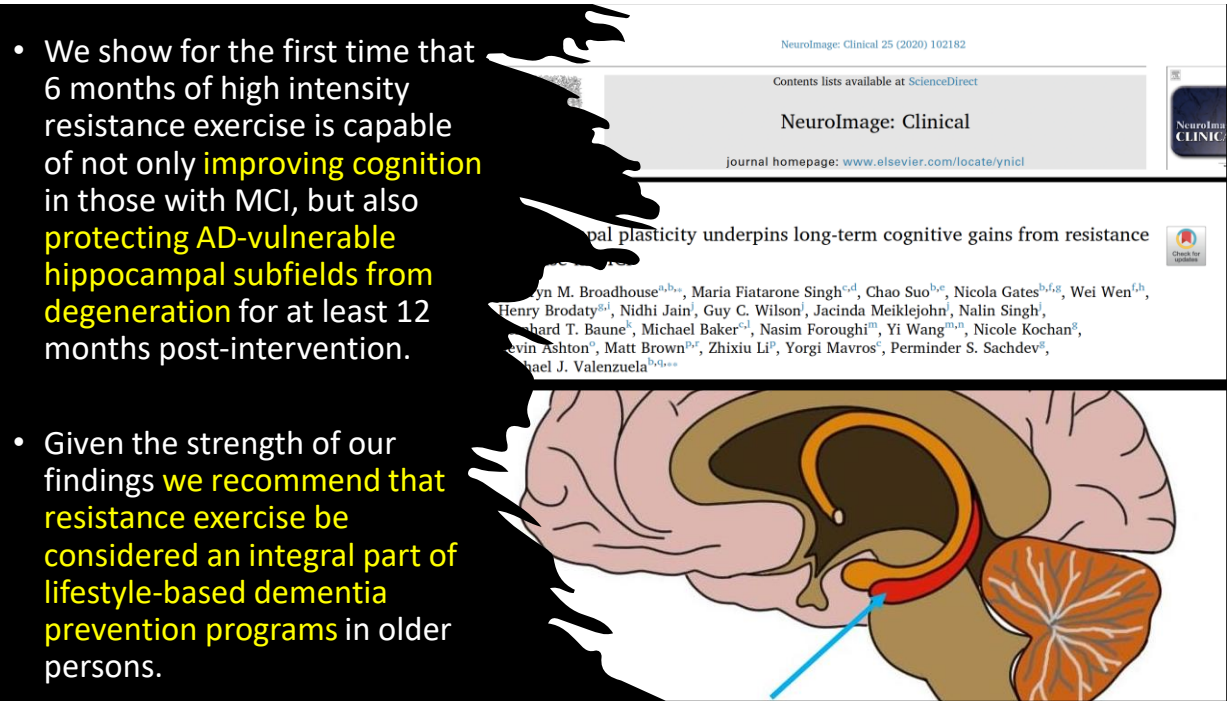
Kathryn M. Broadhouse[a,b,*], Maria Fiatarone Singh[c,d], Chao Suo[b,e], Nicola Gates[b,f,g], Wei Wen[f,h], Henry Brodaty[g,i], Nidhi Jain[j], Guy C. Wilson[j], Jacinda Meiklejohn[j], Nalin Singh[j], Bernhard T. Baune[k], Michael Baker[c,l], Nasim Foroughi[m], Yi Wang[m,n], Nicole Kochan[g], Kevin Ashton[o], Matt Brown[p,r], Zhixiu Li[p], Yorgi Mavros[c], Perminder S. Sachdev[g], Michael J. Valenzuela[b,q,**]

## Long-term Preservation of Hippocampus by PRT

CA1 is strongly implicated in episodic memory and spatial navigation. Similarly, the subiculum has been heavily implicated in mnemonic consolidation processes.

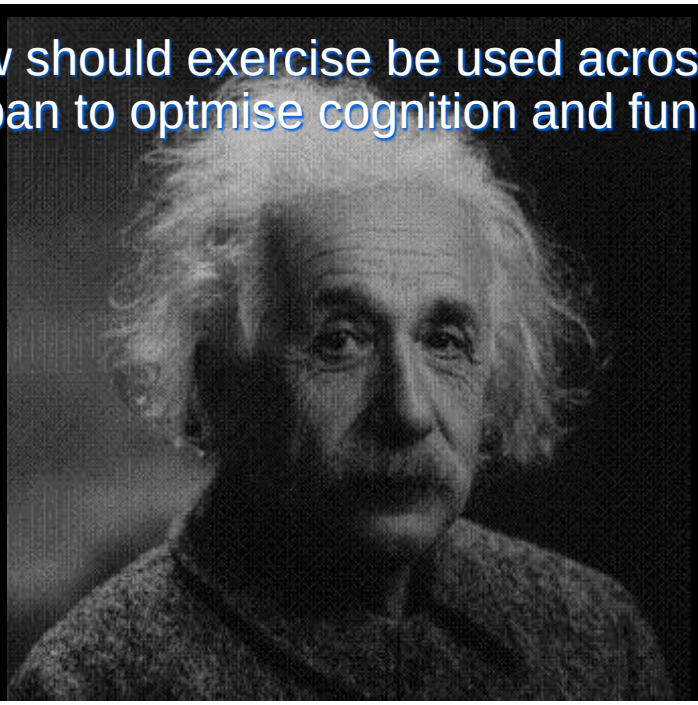
41

- We show for the first time that 6 months of high intensity resistance exercise is capable of not only improving cognition in those with MCI, but also protecting AD-vulnerable hippocampal subfields from degeneration for at least 12 months post-intervention.
- Given the strength of our findings we recommend that resistance exercise be considered an integral part of lifestyle-based dementia prevention programs in older persons.



42

## How should exercise be used across the lifespan to optmise cognition and function?



43

## What Modality of Exercise?

- Aerobic exercise/physical activity/play
- Resistance exercise
- Cognitively complex exercise
  - Tai Chi
  - Balance/coordination
  - Biofeedback
  - Dual tasking
  - Games of skill (tennis, basketball, etc)

44

**Recommendation 2: We Strongly Recommend that Older Adults with Frailty be Referred to a Progressive, Individualized Physical Activity Program that Contains a Resistance Training Component**

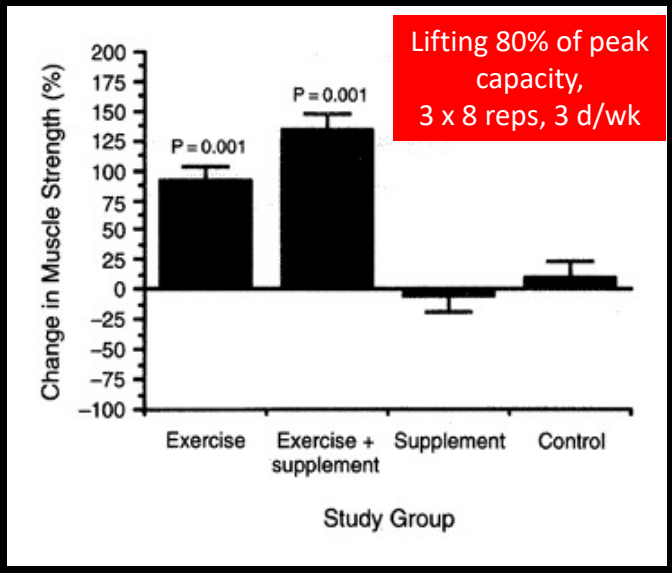
https://www.jamda.com/article/S1525-8610(17)30241-4/fulltext

45

Mean (±SE) Changes in Muscle Strength after Exercise, Nutritional Supplementation, Neither, or Both in 100 Frail Elders

High intensity PRT for 10 wks increased LE strength by >100% in frail nursing home residents

Multi-nutrient energy, protein, micronutrient supplement not significantly additive to PRT for strength gains nor effective by itself




Fiatarone MA et al. N Engl J Med 1994;330:1769-1775.

The NEW ENGLAND JOURNAL of MEDICINE

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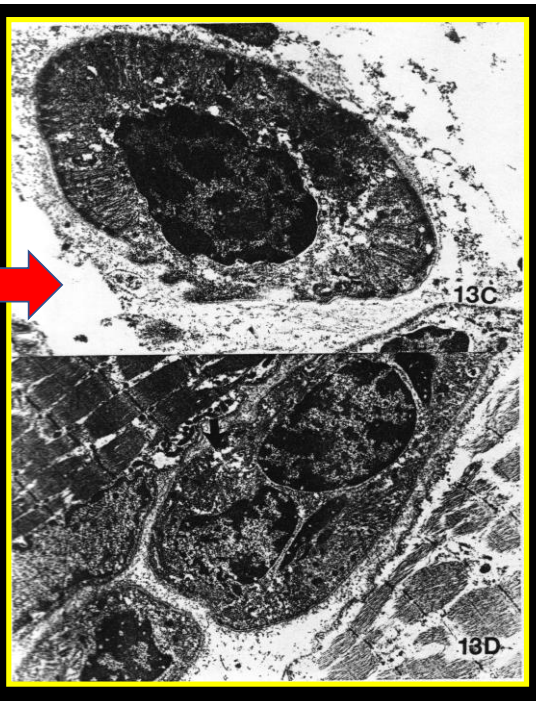
Baby muscle cell

Satellite cell activation, myoblasts and myotube appearance, increased fiber size, >100% increase in strength after only 10 weeks of weight-lifting in **FICSIT** Study

Fiatarone et al, NEJM 1994; AJP 1999

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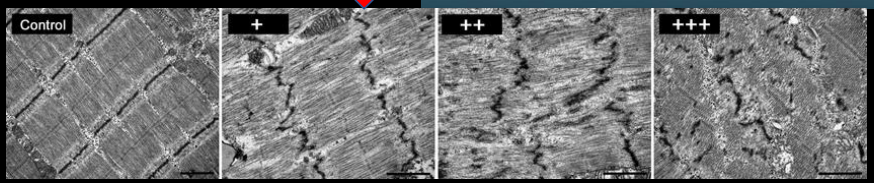
# That which doth not kill me…

Eccentric muscle *damage* leads to repair, muscle hypertrophy and strength gain

Measured exposure to stress, rather than avoiding it, led to adaptation and regeneration

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# The Resistance Training Prescription

## Intensity:

The **MOST IMPORTANT** element of the PRT exercise prescription

Work between 15 and 18 on the Exercise Intensity Scale

**HARD TO VERY HARD**

- Judge intensity on the first repetition of the first set
- As strength increases, increase the weight used to keep the intensity the same
- If you have the ability to measure strength, train at about 80% of the 1-Repetition Maximum (1RM)

| STRENGTH TRAINING RPE SCALE (Rating of Perceived Exertion) | |
|---|---|
| 6 | Light/Easy |
| 7 | |
| 8 | Easy to lift. Can perform 15 repetitions or more without fatiguing |
| 9 | |
| 10 | |
| 11 | Moderate/Somewhat Hard |
| 12 | |
| 13 | Feels somewhat heavy. Can lift between 11 to 15 repetitions, but no more |
| 14 | |
| 15 | Vigorous/Very Hard |
| 16 | Very heavy. Can perform no more than 10 repetitions |
| 17 | |
| 18 | |
| 19 | MAXIMAL |
| 20 | Extremely heavy. Can perform no more than 3 repetitions |

49


Sports Med (2015) 45:1693–1720
DOI 10.1007/s40279-015-0385-9

CrossMark

SYSTEMATIC REVIEW

**Dose–Response Relationships of Resistance Training in Healthy Old Adults: A Systematic Review and Meta-Analysis**

Ron Borde[1] · Tibor Hortobágyi[2,3] · Urs Granacher[1]

PRT prescriptive factors optimizing strength changes in older adults:

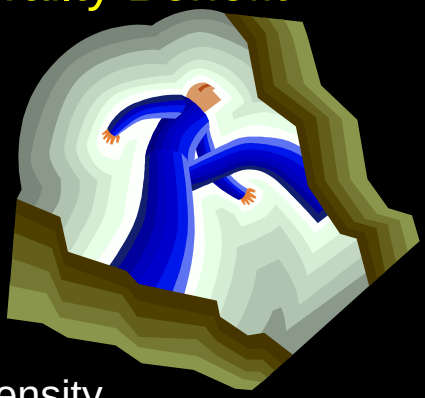
- Longer training period ( >1 yr)
- Higher Intensity [70–80 peak (1RM)]
- Slow movements
- Rest between sets
- Session frequency (2-3 sessions per week)
- Training volume (2-3sets per exercise, 7-9 reps per set)

PLUS:
Prescribe using percentage of 1RM not just perceived exertion whenever possible


Effectiveness of Multimodal Training on Functional Capacity in Frail Older People: A Meta-Analysis of Randomized Controlled Trials

50

# Dose of Exercise for Cognitive/Frailty Benefit



- Frequency
  - 3-7 days/wk aerobic
  - 2-3 d/week resistance training
- Volume
  - 45-60 min/session
- Intensity/Progression
  - Fitness outcomes proportional to intensity
  - Fitness outcomes proportional to brain/cognitive changes
  - Therefore, highest intensity feasible in given cohort

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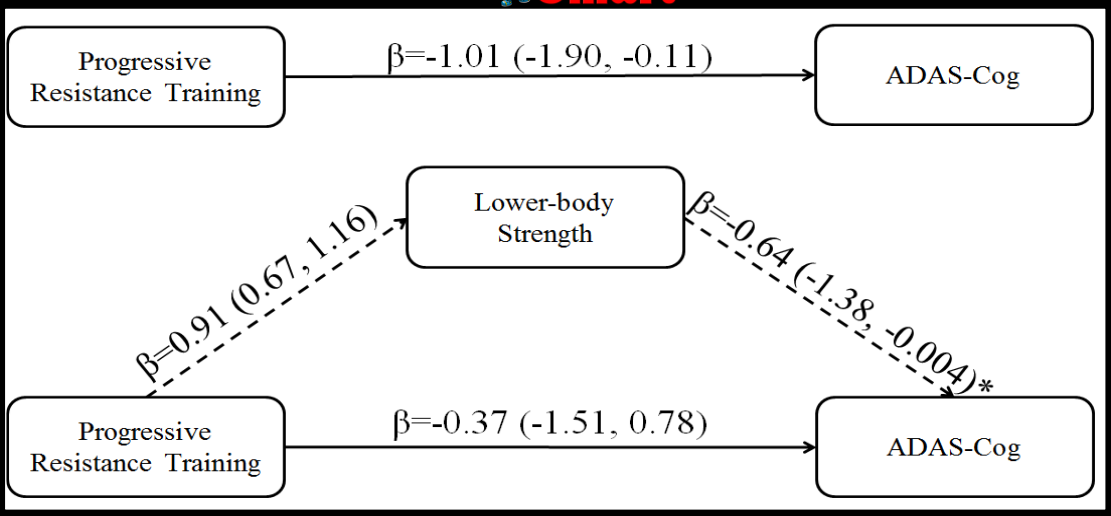
# 63% of cognitive benefits of PRT mediated by *strength gains* in Smart




Mavros, JAGS 2017

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# Targeting *both* Sarcopenia and Obesity to address Metabolic Syndrome/Inflammation and Brain/Frailty pathology

Include Aerobic and Resistance Exercise and Healthy dietary pattern:

- Higher green leafy vegetables/legumes/berries
- Energy balance
- Higher protein from vegetable sources/fish
- Higher fibre/whole grains/nuts
- Extra virgin olive oil as source of fat

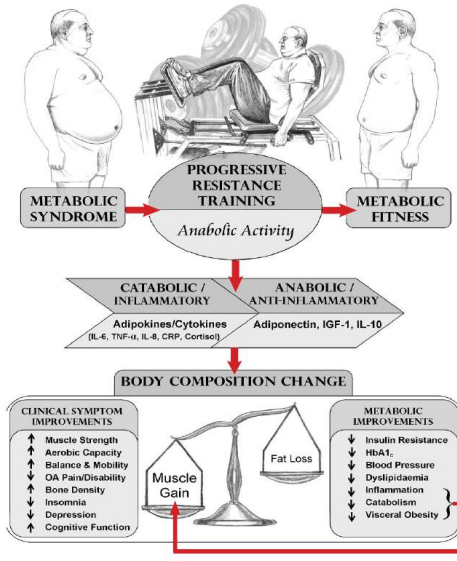


Figure 2 : Mechanism and potential benefits of progressive resistance training in type 2 diabetes

CRP= C-reactive protein
IGF-1= Insulin-like Growth Factor 1
IL= Interleukin
OA= Osteoarthritis
TNF= Tumour necrosis factor

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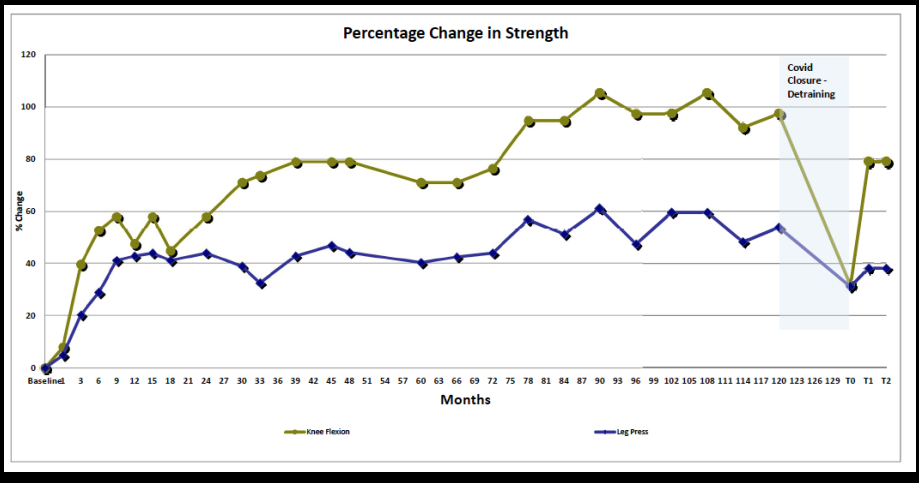
## Sylvia

Training at Centre for Strong Medicine for approx. 11 years
Body weight stable 72.9kg
COVID detraining period 7 months in 2020; Now re-training




55

## What *not* to prescribe for dementia or frailty

- Stretching/flexibility in isolation
- Seated calisthenics
- Toning/range of motion
- Gentle exercise class
- Balance exercises in isolation (without dual tasking)
- Very low intensity aerobic exercise/walking
- Low intensity weight-lifting exercise

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# Cognitive health in Older Adults

Optimise social engagement, functional independence, prevent/treat stroke, AD, PD, CVD, T2D, malnutrition, sarcopenia, frailty, depression

- Address polypharmacy
- High intensity resistance training
- Moderate intensity aerobic exercise; higher intensity if feasible
- Balance training/dual tasking
- Socialisation/eat in company
- Sleep hygiene
- Maintain caregiving roles
- Med/Mind Dietary Pattern
- Avoid weight loss/malnutrition
- Altruistic volunteering
- Correct hearing and vision losses
- Caregiver/patient dyad
- Counseling for bereavement/illness/loss
- Treat HTN, Stroke risk
- Cognitive Training

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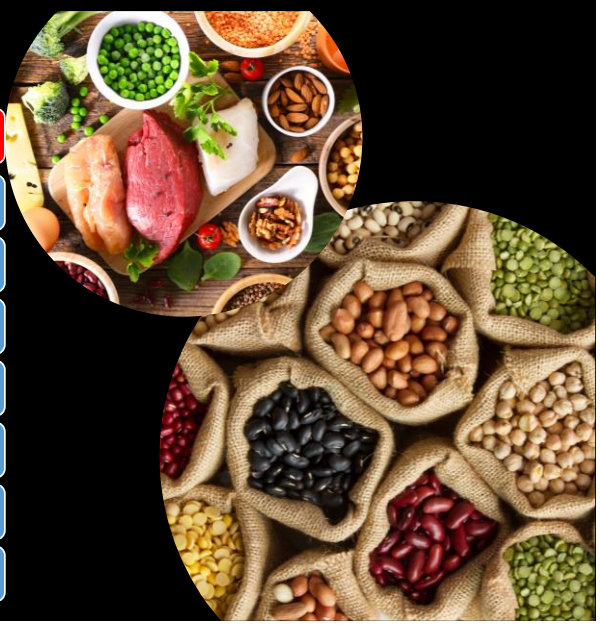
# Nutritional Requirements for Physical and Cognitive Function

## Protein

Low protein intake increases the risk of:

- Cognitive and Physical Frailty
- Sarcopenia
- Weight loss
- Hip fractures
- Skin fragility
- Impaired wound healing
- Impaired immune function



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Adequate nutritional intake can prevent comorbidities such as chronic diseases, impaired immune function, and frailty, cognitive decline.

The capacity to consume the adequate quality and quantity of food is influenced by different factors including food preparation, preference, and the eating process.

Aged-related changes in nutrient digestion, absorption, and metabolism promote modifications in dietary requirements of macro and micronutrients.

Energy needs in older adults are lower. However, the demands for most vitamins, mineral and trace elements are not. Means **NUTRIENT DENSITY IS KEY to adequate nutrition.**

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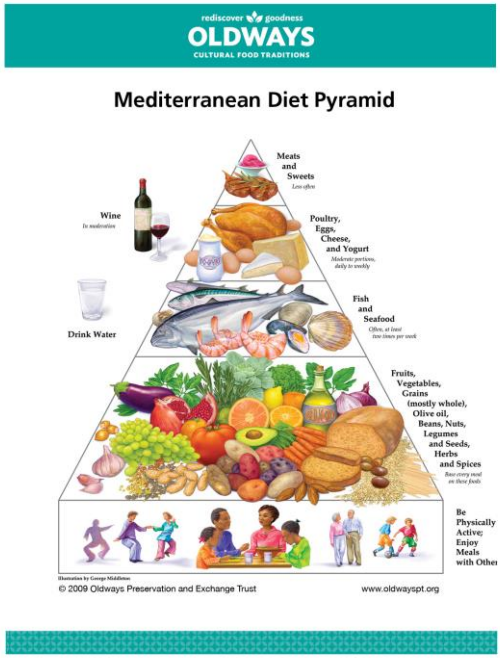
# Mediterranean Diet:

Fruits, vegetables
Whole grains, nuts
Mainly plant-based proteins
High fibre content
EVOO as source of fat
Rich antioxidant/anti-inflammatory components
High in micronutrients
Minimal 'discretionary'/processed food

Social eating, growing herbs/vegetables
Physical activity
Moderate alcohol
Water instead of soda/juice

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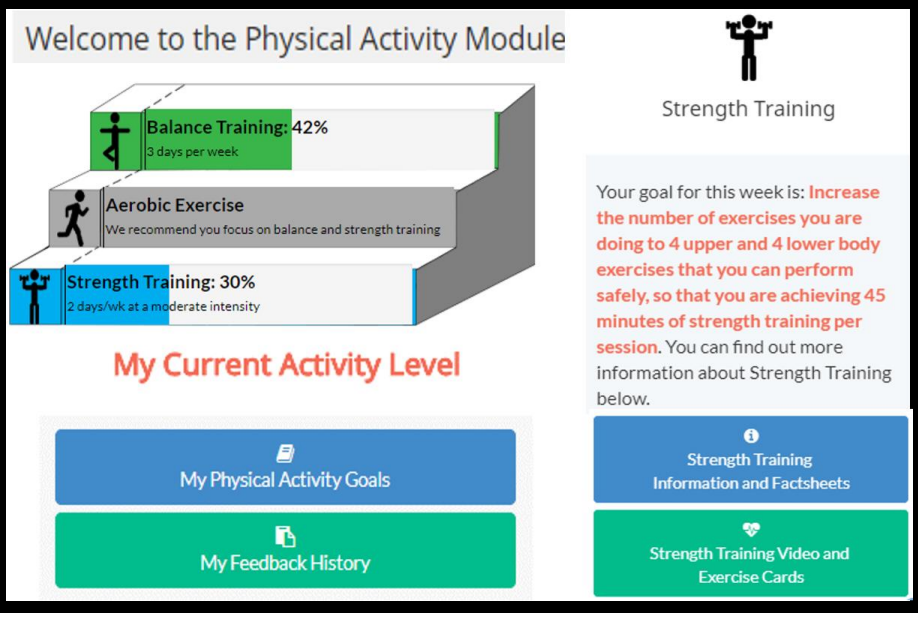
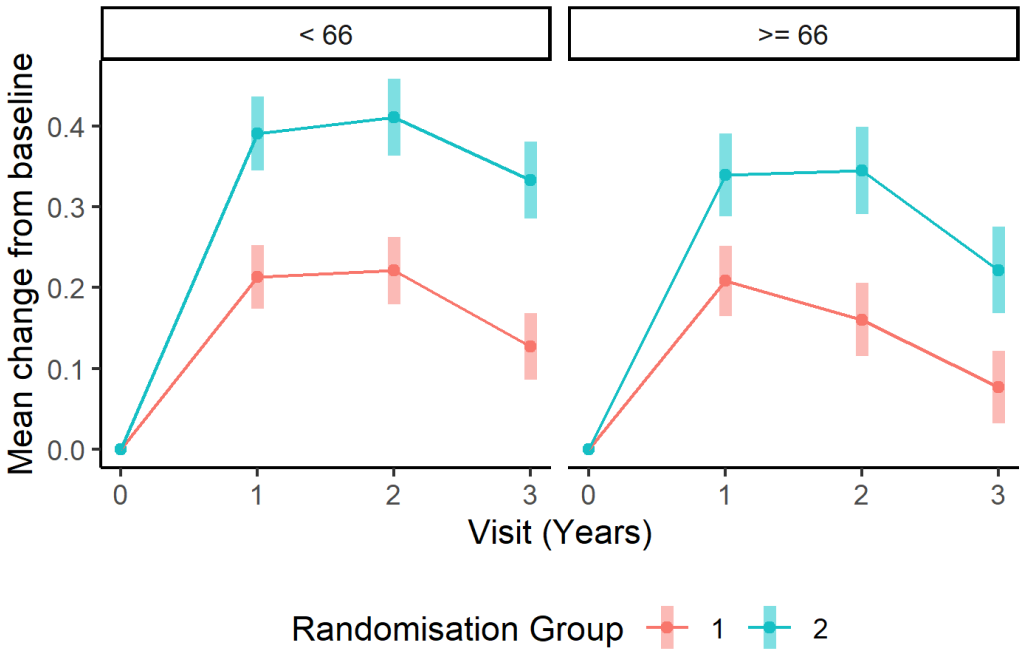
# Maintain Your Brain: Physical Activity Module




62




63

## What is common across geriatric syndromes of sarcopenia, frailty, disability, MCI, dementia, osteoporosis, and Lewy Body Disease ?

- Deconditioning, weight loss, falls, malnutrition, cognitive impairment/delirium and polypharmacy are common factors in the etiology/progression of these conditions
- Requires a comprehensive assessment strategy to maximise treatment efficacy
- A large portion of these contributors are significantly amenable to robust, comprehensive intervention with anabolic +/- aerobic exercise as a foundation, adequate nutrition and drug optimisation.

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# Exercise Staging for Frailty/Dementia

Exercise progression for frailty/falls risk follows the

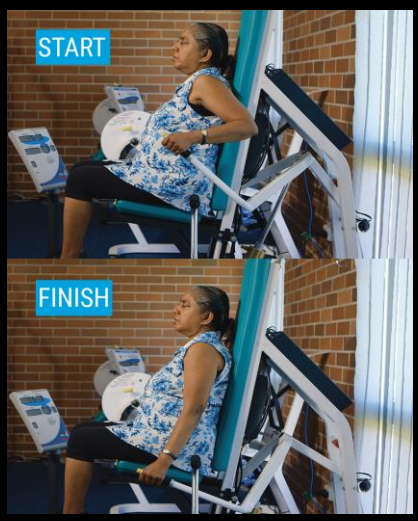
## Get Up, Stay Up, Move

rubric.

*1. First, clients must have adequate strength to stand up. This includes triceps as well as LE extensor strength.*

*2. Next, they need balance that allows them to move without falling.*

*3. When strength and balance are sufficient, ambulatory aerobic exercise can proceed safely.*

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# Get up…Stay up…Move

**TABLE: Important Training Muscles for Older Adults**

| Get Up | Stay Up | Move |
|---|---|---|
| Triceps brachii | Rectus abdominus | Tibialis anterior |
| Gluteus maximus | Erector spinae | Hip flexors |
| Quadriceps | Hip abductors | |

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# Exercise Staging

Exercise progression for frailty/falls risk follows the Get Up, Stay Up, Move rubric.

*Someone with stable gait should be encouraged to practice functional movements that challenge neuromotor skills, such as walking up and down stairs or maneuvering around objects.*

*Clients who can handle these tasks easily can progress to standard cardiorespiratory training, such as walking/hiking/jogging (depending on presence of OA, pain or other MSK conditions).*

*If possible, weight-bearing modalities are preferable to cycling or swimming because they target balance, ambulation, and bone health better than non–weight-bearing exercises.*

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# Putting it all together in clients with complex co-morbidity

Assess all issues relevant to your exercise prescription and likely adoption


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## Medications relevant to exercise

| Drug Category | Concern/Protocol |
|---|---|
| ❑ Insulin  | ❑ Ensure meal or snack eaten before testing/available during testing<br>❑ Watch for hypoglycemic symptoms/signs<br>❑ Have glucometer available |
| ❑ Beta-blockers | ❑ Watch for bradycardia (HR <50) or signs/symptoms such as dizziness<br>❑ Beta-blockers may cause or exacerbate hypotension during exercise; measure BPboth seated and standing before standing exercise starts<br>❑ Use Borg Scale to assess aerobic exertion rather than expected age-related peak HR |
| ❑ Anti-anginal medications | ❑ Know typical angina pattern<br>❑ Have NTG available for all testing sessions if prescribed<br>❑ Question about change in angina pattern before all maximal testing |
| ❑ Bronchodilators/inhalers | ❑ Advise use of inhalers 20 min before exercise testing session<br>❑ Keep inhalers available at all testing sessions<br>❑ Assess for presence of wheezing before and during testing |
| ❑ Chronic oral or inhaled corticosteroids | ❑ Increased requirements for both calcium and vitamin D due to sequestration of vitamin D in abdominal fat and decreased calcium absorption; may cause muscle weakness and increase risk of osteoporotic fracture |
| ❑ Drugs for Parkinson's disease | ❑ Exercise should be timed for "on-period" if fluctuations in motor symptoms/cognition are present |
| ❑ Analgesic medications | ❑ Take 15-30 min before exercise if needed for pain (paracetamol, NSAIDs)<br>❑ Avoid opioid medications if possible close to exercise sessions due to interference with alertness/cognition |
| ❑ Cancer chemotherapy/immunotherapy | ❑ Watch for peripheral neuropathy; requires balance training; fall risk increased<br>❑ May need to limit any weight-bearing forms of exercise and substitute seated exercise |

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# Case Study: Mrs. P

Mrs. P is a 78-yr old woman with a history of autoimmune vasculitis leading to Stage 4 renal impairment (GFR 25) , CAD, s/p MI and 4 stents 8 mo ago, pulmonary embolism (PE) during MI admission, CHF, Hyperlipidemia, HTN, Parkinson's Disease, osteoporosis, recurrent falls including clavicle fx 6 mo ago, RC tear, Mild Cognitive Impairment (MoCA 19/30), depression, constipation, anorexia, vertigo, incontinence. She returned to the clinic where she had been previously training 2 weeks after a fall while brushing her teeth. Had ED admission with neg CT scans for fractures, no MI or recurrent PE found.

MEDS:

Medications:
Prednisone 10mg daily
Apixaban 2.5mg BD
Entresto 12/13mg BD
Nebivolol 1.25mg OD
Panadol osteo
Telmisartan 40mg OD
levodopa + carbidopa 50/12.5mg TDS
Colecalciferol 1000IU OD
Pantoprazole 40mg mane
Melatonin 2mg nocte
Stemetil TDS

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# Mrs. P

1. What assessments are needed? (by AEP or MD)
2. How would assessment results change management plan?
3. What conditions are present that would benefit from exercise, which modality, how should these be prescribed?
4. What should be avoided completely in the exercise prescription?
5. She is only willing to come to clinic one day per week. What should the goals be for your time with her?


72

Medications:
Prednisone 10mg daily
Apixaban 2.5mg BD
Entresto 12/13mg BD
Nebivolol 1.25mg OD
Panadol osteo
Telmisartan 40mg OD
levodopa + carbidopa 50/12.5mg TDS
Colecalciferol 1000IU OD
Pantoprazole 40mg mane
Melatonin 2mg nocte
Stemetil TDS

# Drug-Drug, Drug-Nutrient, Drug-Disease, Drug Exercise, Exercise-disease Interactions

- Drug-drug:
  - Stemetil (prochloperazine) and Levodopa
  - Entresto (sacubitril (neprilysin inhibitor and valsartan) and Telmisartan- 2 ARBs
  - Stemetil and Melatonin
- Drug-disease:
  - Stemetil and Parkinson's Disease
  - Stemetil and Mild Cognitive Impairment
  - Entresto, Nebivolol, Telmisartan, Levodopa and Falls/Vertigo
  - Prednisone and Osteoporosis
  - Entresto and incontinence
- Drug-nutrient:
  - Prednisone and Calcium/vitamin D/protein
  - Pantoprazole and B12, B6, folate, Ca, Mg, Zinc, Iron
- Drug-exercise:
  - Apixaban
  - Prednisone
  - Nebivolol
  - Stemetil
  - Telmisartsn/Entresto

## Conditions requiring exercise:

- PD
- Osteoporosis
- Sarcopenia
- Frailty
- CHF
- CRF
- HTN
- CAD
- MCI
- Falls
- RC disease
- Anorexia/wt loss/malnutrition
- Orthostasis
- Depression

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# Conditions requiring exercise:

| Disease State | Evidence-based Exercise | Feasibilty/Staging |
|---|---|---|
| PD | PRT/Aerobic/TM/Dance | |
| Osteoporosis Sarcopenia | PRT/Power | |
| CHF | Aerobic/PRT/combined | |
| CRF | Aerobic/PRT/combined | |
| HTN | PRT/Aerobic/Isometric RT | |
| CAD | Aerobic/PRT/combined | |
| MCI | Aerobic/ PRT/dual tasking | |
| Falls/Frailty | PRT and Balance | |
| RC tear | Shoulder Rehab PRT | |
| Anorexia/wt loss | PRT | |
| Orthostatic symptoms | Balance/Plantar flexion | |
| Depression | PRT/Aerobic/Combined | |
| Incontinence | Pelvic floor PRT/PRT/Balance | |

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# Staging the prescription:

| Disease State | Evidence-based Exercise | Feasibilty/Staging |
|---|---|---|
| PD | PRT/Aerobic/TM/Dance | PRT |
| Osteoporosis Sarcopenia | PRT/Power | PRT, no forward flexion |
| CHF | Aerobic/PRT/combined | PRT |
| CRF | Aerobic/PRT/combined | PRT |
| HTN | PRT/Aerobic/Isometric RT | - |
| CAD | Aerobic/PRT/combined | PRT |
| MCI | Aerobic/ PRT/dual tasking | PRT |
| Falls/Frailty | PRT and Balance | PRT and Balance |
| RC tear | Shoulder Rehab PRT | Shoulder Rehab PRT/Posture |
| Anorexia/wt loss | PRT | PRT |
| Orthostatic symptoms | Balance/Plantar flexion | Balance/Plantar flexion |
| Depression | PRT/Aerobic/Combined | PRT |
| Incontinence | Pelvic floor PRT/PRT/Balance | Pelvic floor PRT/PRT/Balance |

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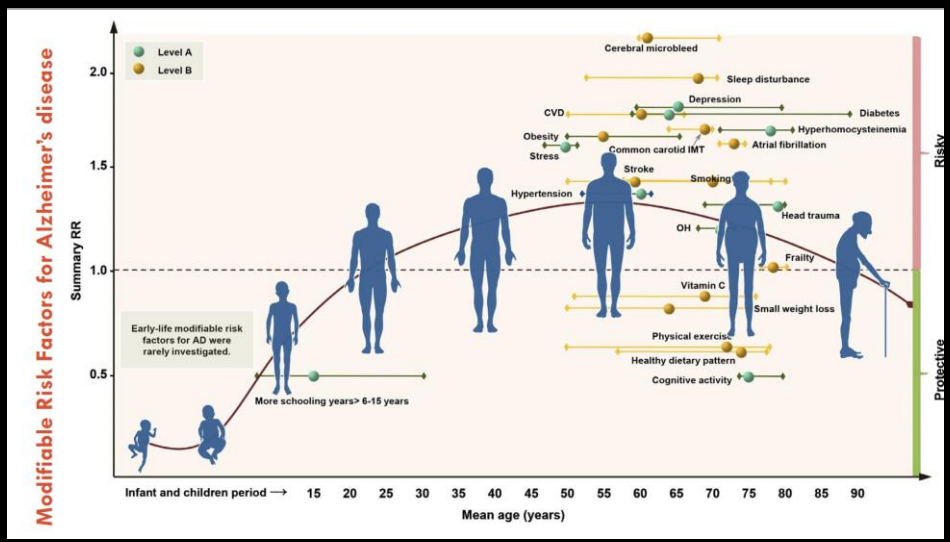
# Optimal Exercise and Nutrition Should Start *in utero* and Continue throughout Life




The older you are- the more ANABOLIC and Anti-inflammatory influences must outweigh CATABOLIC and Inflammatory Ones for Optimal Health and Function

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## What *not* to prescribe for physical or cognitive frailty

- Stretching/Flexibility in isolation
- Seated calisthenics
- Toning/range of motion
- Gentle exercise class
- Balance exercises in isolation
- Low intensity aerobic exercise/walking
- Low intensity weight-lifting exercise


…or virtually anything else!

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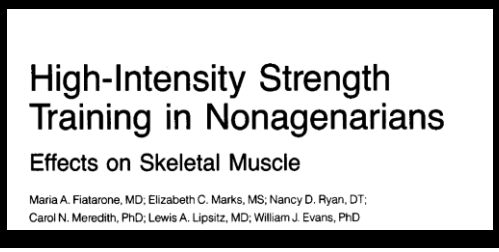
## *Frailty* is not a contraindication to robust exercise. Rather, it is one of the most important reasons to prescribe it.

Maria A. Fiatarone, MD
First Lecture
Harvard Division on Aging
1988

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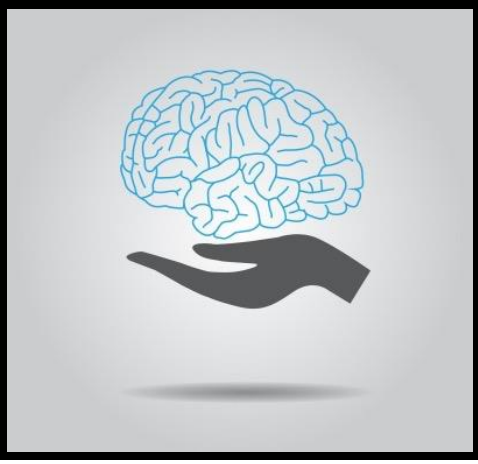
## Keep in mind individual preferences and need for life-long participation



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## Polypharmacy, malnutrition and immobility superimposed on Lewy Body Dementia: targeting all factors amenable to intervention is key to optimisation of cognition and function

Inskip M, et al. BMJ Case Rep 2020;13:e231336. doi:10.1136/bcr-2019-231336

80

# Regaining mobility and function

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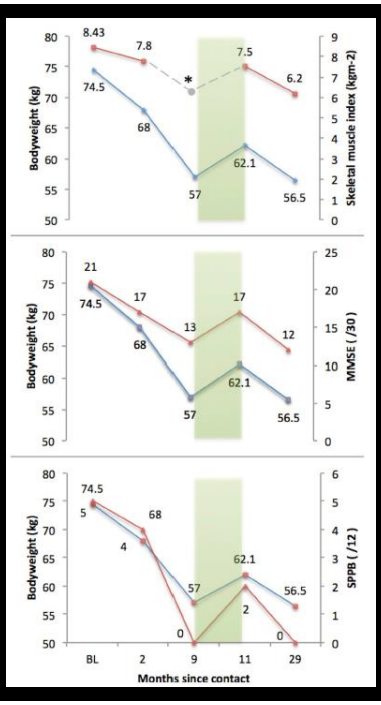
# Treating sarcopenia, frailty, undernutrition, cognitive decline, and mobility impairment together

- Cognitive/functional changes parallel weight loss and regain
- Improvements with frailty intervention of anabolic exercise, nutrition, and deprescribing in: weight, muscle mass, cognition, mobility




Inskip M, et al. BMJ Case Rep 2020;13:e231336. doi:10.1136/bcr-2019-231336

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# What Next?


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# Strength and Power Training in Acute/Geriatric Hospital Settings

JAMA Internal Medicine | Original Investigation

Effect of Exercise Intervention on Functional Decline in Very Elderly Patients During Acute Hospitalization
A Randomized Clinical Trial

Nicolás Martínez-Velilla, PhD, MD; Álvaro Casas-Herrero, PhD, MD; Fabricio Zambom-Ferraresi, PhD; Mikel López Sáez de Asteasu, MSc; Alejandro Lucia, PhD, MD; Arkaitz Galbete, PhD; Agurne García-Baztán, MD; Javier Alonso-Renedo, MD; Belen González-Glaría, PhD, MD; María Gonzalo-Lázaro, MD; Itziar Apezteguía Irátzoz, PhD, MD; Marta Gutiérrez-Valencia, PharmD; Leocadio Rodríguez-Mañas, PhD, MD; Mikel Izquierdo, PhD

JAMA Intern Med. doi:10.1001/jamainternmed.2018.4869
Published online November 12, 2018.

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# Recovering muscle strength/mass after renal failure during dialysis

The **PEAK** Study

St. George Hospital

Cheema, Fiatarone Singh

86

Gerontology and Geriatric Medicine
Volume 9, 2023
© The Author(s) 2023, Article Reuse Guidelines
https://doi.org/10.1177/23337214231203472

Sage Journals

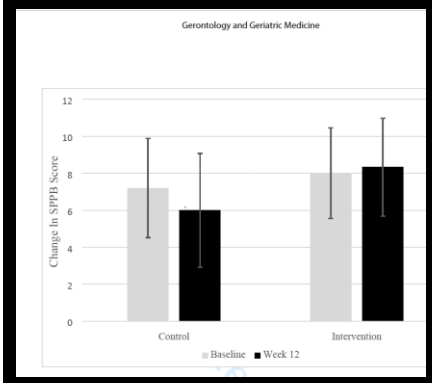
*Article*

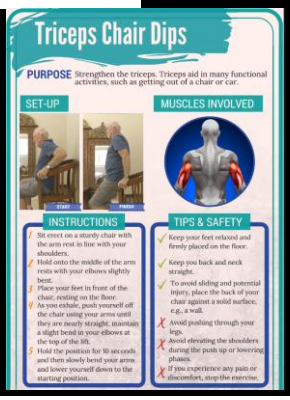
**Caring for Informal Dementia Caregivers and Their Loved Ones Via the HOMeCARE Exercise and Mindfulness for Health Program (HOMeCARE): A Randomized, Single-Blind, Controlled Trial**

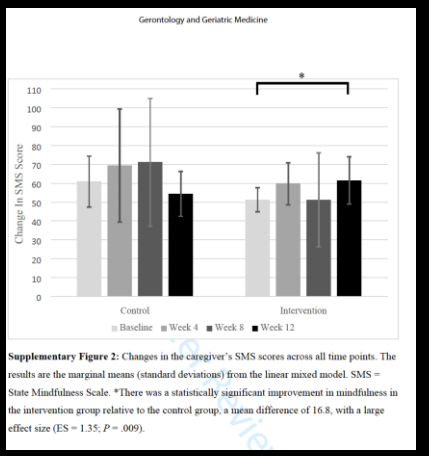
Tommy Lang, BAppSc(Hons) [1], Kenneth Daniel, MND [1], Michael Inskip, PhD [1,2], Yorgi Mavros, PhD [1], and Maria A. Fiatarone Singh, AM, MD [1,3,4]

HOMeCARE

https://www.strongmindshomecare.org/




**Supplementary Figure 2:** Changes in the caregiver's SMS scores across all time points. The results are the marginal means (standard deviations) from the linear mixed model. SMS = State Mindfulness Scale. *There was a statistically significant improvement in mindfulness in the intervention group relative to the control group, a mean difference of 16.8, with a large effect size (ES = 1.35; $P$ = .009).

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# Key Lifestyle Principles for Optimal Ageing with Resilience

- Maintain high energy expenditure throughout life
- Need for anabolic exercise increases throughout life to mitigate body composition changes underlying disease and disability
- Match energy intake to energy requirements
- Increase nutrient density as energy requirements decrease: protein and micronutrients
- Maximize dietary diversity/plant-rich (MEDITERRAEAN-type) diet
- Accumulate anti-inflammatory exercise, lifestyle and dietary habits
- Practice lifelong learning of novel things
- Don't do it alone


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## Dedication

*This work is dedicated to the memory of my beloved grandmother*

*Jeanne Marie Celine Torre Saint Gaudens*
*October 15, 1895–January 27, 1981*

*My first and greatest mentor in wellness.*
*For making me exercise with Jack LaLanne every afternoon,*
*And eat bread that was a different color than everyone else's,*
*But mostly for showing me the way to age with grace and wisdom;*
*And know the best is yet to come.*



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