

# *Positive Ageing Through Exercise*

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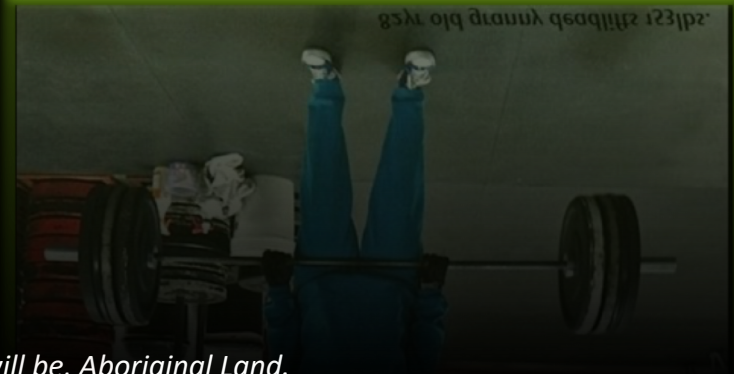
Sydney School of Health Sciences, Sydney Medical School

Faculty of Medicine and Health

The University of Sydney



82yr old granny deadlifts 153lbs.



82yr old granny squats 123lbs.

*This land on which we meet always was, and always will be, Aboriginal Land.*

*I pay my respects to the Traditional Custodians of the lands on which we are gathered today, and to their Elders, past, present and emerging, and acknowledge all Aboriginal and Torres Strait Islanders joining us today.*

The mission of  
medicine is the  
assertion and  
assurance of the  
human potential

Dr. Walter Bortz II







*“All parts of the body which have a function, if **used in moderation and exercised in labors to which each is accustomed**, become thereby well-developed and age slowly; but if unused and left idle, they become liable to disease, defective in growth and age quickly.”*

Hippocrates

Ruth Frith, OAM  
RIP age 104 in 2014



- At 73, she took up athletics
- At 102, she became the world's oldest competing female athlete

If exercise is to be implemented as medicine by health care professionals as suggested by Hippocrates, then it requires the same attention to:

1. Specific evidence-based application
2. Prescriptive elements
3. Assessment of risks and benefits
4. Adjustment for individual needs
5. Monitoring and promotion of adherence
6. Measurement of outcomes

As applied to other medical treatments

# The Exercise Pill...



"To treat your high blood pressure, diabetes, hyperlipidemia, oosteoporosis... take this new pill every day. Take it out for a jog, then take it to the gym, then take it for a bike ride..."

Use it  
like the  
drug it  
is.....













# How to use exercise as medicine

- Prevent or treat conditions which we have
- Substitute for or augment treatment
- Augment the effectiveness of treatment strategies
- Offset the side effects of treatment
- Counter age-related increase in risk factors



or symptoms for  
ment  
hazardous forms  
the preventive or  
ments  
biology which  
mortality

Therapeutic Target	Exercise Effective	Drug available
Optimization of peak body composition and fitness		
Adipose mass and distribution		
Aerobic fitness		
Bone density/mass/geometry		
Brain morphology and function		
Metabolic fitness		
Muscle function		
Muscle mass		
Psychological well-being		

Therapeutic Target	Exercise Effective	Drug Available
Prevention of risk factors for chronic disease		
Cognitive dysfunction/brain atrophy	👍	
Depression	👍	
Hyperlipidemia	👍	
Hypertension	👍	
Insomnia	👍	
Insulin resistance, glucose intolerance	👍	👍
Systemic inflammation	👍	

Therapeutic Target	Exercise Effective	Drug Available
Prevention of age-related changes in physiology and function		
Balance impairment	👍	
Decline in aerobic capacity	👍	
Endothelial dysfunction	👍	👍
Insulin resistance/glucose intolerance	👍	👍
Osteopenia/osteoporosis	👍	👍
Sarcopenia	👍	
Visceral and general obesity	👍	



Therapeutic Target	Exercise Effective	Drug Available
Treatment of Chronic Disease		
Arthritis	👍👍	👍
Atherosclerosis	👍	👍👍
Cancer	👍	👍👍
CHF	👍	👍👍
Cognitive impairment/dementia	👍	
COPD, asthma	👍	👍👍
Depression/anxiety	👍👍	👍
Diabetes	👍	👍👍
Falls	👍	
Functional impairment/frailty	👍	
HTN	👍	👍👍
Liver disease	supportive	supportive
Osteoporosis	👍	👍👍
Parkinson's disease	👍	👍👍
Peripheral neuropathy	👍	
PVD	👍	surgery
Renal failure	👍	supportive; renal replacement therapy
Stroke	👍👍	👍

# Modality and Intensity Matter





Before



After

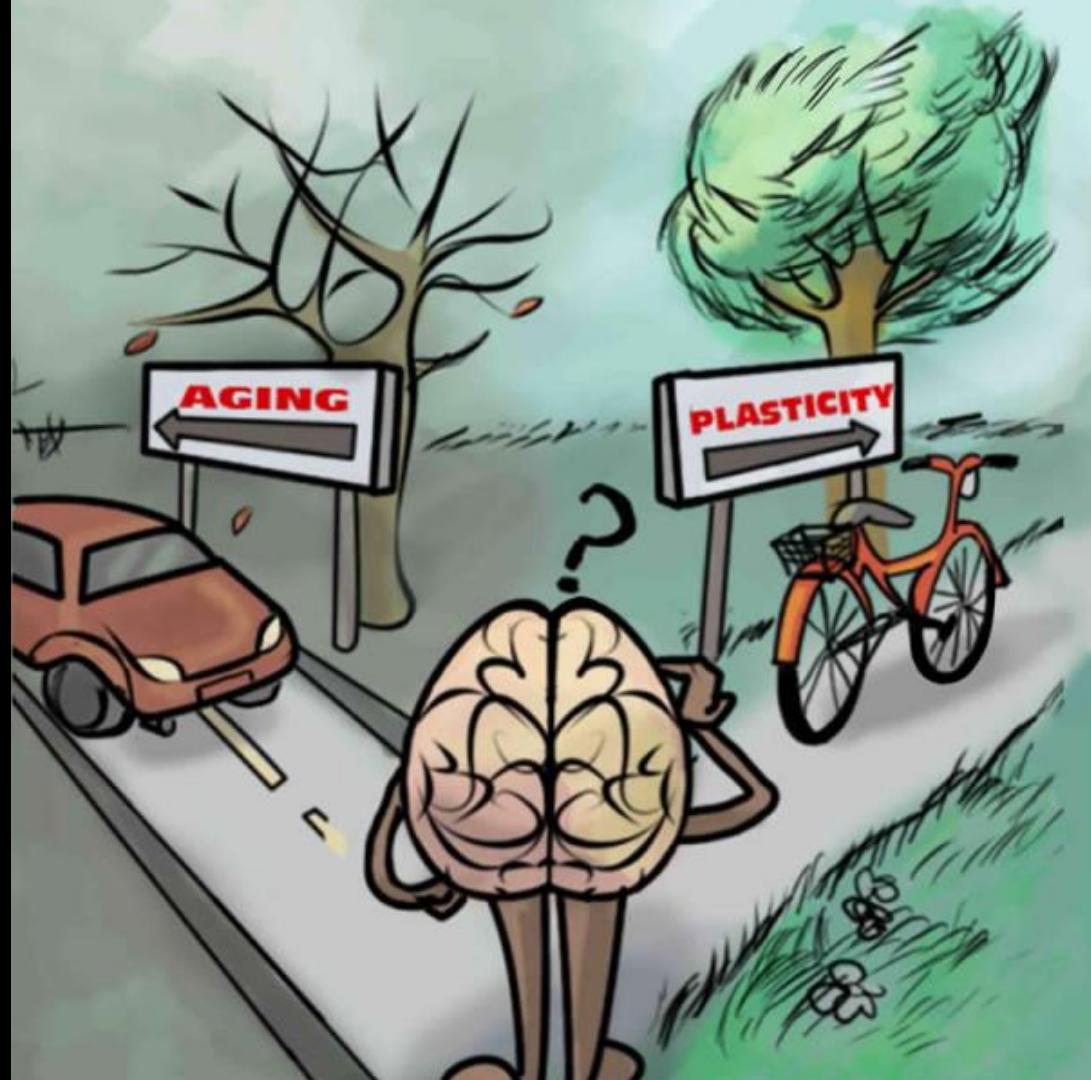


6 Years Later

Dr. Jeffry Life

# Examples of Exercise as Medicine Evidence Base

- Depression
- Osteoporosis
- Frailty





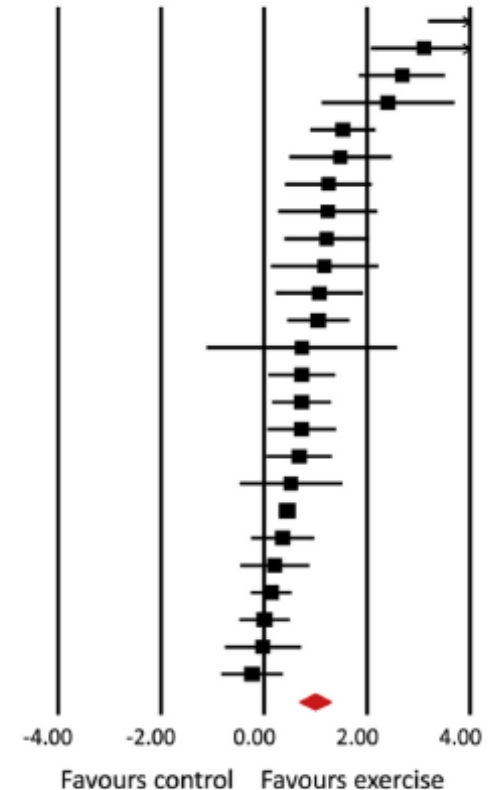
# Exercise and Depression



**Exercise Effect Size in depression is more than 3-fold *larger* than medications, CBT or IPT**

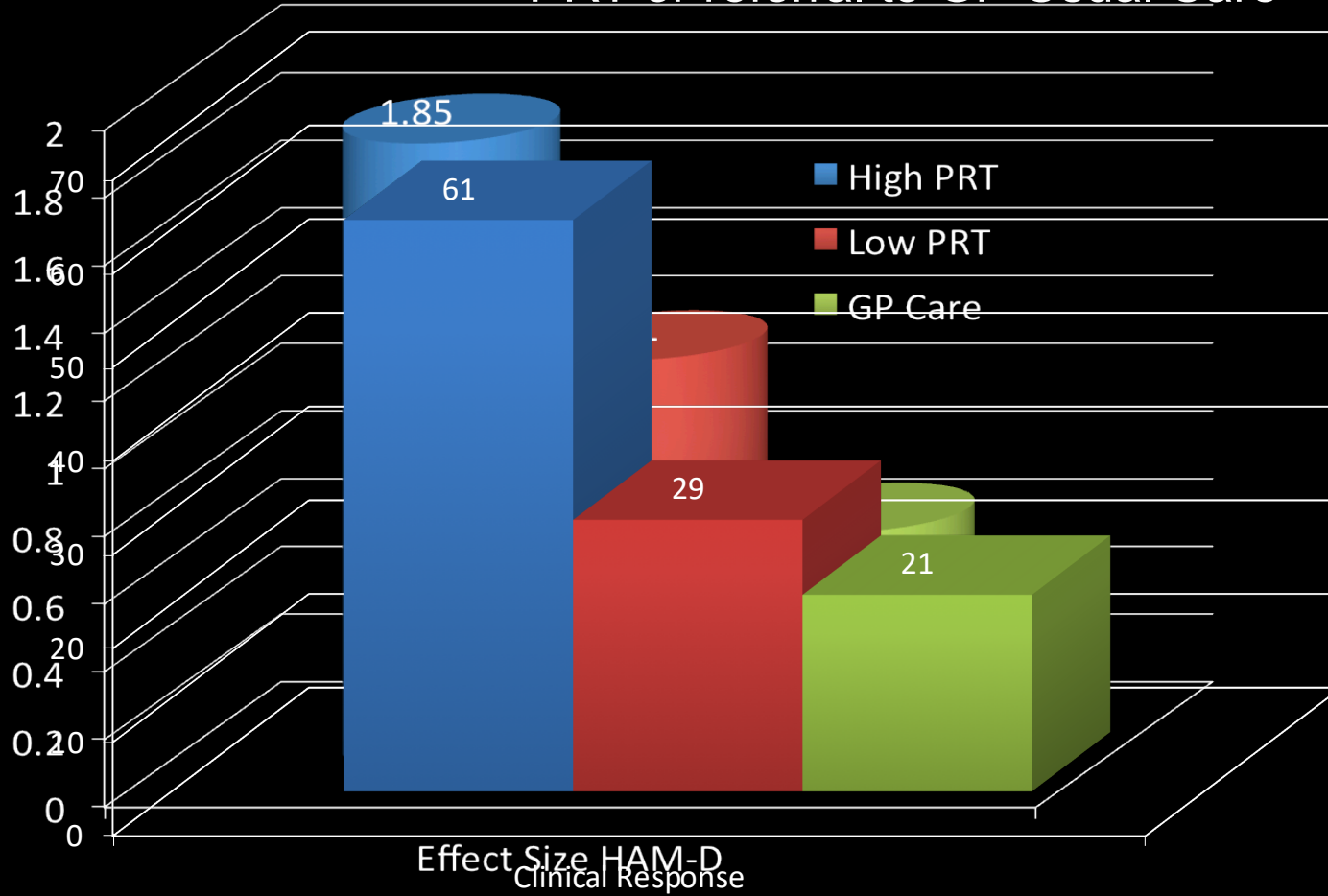
Study nameStatistics for each studyStd diff in means and 95% CI

	Std diff in means	Lower limit	Upper limit	p-Value
Mota-pereira 2011	4.599	3.189	6.009	0.000
Singh 1997	3.105	2.075	4.135	0.000
Danielsson 2014	2.679	1.845	3.512	0.000
Mutrie 1988	2.408	1.115	3.702	0.000
Setaro 1985	1.529	0.899	2.160	0.000
Mcneil 1991	1.484	0.495	2.474	0.003
Brenes 2007	1.249	0.407	2.092	0.004
Hemat-far 2012	1.237	0.280	2.193	0.011
Pilu 2007	1.217	0.397	2.036	0.004
Epstein 1986	1.176	0.132	2.220	0.027
Doynes 1987	1.075	0.231	1.919	0.013
Nabkasorn 2005	1.052	0.449	1.655	0.001
Orth 1979	0.734	-1.112	2.581	0.436
Huang 2015	0.732	0.083	1.380	0.027
Schuch 2015	0.729	0.157	1.302	0.013
Singh 2005	0.729	0.063	1.395	0.032
Shahidi 2011	0.683	0.045	1.321	0.036
Oertel Knoechel 2014	0.525	-0.472	1.521	0.302
Hallgreen 2015	0.452	0.294	0.610	0.000
Kerling 2015	0.362	-0.248	0.973	0.245
Gary 2010	0.207	-0.464	0.878	0.546
Blumenthal 2007	0.137	-0.255	0.530	0.493
Veale 1992	0.009	-0.481	0.498	0.973
Williams 2008	-0.022	-0.761	0.717	0.953
Sims 2009	-0.230	-0.824	0.363	0.447
	0.987	0.686	1.288	0.000



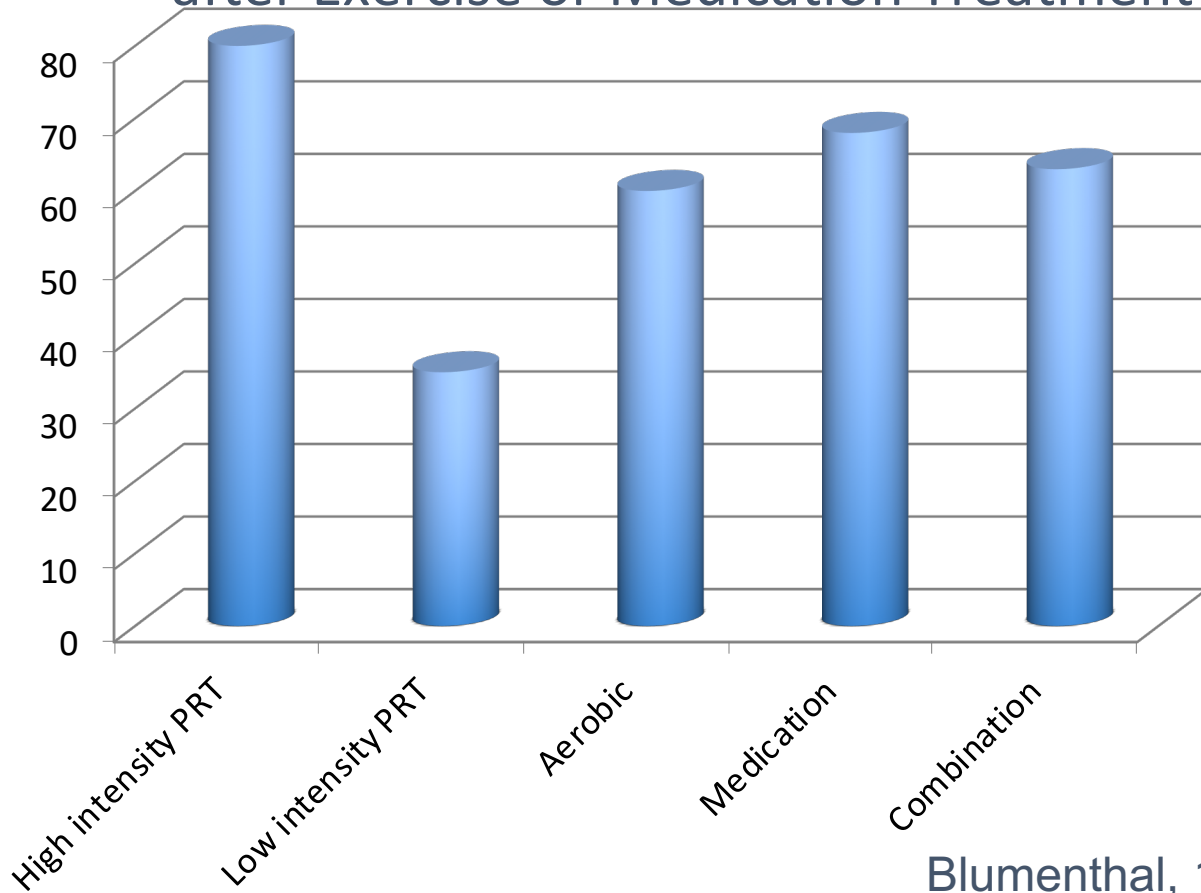
Std diff in means = standardized differences in means, CI = Confidence Interval

# High Intensity PRT reduces depression significantly more than Low Intensity PRT or referral to GP Usual Care



Singh J of G, 2005

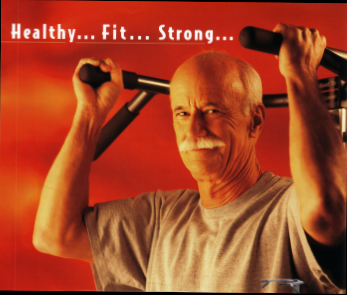
# Relative Change in Depressive Symptoms in Older Adults with MDD after Exercise or Medication Treatment



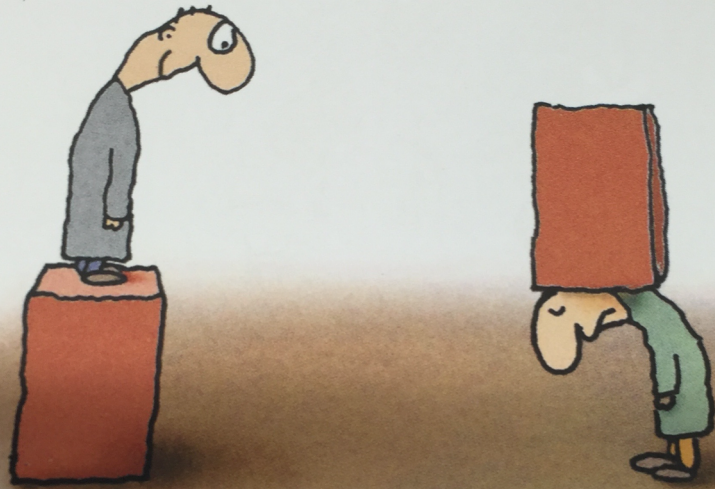
Blumenthal, 1999; Singh 2005



# Rationale for *choice* of Exercise Prescription for Depression Prevention/Treatment



- ✓ Aerobic exercise associated with lower risk of depression in epidemiological studies
- ✓ Both PRT and aerobic exercise prevent type 2 diabetes/obesity/CVD = risk factors for depression
- ✓ Both PRT and aerobic exercise effectively treat depression and associated co-morbidities
- ✓ Depression benefit proportional to fitness adaptations (strength, aerobic capacity)
- ✓ PRT also addresses sarcopenia, cachexia, disuse syndromes associated with chronic disease and aging
- ✓ Need adequate *dose* of aerobic and *intensity* of PRT for optimal anti-depressant effects
- ✓ Group or individual training equivalent



*That which does not kill me....*

Why does lifting  
something  
heavy or  
sweating make  
you happier?



*"Things are still a little rough for me, and occasionally I lose hope and get depressed—but I'm getting stronger every day."*

# Exercise and Osteoporosis





96-yr old former CEO with recurrent injurious falls

Hip fracture – May 2019

Facial injury- Oct 2019

Pelvis fracture- Oct 21 2019



# What does hip fracture look like?





**Figure 12–2. Weight Training Exercises Can Improve Strength, Balance, and Flexibility in Older Adults**



**Note:** Community exercise programs for older adults are based on evidence that osteoporosis and related disability can be prevented or slowed by balance and strength training exercises, diet, appropriate medications, and a safe environment.

Source: NJDHSS 2000.



JAMDA

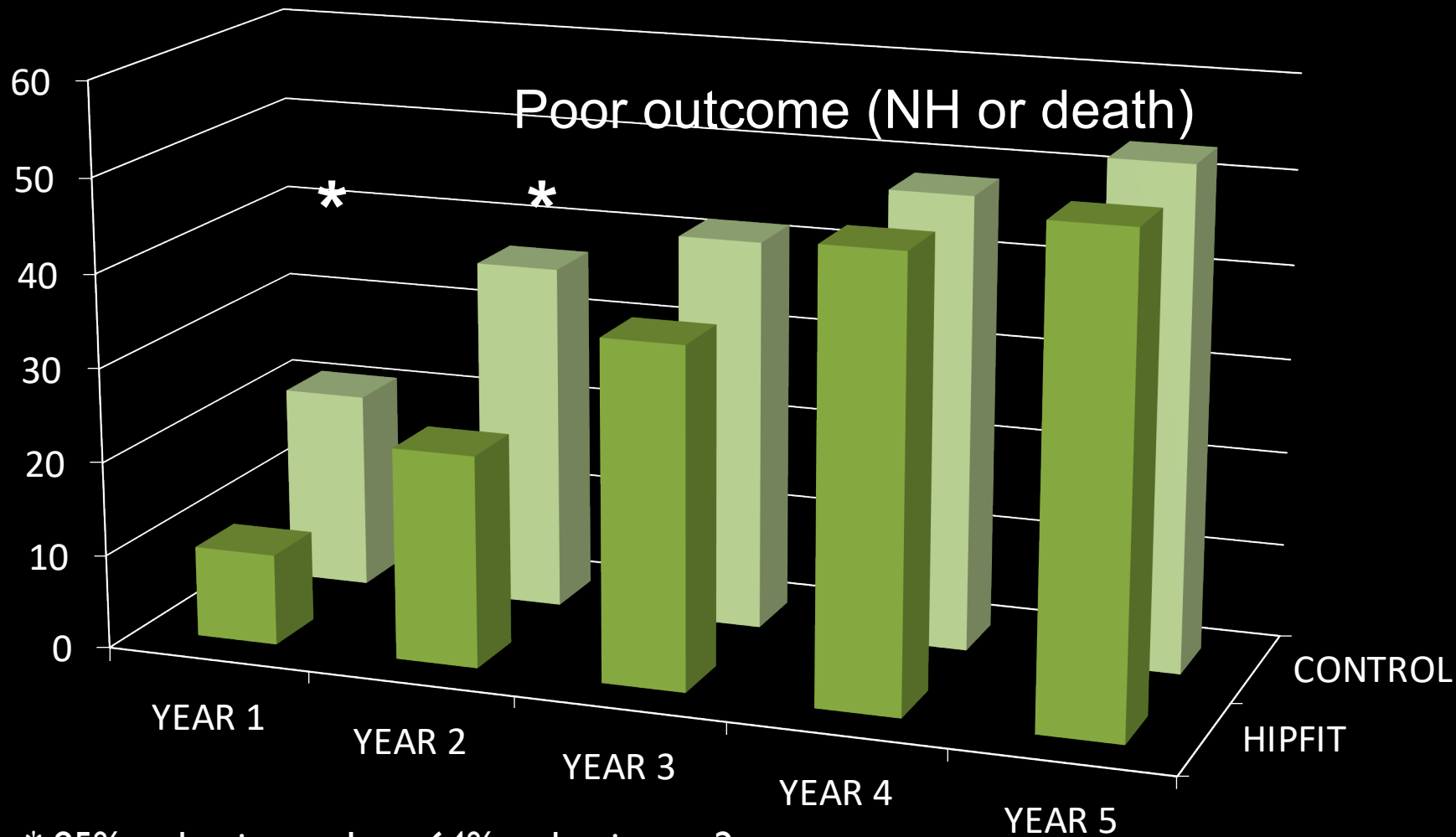
journal homepage: [www.jamda.com](http://www.jamda.com)



## Original Study

# Effects of High-Intensity Progressive Resistance Training and Targeted Multidisciplinary Treatment of Frailty on Mortality and Nursing Home Admissions after Hip Fracture: A Randomized Controlled Trial

Nalin A. Singh MBBS<sup>a</sup>, Susan Quine PhD<sup>b</sup>, Lindy M. Clemson PhD<sup>c</sup>, Elodie J. Williams BAppSc<sup>d</sup>, Dominique A. Williamson BAppSc<sup>d</sup>, Theodora M. Stavrinos<sup>d</sup>, Jodie N. Grady BAppSc<sup>d</sup>, Tania J. Perry BAppScOT<sup>d</sup>, Bradley D. Lloyd MSc<sup>d</sup>, Emma U.R. Smith PhD<sup>d</sup>, Maria A. Fiatarone Singh MD<sup>e,\*</sup>



\* 85% reduction at 1 yr., 64% reduction at 2 yrs.

*Osteoporosis prevention, diagnosis and management in postmenopausal women and men over 50 years of age*

2nd edition

# Current Recommendations for RACGP Physicians in Australia

## General bone health maintenance and fracture prevention

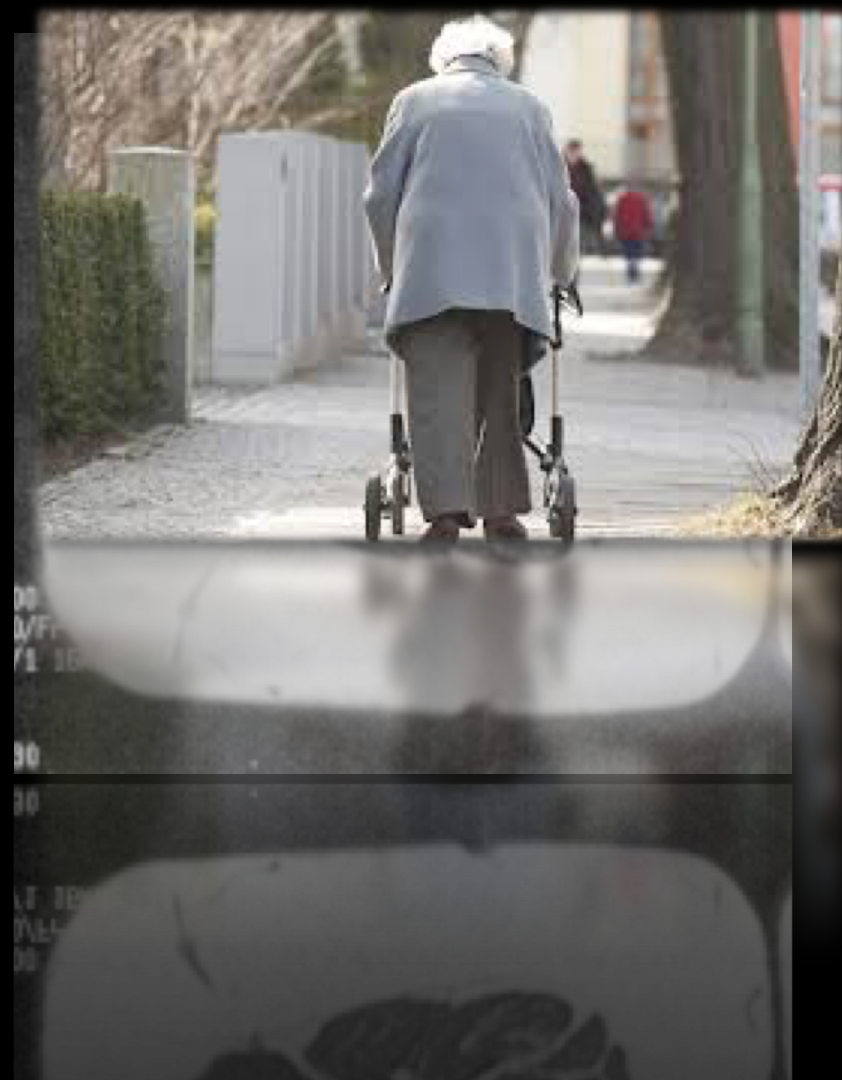
Chapter	No.	Recommendation	Grade
Exercise	11	Individuals over 50 years of age without osteoporosis should participate regularly in progressive resistance training and balance training exercises. Resistance exercise should be regular (2–3 days per week), moderate–vigorous, progressive and varied to influence BMD and reduce fall and fracture risk.	A
	12	Prescribe high-intensity progressive resistance and balance training to older adults with osteoporosis to prevent further bone loss and/or improve BMD, improve function, treat sarcopenia, and decrease fall and fracture risk.	A
	13	Prescribe extended exercise therapy, including resistance and balance training, after hip fracture to improve mobility, strength and physical performance. Evidence for the benefits of exercise after vertebral and non-hip fractures is limited.	A

# Exercise and Frailty

# What of frailty?

- Shrinkage (of muscle)
- Slowness
- Strength loss
- Sedentariness
- Sleepiness (fatigue)

*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.*



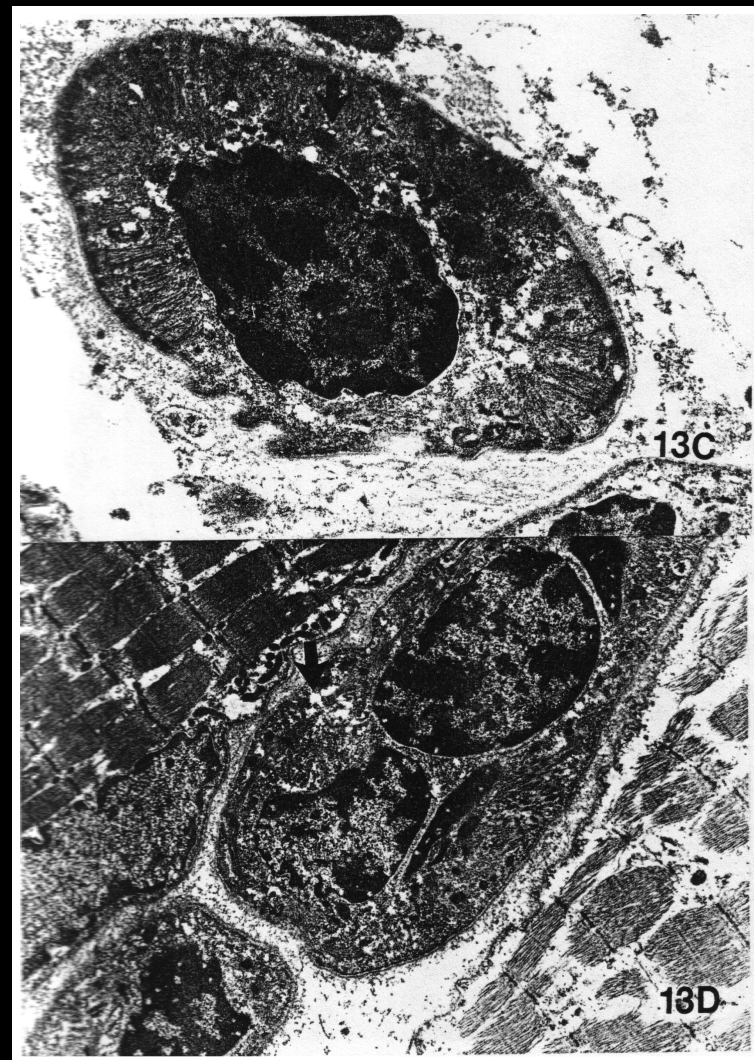


We have **no drugs** for ageing, frailty, mobility impairment and many of its co-morbidities and risk factors...



- Poor balance
- Slow gait speed
- Sedentariness
- Sarcopenia
- Wasting/anorexia
- Muscle weakness
- Fatigue
- Poor endurance
- Isolation/loneliness
- Injurious Falls
- Low self-efficacy
- Poor sleep quality/quantity
- Poor quality of life/loneliness
- Cognitive impairment
- Functional dependency

Up to 25% of the 2 billion older adults globally may be frail in 2050



## Boston FICSIT Study

Fiatarone, NEJM 1994

Fiatarone Singh AJP, 2000

Highly significant  
and clinically  
meaningful  
increase in  
strength in frail  
elders after 10  
wks high intensity  
PRT

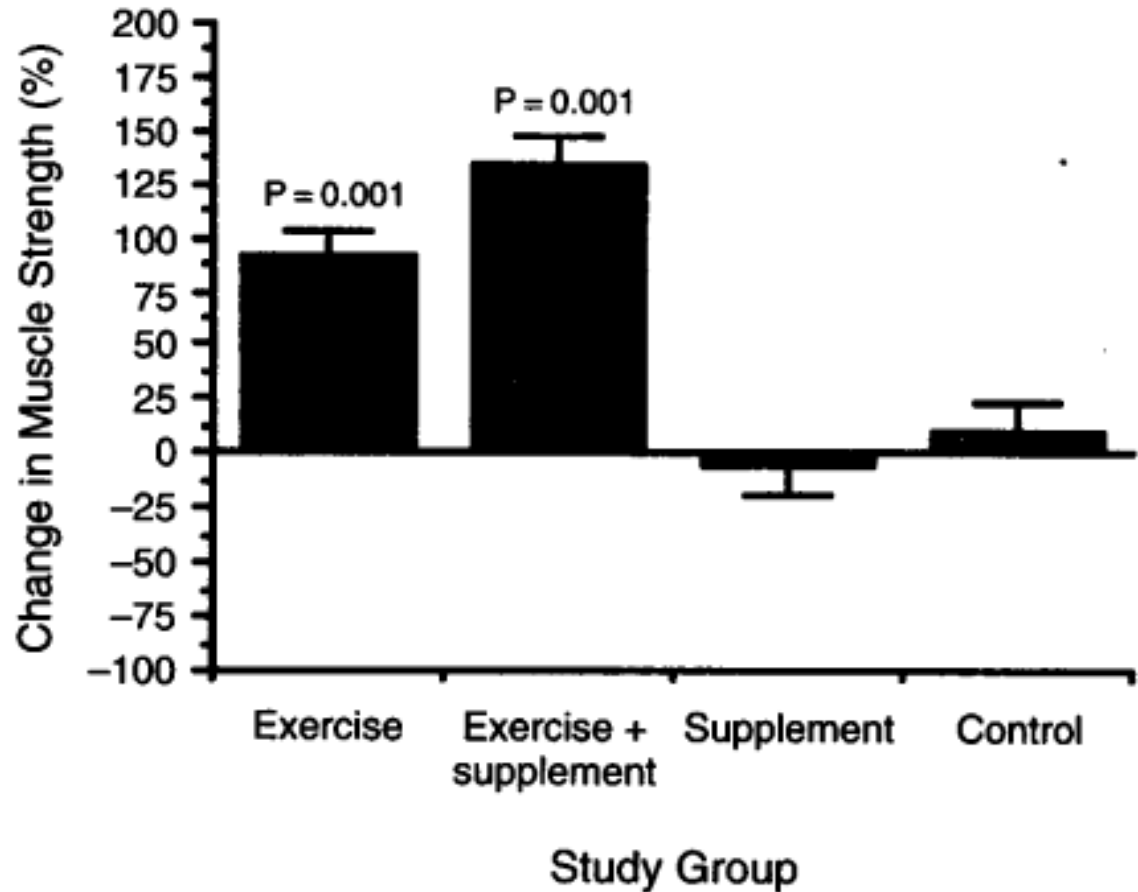


Figure 2. Mean ( $\pm$ SE) Changes in Muscle Strength after Exercise, Nutritional Supplementation, Neither, or Both.



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

Ron Borde<sup>1</sup> · Tibor Hortobágyi<sup>2,3</sup> · Urs Granacher<sup>1</sup>

Resistance training  
prescriptive factors affecting  
strength changes in older adults:

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



Jack LaLanne 1914–2011  
*‘Godfather of Modern Fitness’*

Frailty is not inevitable or  
untreatable.

*Rather than being a barrier to robust  
exercise prescriptions, it is one of the  
most important indications for their  
promotion by health care providers.*

Ernestine Shepherd, 84  
World's Oldest Competitive Female Bodybuilder



# How to incorporate evidence-based exercise prescriptions and promotion of PA into health care

- Know when exercise can be used as alternative vs. adjunctive treatment for chronic diseases
- Prescribe specifically, not generically
- Incorporate into standard health care settings and every health care encounter
- Utilize only evidence-based programs
- Record adherence and adaptations and adverse events as you would for *any other* medical treatment



*Do not go gentle into that good night,  
Old age should burn and rave at close of  
day;  
Rage, rage against the dying of the light.*

*Though wise men at their end know  
dark is right,  
Because their words had forked no  
lightning they  
Do not go gentle into that good night.*

*Dylan Thomas*



**THANK YOU**  
TO ALL THOSE WHO HAVE  
RAGED WITH ME AND  
CONTRIBUTED TO OUR WORK  
TO SUPPORT AGING WITH  
DIGNITY, STRENGTH AND GRACE  
FOR OVER 3 DECADES