

# Exercise for Prevention and Management of Dementia

# vario

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# Exercise and Dementia

- Prevent or delay onset of dementia
- Prevent or manage other chronic disease and disability – lifestyle diseases continue to progress
- Improve psychological and physical health of people with dementia
- Improve mood – more manageable
- Carer support and wellbeing

# Largest Epidemic Ever

- 60% of all deaths world wide are due to chronic disease
- More than one billion adults worldwide are overweight; at least 300 million of them are clinically obese – will surpass 1.5 billion by 2015.
- 22 million children under five years old are overweight

World Health Organization, 2006

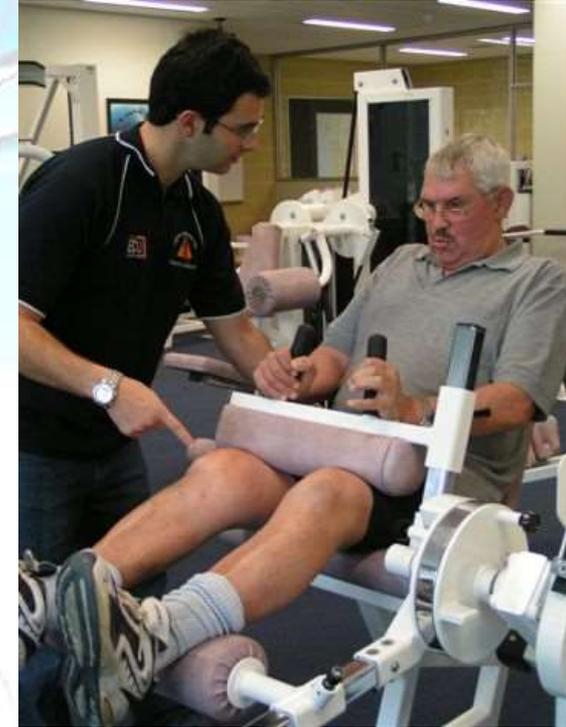
# Where is the culprit?

“Chronic, non-communicable diseases are currently responsible for around 70% of the total burden of illness and injury experienced by the Australian population. The proportion is expected to increase to close to 80% by 2020”

Preventing Chronic Disease: A Strategic Framework – Background Paper, October 2001

# Chronic Disease

- slow progress, long continuance
- individual crosses threshold - “clinical horizon” to manifest
- mechanisms underlying are active long before outwardly affected



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# Examples of Major Chronic Diseases

- cardiovascular disease (atherosclerosis, heart failure, hypertension, and stroke)
- obesity
- type 2 diabetes
- some cancers
- osteoporosis
- sarcopenia
- Alzheimer's disease



# Risk Factors and Lifestyle

- Major risk factors eliminated
- >80% of heart disease, stroke and type 2 diabetes would be prevented
- 40% of cancer would be prevented
- Alzheimer's???
- Major risk factors
  - unhealthy diet
  - physical inactivity
  - tobacco use
- Requires a new approach
- Prevention, treatment, lifestyle modification

World Health Organization, 2006

“the human genome evolved over at least the last 45,000 years within an environment of high physical activity”

“the current human genome expects and requires humans to be physically active for normal function and health maintenance”

We are programmed for physical activity



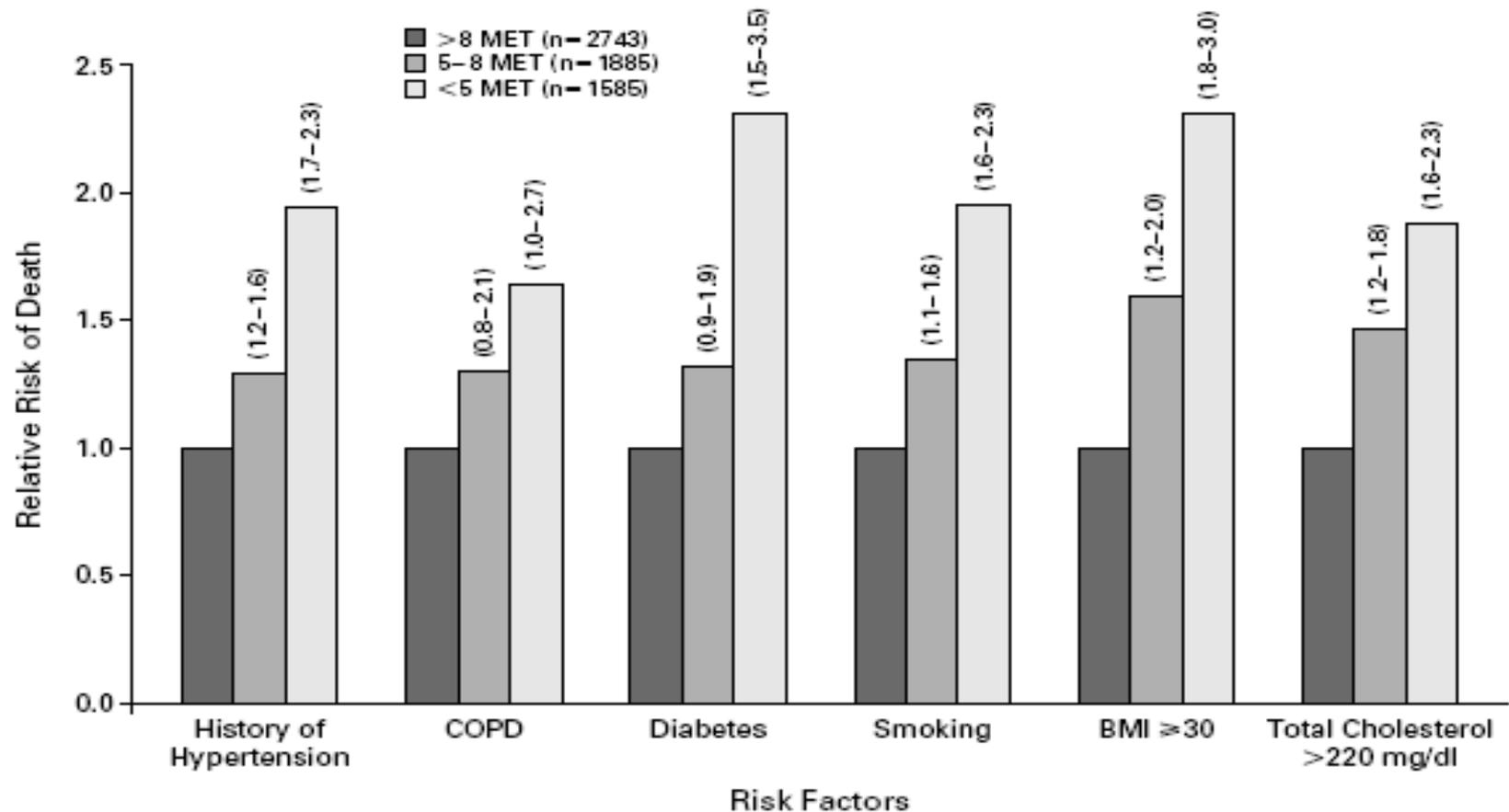
*Booth et al, JAP 2000*

“Indeed, with the possible exception of diet modification, we know of no single intervention with greater promise than physical exercise to reduce the risk of virtually all chronic diseases simultaneously”

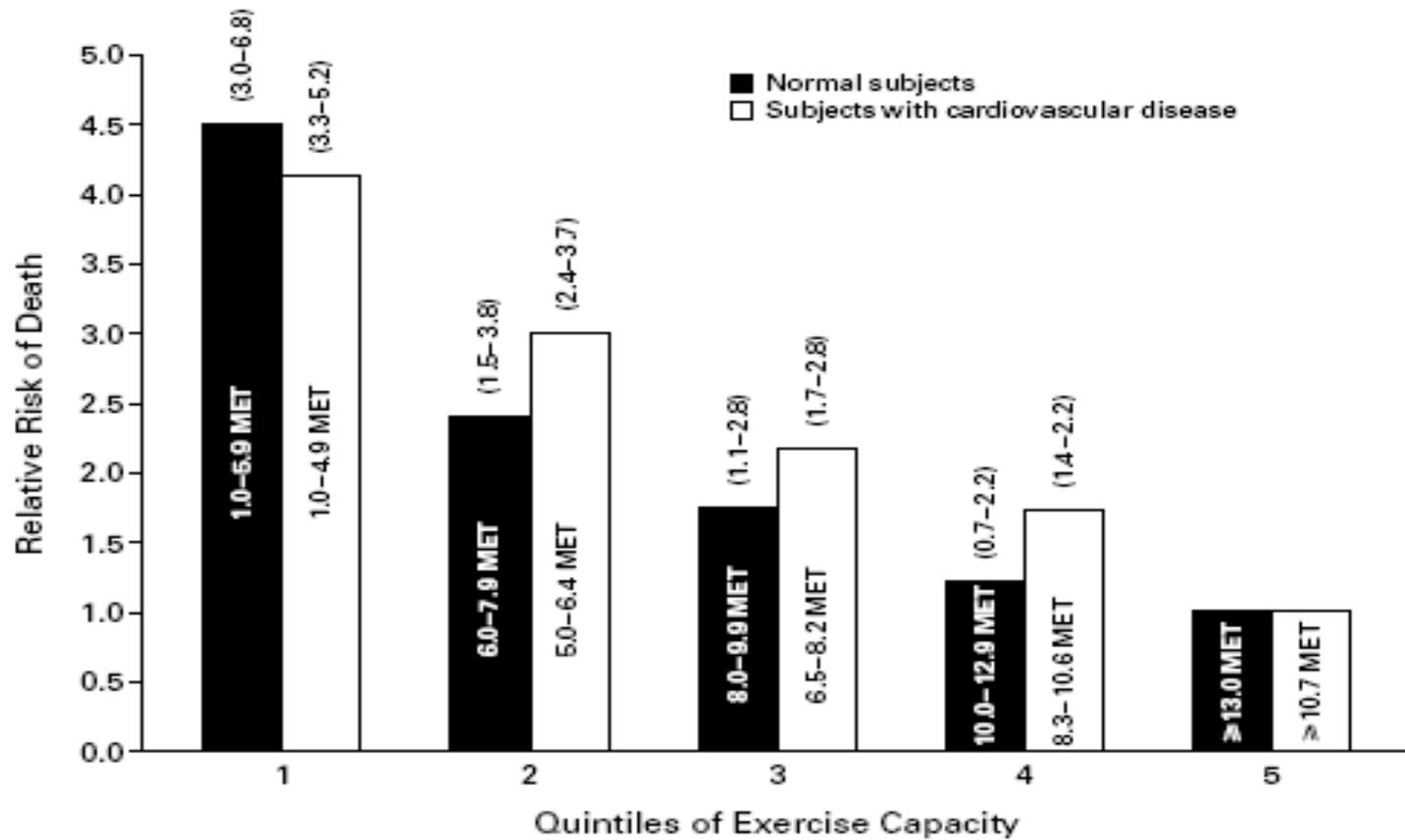
*Booth et al, JAP 2000*



# Protective Effect of Exercise in Different Chronic Conditions

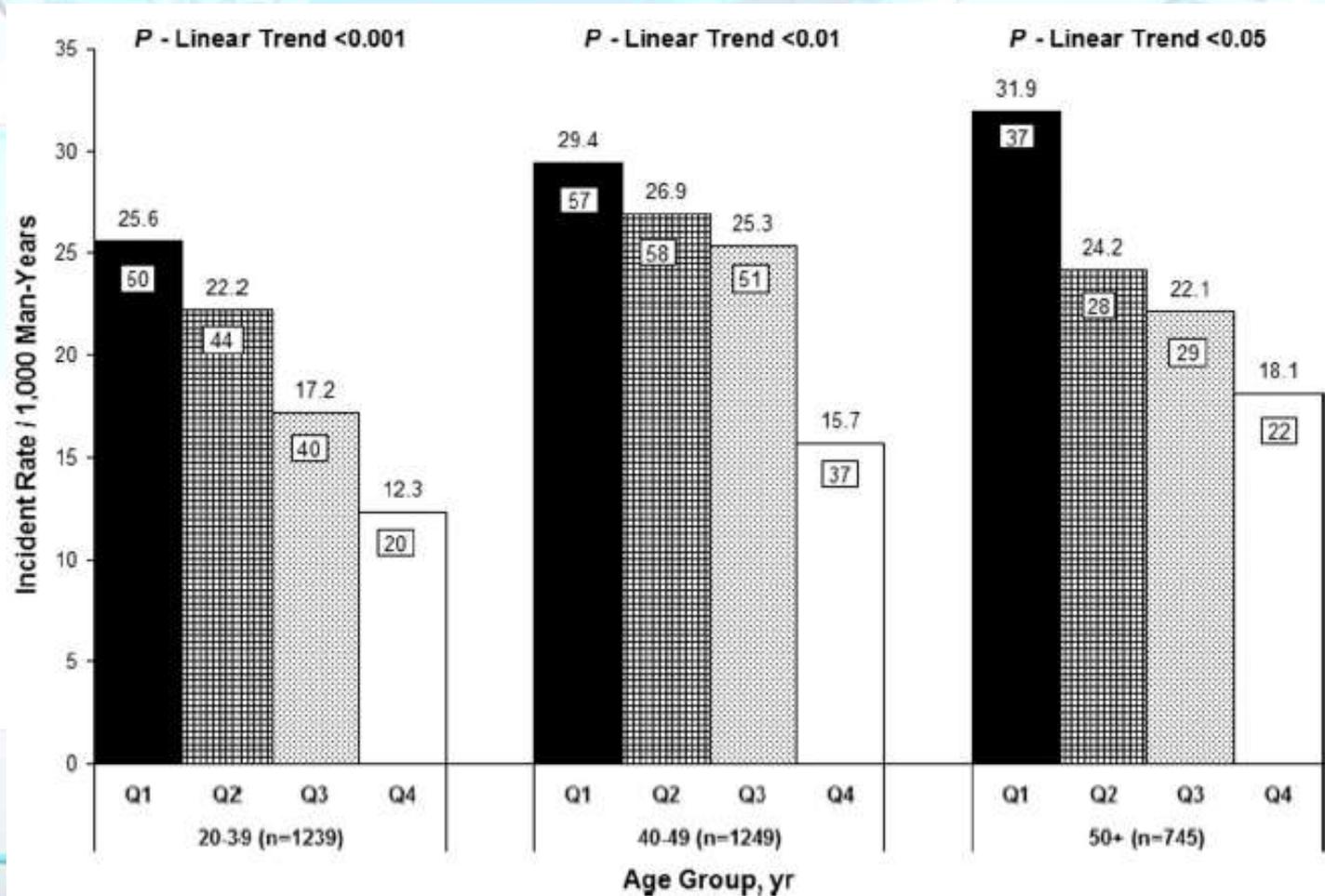


# Protective Effect of Exercise Cardiovascular Disease



# Muscle Strength Incidence Metabolic Syndrome

[Q1=lowest muscle strength - Q4=highest muscle strength]



# Guidelines for healthy adults under age 65

## Basic recommendations from ACSM and AHA

Do moderately intense cardio 30 minutes a day,  
five days a week

Or

Do vigorously intense cardio 20 minutes a day, 3  
days a week

And

Do eight to 10 strength-training exercises, eight to  
12 repetitions of each exercise twice a week.

# Guidelines for healthy adults over age 65 (or adults 50-64 with chronic conditions, such as arthritis)

Do moderately intense aerobic exercise 30 minutes a day, five days a week

Or

Do vigorously intense aerobic exercise 20 minutes a day, 3 days a week

And

Do eight to 10 strength-training exercises, 10-15 repetitions of each exercise twice to three times per week

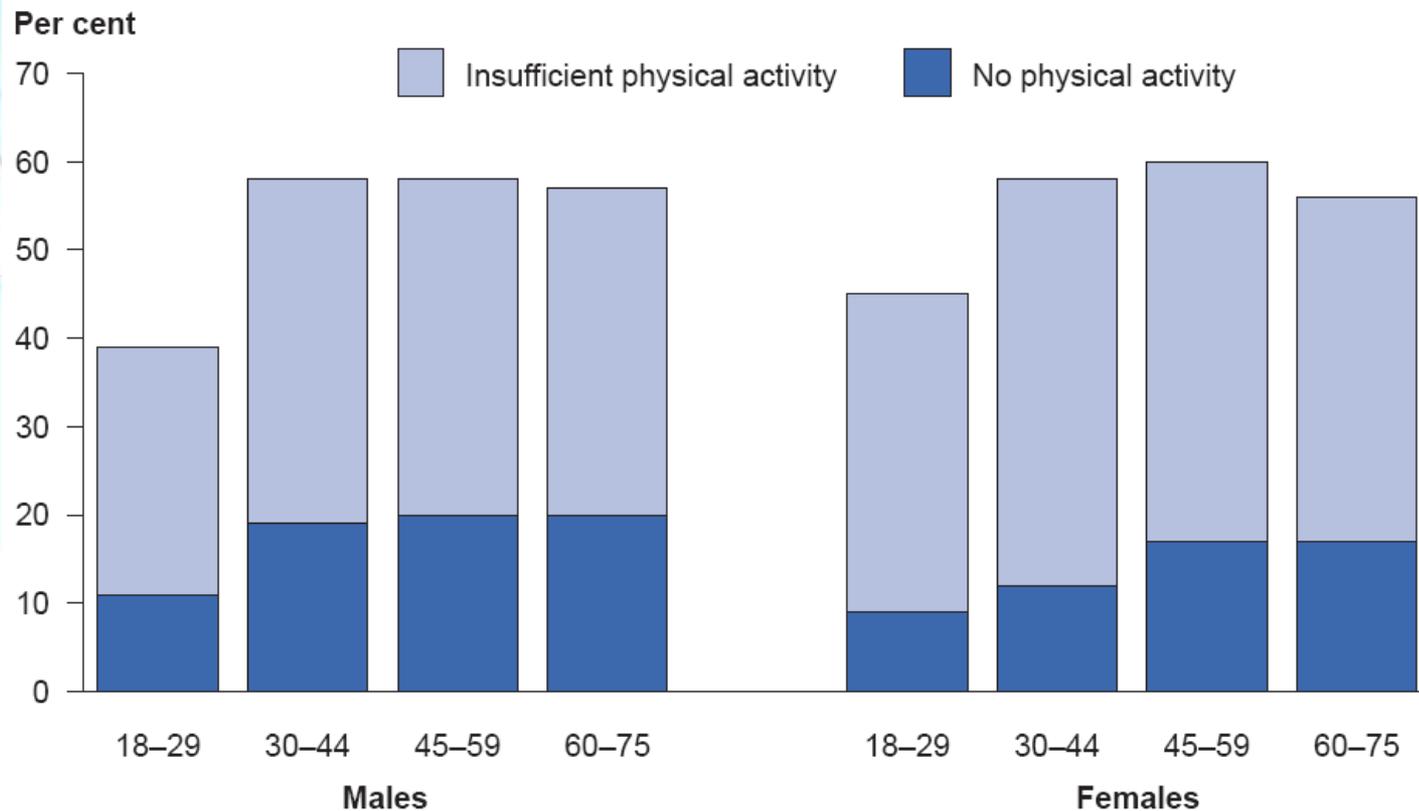
And

If you are at risk of falling, perform balance exercises

And

Have a physical activity plan.

# Rates of Physical Inactivity



## Notes

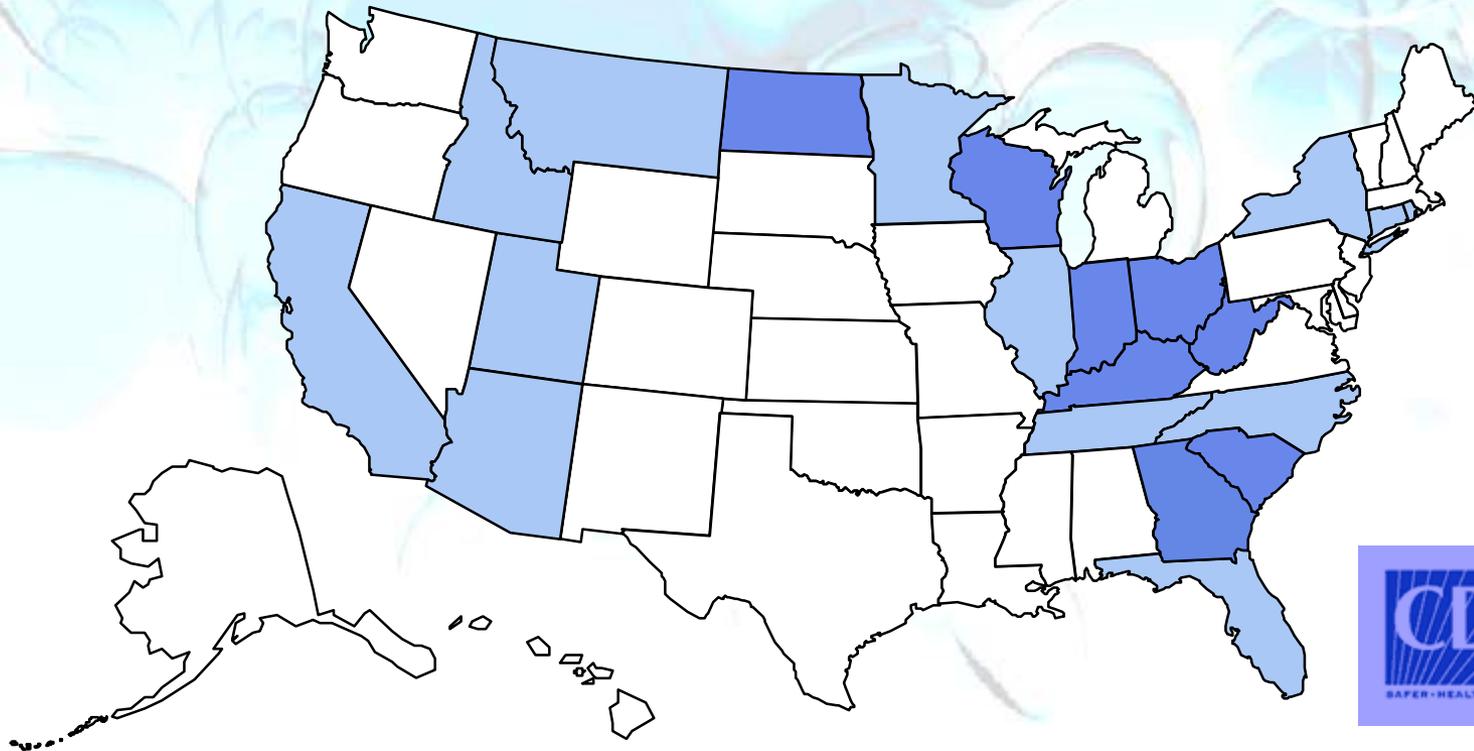
1. Age-standardised to the Australian population as at 30 June 2001.
2. People aged 18-75 years.
3. Insufficient physical activity is less than 150 minutes and/or less than five sessions in the previous week.

Source: AIHW analysis of the 2000 National Physical Activity Survey.

# Obesity Trends\* Among U.S. Adults

## BRFSS, 1985

(\*BMI  $\geq 30$ , or  $\sim 30$  lbs overweight for 5' 4" person)



# Exercise and Alzheimer's Disease

- Application across spectrum of problem:
  - Reducing risk in general population – prophylactic
  - Reversing or slowing progression in early stage
  - Maintaining QOL, structure and function in later stage
  - Enhancing care and carers

# Lifestyle and Alzheimer's Disease

- Prevent or delay AD, slow disease progression
- If incidence of AD could be reduced by 50% from 2005, then over the period 2005-2010, cumulative savings of \$2.0bn would be realised - \$105bn over 2005-2050.
- Cost of AD in 2004 = \$3.6bn for 200,000 patients
- 100 at risk people undergoing prophylactic program would produce saving \$1.8million per year

# Epidemiology

- Epidemiological studies into Alzheimer disease indicates physical activity appears beneficial, as does a diet with high levels of vitamins B6, B12 and folate, while red wine in moderate quantities also appears protective

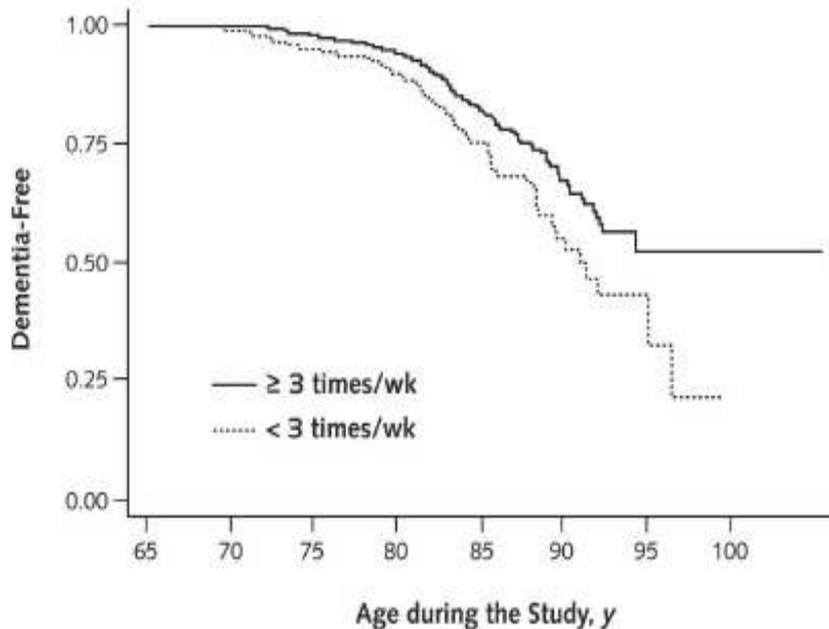


*McDowell, I. Alzheimer's disease: insights from epidemiology. Aging-Clinical & Experimental Research. 13:143-162, 2001.*

# Exercise and risk of Dementia

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Figure 1. Kaplan-Meier survival estimates for the probabilities of being dementia-free.



Persons who exercised 3 or more times per week were more likely to be dementia-free than those who exercised fewer than 3 times per week.

- Population based-study (n=1740)
- 6.2 years follow up
- Incidence rate of dementia was 13.0 per 1000 person-years (exercise 3 or more times week)
- 19.7 per 100- person-years (exercise fewer than 3 times week)
- Exercise is associated with a delay in onset of dementia and Alzheimer's disease
- Support the effect of exercise beyond musculoskeletal and cardiovascular benefits

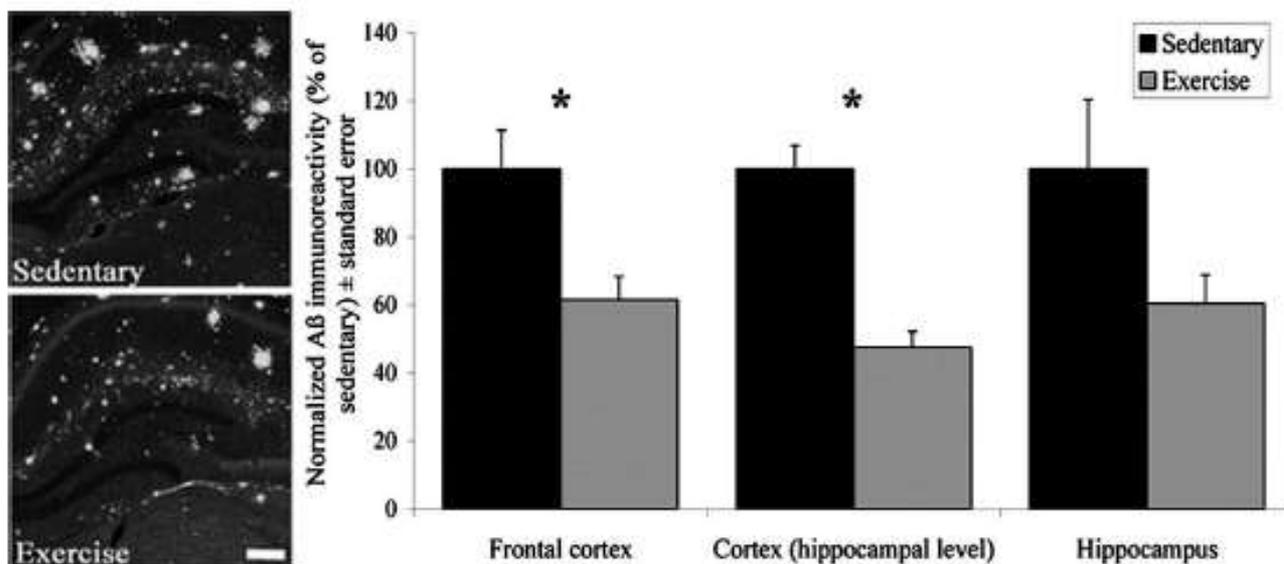
# Biological Basis 1

1. Physical exercise increases blood flow through the brain and oxygen delivery and this may help to preserve brain function.
2. Exercise stimulates growth in certain regions of the brain in older people (Colcombe, 2006) and causes the production of substances which facilitate nerves called neurotrophic factors (Tang, 2007)
3. Loss of brain density and volume are significantly less in older people with higher aerobic fitness (Colcombe, 2003). Physical exercise appears to spare brain tissue.
4. Beta amyloid is a key to the cause of Alzheimer's. Research indicates at least in animal studies that physical exercise reduces the levels of beta amyloid in the brain and this may be the principal mechanism by which the exercise inhibits the development of Alzheimer's disease (Adlard, 2005).

# Biological Basis 2

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- Voluntary exercise reduces A $\beta$  load in different brain regions TgCRND8 mice



**Figure 1.** The effect of exercise on A $\beta$  load in three different brain regions of TgCRND8 mice. Exercising animals show a significant (\*) reduction in A $\beta$  immunoreactivity in the frontal cortex ( $p = 0.018$ ) and cortex at the level of the hippocampus ( $p = 0.0003$ ). There is also a decrease in A $\beta$  in the hippocampus of exercising animals ( $p = 0.06$ ). The photomicrograph shows a representative section from both groups. Scale bar, 200  $\mu$ m. Error bars indicate  $\pm$  SE.

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# Risk Factors for Alzheimer's Disease



# Cholesterol

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- Exercise and nutrition demonstrated effects on:
  - Lowered TC
  - Lowered LDL-C
  - Increased HDL-C
  - Lowered triglycerides

*Scranton, R., et al. Predictors of 14-year changes in the total cholesterol to high-density lipoprotein cholesterol ratio in men. American Heart Journal. 147(6):1033-1038, 2004*

# Homocysteine

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- Amino acid produced by the body
- Elevated levels associated with AD
- Modifiable through exercise and nutrition
- For example:
  - 6 months exercise in elderly  
serum homocysteine decreased 5.34%
  - increased 6.1% for control group
- Folate, dietary fiber, caffeine and alcohol also factors

*Vincent, K. R., et al. Homocysteine and lipoprotein levels following resistance training in older adults. Preventive Cardiology. 6:197-203, 2003.*

# Hypertension

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- Exercise can lower BP in patients with stage 1 and 2 essential hypertension
- Average reduction in BP is 10.5 mm Hg for systolic and 7.6 mm Hg for diastolic BP

*Kokkinos, P. F., P. Narayan, and V. Papademetriou. Exercise as hypertension therapy. Cardiology Clinics. 19:507-516, 2001.*

# Diabetes

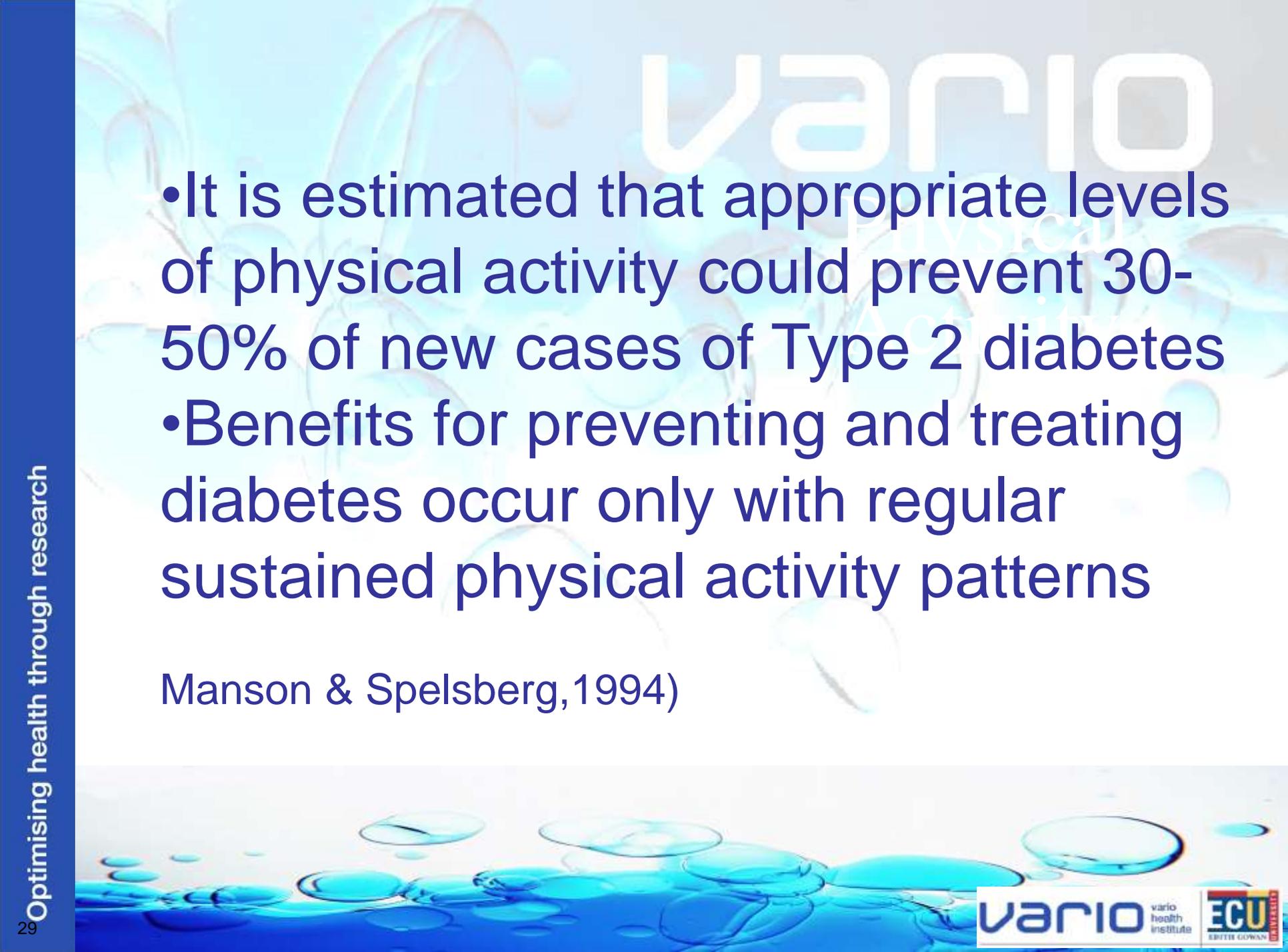
- Diabetes is the world's fastest growing disease
- It's Australia's sixth leading cause of death
- Over one million Australians have it — but 50% are as yet unaware
- Every 10 minutes someone is diagnosed with diabetes

<http://www.diabetesaustralia.com.au/>

# Exercise and Diabetes

- Exercise improves insulin resistance
- Beneficial for preventing and treating type 2 diabetes
- Aerobic exercise hindered in older, obese, co-morbid patients
- Resistance exercise in particular is safe and effective

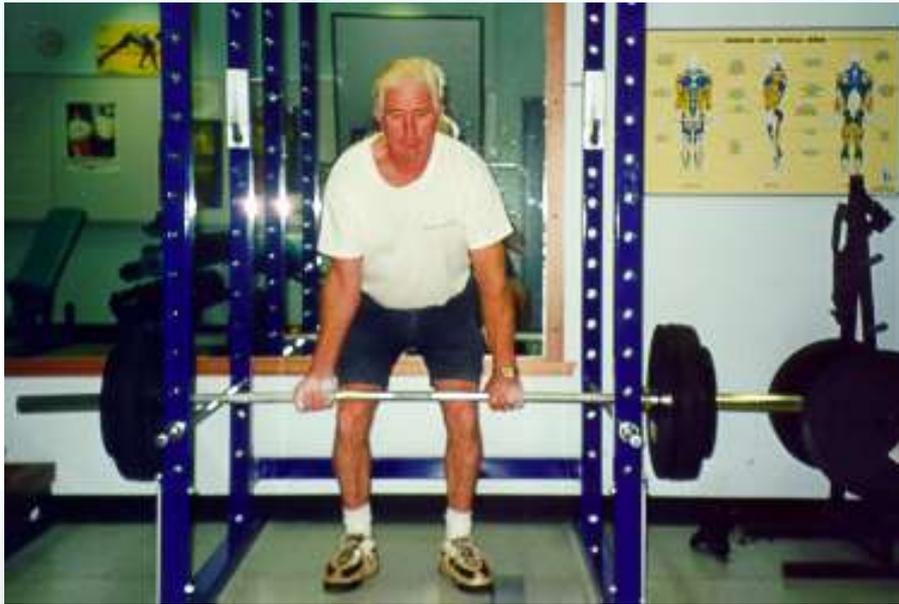
Willey and Singh. *Diabetes Care*, 2003

- 
- It is estimated that appropriate levels of physical activity could prevent 30-50% of new cases of Type 2 diabetes
  - Benefits for preventing and treating diabetes occur only with regular sustained physical activity patterns

Manson & Spelsberg, 1994)

# Obesity and Overweight

- Combination of exercise and dietary modification is the only effective long-term strategy for controlling body weight



# Resistance Exercise - Fat and Lean Tissue

- Recent evidence<sup>1</sup> in support of RT as effective intervention for fat loss
- Diet modification most impact
- RT counteracts muscle and bone loss
- 2 key mechanisms:
  - Metabolically costly with elevation up to 38 hours post<sup>2</sup>
  - Increased muscle mass – higher resting metabolic rate<sup>3</sup>

<sup>1</sup>Banz, et al. *Experimental Biology & Medicine*, 2003

<sup>2</sup>Schuenke et al. *European Journal of Applied Physiology*, 2002

<sup>3</sup>Byrne & Wilmore. *International Journal of Sport Nutrition & Exercise Metabolism*, 2001

# ApoLipoprotein E **VARIO**

- APOE epsilon-4 is strongly associated with AD
- role in lipid metabolism and coronary heart disease
- Routine screening for AD risk?
- Modification of effects through exercise and nutrition?

# Testosterone and Estrogen

- Sex hormones have a role in maintaining cognitive function
- Age related reduction or intentional deprivation appears to impact AD negatively
- Exercise and body composition changes can alter testosterone and estrogen even in the elderly

# Beta Amyloid

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- Protein implicated as the cause of AD
- Exercise and nutrition effects are not well known
- Pilot work in our labs during past few years have produced positive results
- Combination of cognitive and physical exercise (Wicking Trust)

# Reversing or slowing progression in early stage

- Psychogeriatric patients illustrate significant short term improvement in cognitive function - physical activity appears to have some arousal effect in these patients
- Several studies have demonstrated improvement with longer term exercise intervention

# Maintaining QOL, Structure and Function

- Reducing depression
- weight loss and cachexia - frequent clinical findings in dementia patients
- dietary intake and physical activity to maintain muscle mass
- important clinical strategies requiring further investigation
- Fatigue and declining neuromuscular function can be slowed or even reversed by exercise

# Keeping the Carer healthy

- Exercise, nutrition, relaxation, connectedness, family, social interaction, respite
- Contribute \$billions to Australian Economy
- Delay chronic disease
- Maintain structure and function

# Managing Co-Morbidities

- Dementia patient and carer
- Chronic Disease processes continue



# Sarcopenia

- Loss of muscle mass and function
- 60% of over 80yrs
- Cause of loss if independence
- Anabolic exercise most effective strategy to prevent or reverse sarcopenia



# Causes of Sarcopenia

- nutrition (under-nutrition and lack of vitamin D)
- decreased hormone levels (e.g growth hormone, testosterone)
- reduced physical activity particularly high intensity
- loss of nerves that innervate the muscles



Grounds, M.D. *Biogerontology*, 2002

image from <http://www.cotavic.org.au/>

# Exercise and Nutrition Intervention Studies

- Increased protein turnover, muscle CSA, and fiber area even in very old
- Optimal combinations of resistance exercise and nutrition
- Glucose and Amino acid intake
- Creatine and other supplementation
- Timing meals for most positive anabolic environment



# Resistance Exercise and Osteoporosis

- Evidence is conclusive
- Lifelong physical activity has strong preventative effect
- Resistance exercise - greatest efficacy
- Example\*
  - 1 year study of strength and endurance training
  - 1.3% increase BMD in training group
  - 1.2% decrease for control

\*Kemmler et al. *Archives of Physical Medicine & Rehabilitation*, 2003

# Resistance Exercise and Osteoarthritis

- Increased function e.g. stair climb and descend, chair rise, walking
- Reduced ratings of pain
- Reduced stiffness
- Studies report resistance exercise to be “safe, effective and well tolerated in OA patients”



# Exercise and Cardiovascular Disease

- Strong protective effect
  - Reduced body fat
  - Improved blood lipids
  - Reduced blood pressure
  - Improved heart and vascular function
- Important therapy
  - Early stage recovery to long term management

# Physical activity and cancer risk

- People who are physically inactive are nearly twice as likely to develop colon cancer (Colditz et al. 1997).
- Physical activity is also associated with around a 30% reduction in the risk of women of all ages developing breast cancer (Thune & Furberg 2001).

# Research Review of Exercise and Cancer Studies

- 26 published studies with pre and post intervention measures and statistical analysis
- 18 during cancer treatment
  - 14 cardiovascular training
  - 2 mixed cardiovascular and flexibility
  - 2 resistance training
- 8 after cancer treatment
  - 4 cardiovascular training
  - 4 cardiovascular, resistance training and flexibility

Galvao and Newton Journal of Clinical Oncology, 2005.

# General Increases

- muscle and bone tissue mass
- cardiorespiratory fitness
- maximum walk distance
- immune system capacity
- physical functional ability
- flexibility
- muscle strength
- QOL
- hemoglobin



# General Decreases

- Nausea
- Body fat
- Fatigue
- Symptom experience
- Duration of thrombopenia and neutopenia
- Lymphocytes and monocytes
- Duration of hospitalization
- Anaerobic energy reliance
- Heart rate
- Resting systolic blood pressure



# General Decreases...2

- Psychological and emotional stress
- Depression and anxiety



# Prostate Cancer and ADT

- Commonly prescribed for prostate cancer patients
- Often increases cognitive decline
- Critical loss of bone and muscle
- Anabolic exercise most effective for limiting sarcopenia and osteoporosis



# Cancer Survival: Time to Get Moving? Data Accumulate Suggesting a Link Between Physical Activity and Cancer Survival

Journal of Clinical Oncology August 2006

# 50 to 60% increase in survivorship!

- 2 large prospective studies in colorectal cancer published in Journal of Clinical Oncology by Meyerhardt et al 2006
- 9 to 18 + MET hours per week or 4-5 sessions of brisk walking 30-60 minutes per week

# Compared to other therapies

- “Such an effect parallels that of (one of the leading treatments for breast cancer), an agent heralded by the oncologic care community and by the Director of the National Cancer Institute, Andrew C. von Eschenbach, MD, as “a major advance and turning point in eliminating suffering and death from cancer.”

*Herceptin costs more than \$70,000 per quality-adjusted life year saved*

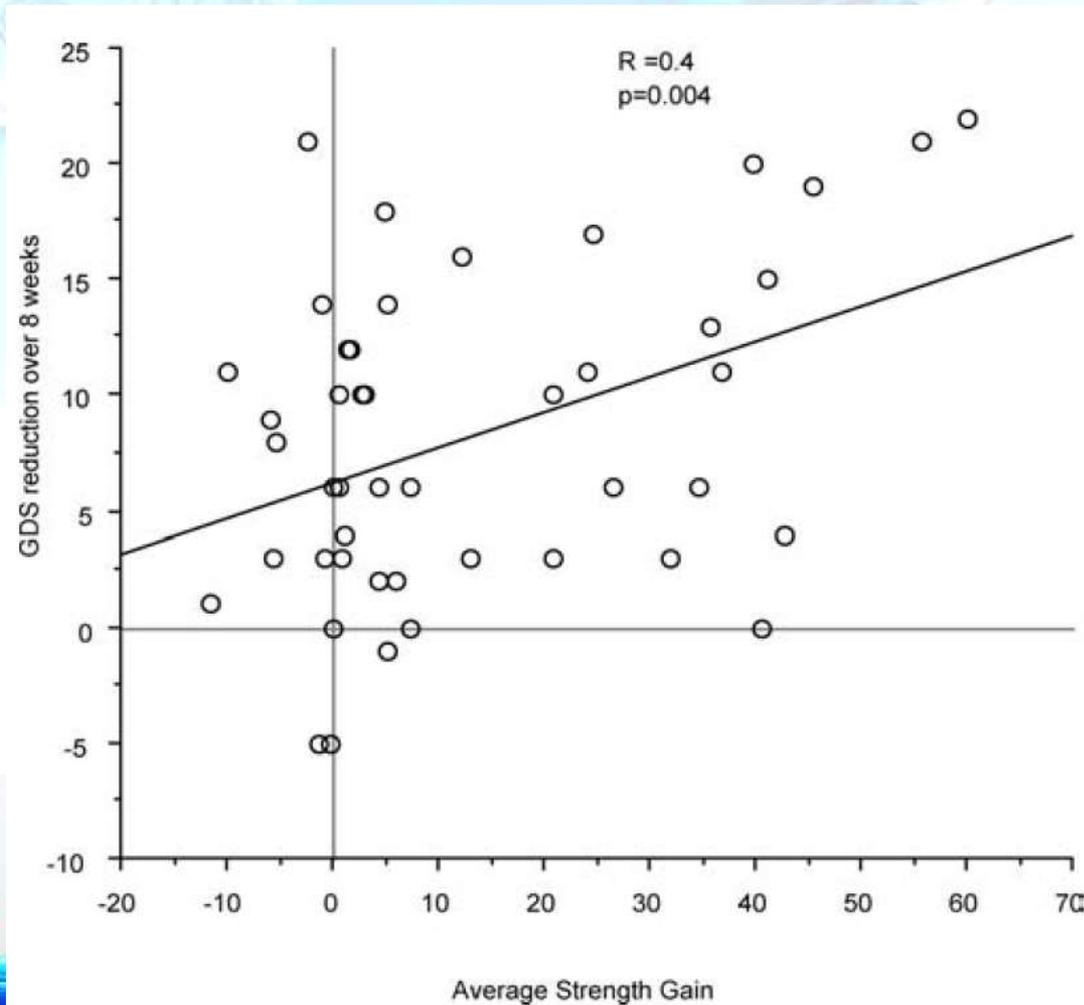
# Anxiety and Depression

- Appropriate physical activity can result in large improvement in anxiety and depression
- Recent research has shown resistance training to be more effective than GP care in older people with diagnosed depression

*Singh NA. et al. A randomized controlled trial of high versus low intensity weight training versus general practitioner care for clinical depression in older adults.*

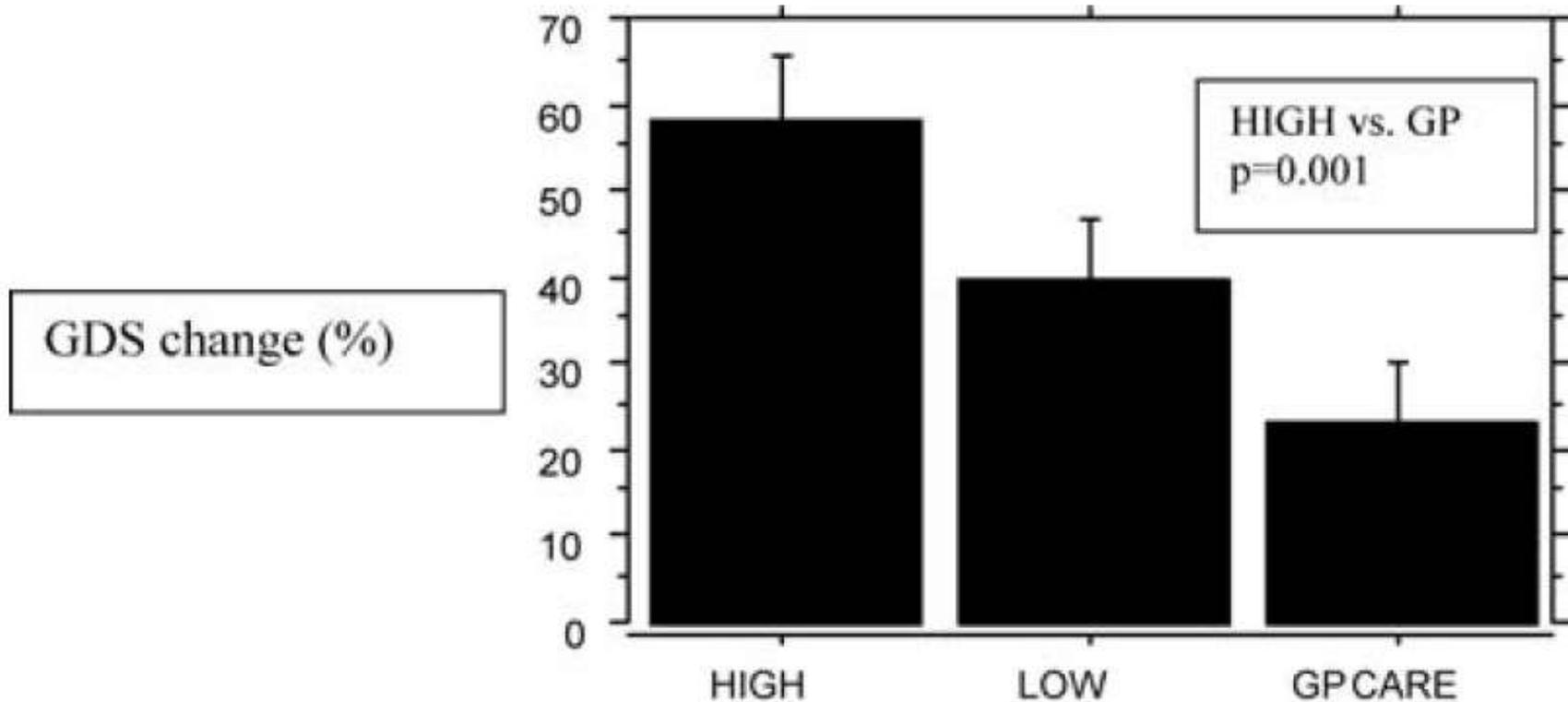
*The Journals Of Gerontology. Series A, Biological Sciences And Medical Sciences 2005 Jun; Vol. 60 (6), pp. 768-76.*

# Depression and Resistance Training



*Singh NA. et al. 2005*

# Depression and Resistance Training



*Singh NA. et al. 2005*



# What is Anabolic Exercise?

- Repetitive movements performed against resistance
- Resistance limits number completed to generally less than 12 repetitions per set

# Exercise recommendations

- Resistance training
  - 2-3 times per week
  - 3 sets of each exercise
  - Intensity of 6-10 RM
  - 60-120 secs rest between sets
  - 6-9 exercises per session
  - Functional exercises
  - Warmup and cool down
  - Total of 45-60 minutes



# What is Aerobic Exercise?

- Emphasizes cardiorespiratory system
- Longer duration exercise involving large muscle groups in repetitive actions
- 20 minutes or longer at 60% HRmax or higher
- Jogging, rowing, cycling, swimming, walking

# Exercise recommendations

- Aerobic Training
  - 4-5 times per week
  - Continuous exercise using large muscle groups
  - Cycling, jogging, swimming, rowing, walking etc.
  - Heart rate of 60-90% of maximum
  - $220 - \text{age}$
  - Warmup and cool down
  - Total of 150 minutes per week

# Target Heart Rate

## Example:

For a person **42 years old:**  
 **$220 - 42 = 178$  Maximum Heart Rate**

**$178 \times 0.8 = 142$  Upper Limit of Target Heart Zone** ( $142/6 = 24, 10$  sec. count)

**$178 \times 0.6 = 107$  Lower Limit of Target Heart Zone** ( $107/6 = 18, 10$  sec. count)

# Heart Rate

- Pulse at wrist or carotid
- Polar Heart Rate Monitor

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Exercise  
Scientific and  
Sports Medicine

# Exercise recommendations

- Flexibility
  - 10-15 minutes
  - Every day
  - Hold static stretch for 60-120 seconds

# Rating of Perceived Exertion

6 No exertion at all

7 Extremely light

8

9 Very light

10

11 Light

12

13 Somewhat hard

14

15 Hard (heavy)

16

17 Very hard

18

19 Extremely hard

20 Maximal exertion

**9** corresponds to "very light" exercise. For a healthy person, it is like walking slowly at his or her own pace for some minutes.

**13** on the scale is "somewhat hard" exercise, but it still feels OK to continue.

**17** "very hard" is very strenuous. A healthy person can still go on, but he or she really has to push him- or herself. It feels very heavy, and the person is very tired.

**19** on the scale is an extremely strenuous exercise level. For most people this is the most strenuous exercise they have ever experienced.

# Home-Based Program

- Warmup of light calisthenics – e.g. walking
- Resistance training exercises
- Aerobic exercise
- Cool-down and stretch

# Squat

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# Pushup



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# Standing Row

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# Abdominal Crunch

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# Standing Leg Curl

# VARIO



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# Back

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# Shoulder Press

# VARIO



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# Triceps

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# Bicep Curl

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# Combining Cognitive and Physical Exercise

- Good evidence in support of cognitive or physical exercise alone
- Current research combining both
- Increased blood flow and increased metabolism and hormones

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“There is no pharmacological intervention that holds a greater promise of improving health and promoting independence in the elderly than does exercise”

Evans & Campbell, Journal of Nutrition, 1993

# Vario Health Institute and Wellness Clinic



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# Thank You

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