

## Exercise Management of Chronic Disease

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## Rising cost of health care

- 10% per annum in Australia
- Each year a greater proportion of the GDP
- 9.7% in 2003–04.
- Unsustainable
- \$78.6 billion total health expenditure 2003–04.

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## Health Service Use

- increased by almost any measure:
  - medical services up by 4.4% in just one year
  - hospital stays up almost 9% in the public sector over the last five years
  - 30% in the private sector
  - pharmaceutical prescriptions up 41% over the latest decade

Australia's Health 2006, AIHW

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## 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

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## 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



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## Risk Factors and Lifestyle

- If the major risk factors for chronic disease were eliminated, at least 80% of heart disease, stroke and type 2 diabetes would be prevented; and 40% of cancer would be prevented
- Major risk factors for chronic disease are an unhealthy diet, physical inactivity, and tobacco use
- Requires a new approach
- Prevention and treatment through lifestyle modification

World Health Organization, 2006

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## We are programmed for physical activity

“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”



Booth et al, JAP 2000

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“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



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Patient has injury or a chronic disease does give immunity to other lifestyle disease

e.g. high probability will survive their cancer

Will you survive the consequences of your choices?

How will it feel to survive cancer but be struck down with a preventable chronic disease

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## What is Anabolic Exercise?



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

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## 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

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## 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
  - 3-4 times per week
  - Continuous exercise using large muscle groups
  - Cycling, jogging, swimming, rowing, walking etc.
  - Heart rate of 60-90% of maximum
  - 220 – age
  - Warmup and cool down
  - Total of 30-60 minutes per day

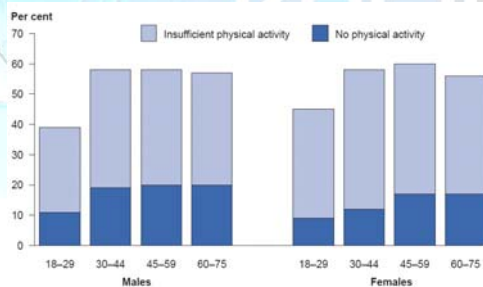
## Guidelines for healthy adults under age 65 Basic recommendations from ACSM and AHA

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: AHW analysis of the 2000 National Physical Activity Survey.

## 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



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## 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.ccs.vic.org.au/>

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## 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



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## 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

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## 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”



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## 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

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## 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).

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## 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

Galvão 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
- Critical loss of bone and muscle
- Anabolic exercise most effective for limiting sarcopenia and osteoporosis



## Current Research – Effects of ADT

- 36 weeks of ADT with 72 men with prostate cancer
- Decreases lean mass of upper limb (5.6%), lower limb (3.7%), trunk (1.4%), and whole body (2.4%)
- Fat mass increased by 20.7%, 18.7%, 12.0%, and 13.8% ( $p < 0.001$ )
- Hip (1.5%), spine (3.9%) and whole body (2.4%) BMD decreased
- physical activity levels decreased and levels of fatigue increased.

## Current Research – Exercise Intervention

- 20 weeks of RT with 11 men on ADT for prostate cancer
- Significant improvements in muscle strength (24-40%), endurance (51-106%), walking ability (4-21%), stair climb (8%), and chair rise (21%).
- Large and significant increase in dynamic balance ability – reduced falls risk

Galvão et al MSSE 2006



## 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

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## 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*

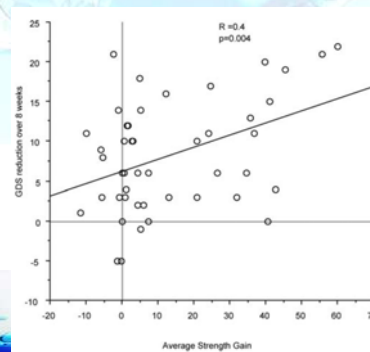
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## Anxiety and Depression

- 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

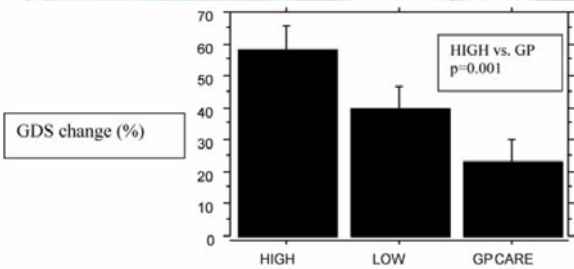
*Singh NA. et al. A randomized controlled trial of high versus low intensity weight training versus general practitioner care for clinical depression in older adults. The Journals Of Gerontology. Series A, Biological Sciences And Medical Sciences 2005 Jun; Vol. 60 (6), pp. 768-76.*

## Depression and Resistance Training



*Singh NA. et al. 2005*

## Depression and Resistance Training



Singh NA, et al. 2005

## 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/>

## Resistance 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 safe and effective

Willey and Singh, *Diabetes Care*, 2003

## Cardiovascular Disease in Australia

- leading cause of death among Australians in 2004
- 47,637 deaths (36% of all deaths)
- a leading cause of disability - 1.4 million Australians (6.9% of the population)
- 17% of total disease burden
- coronary heart disease 53%
- stroke 25%
- heart failure 5%
- peripheral vascular disease 5%



Australian Institute of Health and Welfare  
*Australia's Health 2006*

## Cholesterol

- 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

## Hypertension

- 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.

## Resistance exercise & blood pressure

- Evidence for safety of resistance exercise
  - Cardiac rehabilitation programs (McCartney, 1998 & Pollock et al., 2000)
  - Dynamic resistance exercise evoked similar response as walking up an incline surface for 4 minutes (Benn et al., 1996)
  - At same torque output (100% ISO peak torque), ECC knee extension imposes less BP change than ISO knee extension (Huggett et al., 2004)
  - 6653 maximal strength tests - no reported incidence of major CV events (Gordon 1995)

## 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

- Progression
- Adequate intensity
- Periodized
- Exercise selection for functional improvement
- Include explosive movements?
- Sufficient recovery
- Nutrition
- Anabolic and aerobic exercise throughout life

### Design recommendations for exercise programs



“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



Age: 73  
Weight: 70kg  
Bench: 100kg  
Squat: 120kg  
Hang clean: 110kg

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