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EXERCISE AND THE OLDER PERSON

Series on clinical management
problems in the elderly
No 2

Report of the Health Care Committee
Expert panel for health care of the elderly

NHMRC

National Health and Medical Research Council

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Foreword

With the increased focus on improved lifestyle in the community it is timely that the requirements of the older person be reviewed. Advancing age brings physiological as well as pathological decline in various organ systems. These factors contribute to a lesser level of fitness experienced by older people. This paper provides a clear up to date outline of some of the important age related changes.

Exercise has numerous advantages as highlighted in this paper. Besides improving cardiorespiratory fitness it has benefits in stretching, strengthening, balance and endurance — all very important functions for the elderly. As there are few barriers to exercise, this paper will be of relevance to all those who treat or work with older people including general practitioners, physiotherapists, coordinators and health professionals of the day hospitals, day centres and senior citizen groups. It offers recommendations and guidelines for older people to exercise and maintain fitness. The prescription process is not complex and is made all the easier by the clear background information provided.

The bottom line is that exercise in some form or other performed with appropriate attention to common sense and safety can help promote a healthier lifestyle to an advanced age even in the mentally and physically disabled. The challenge for a health care professionals is to encourage and motivate their patients to exercise.

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Executive summary

- The term 'exercise' can encompass 'activity', 'play', 'movement' or 'sport' by individuals, groups or teams. Exercise implies a time commitment to motor activity that is hopefully pleasurable and beyond the level usually applied to the routines of daily life.
- Exercise is thus possible for the able and the disabled individual.
- When taken in moderation, exercise benefits the health of people of all ages, including older persons. The implication of this is that sensible exercise, as a habit in life, should be made a priority in the education of the young.
- Facilities for exercise should be provided without deterrents induced by distance, cost or, in some venues, the prevailing weather.
- Older persons are increasingly aware that exercise is fun and promoting of social interaction. Exercise provides a capacity to better recover from debilitating illness.
- Through exercising, the older person reveals comparable gains to those seen in the young. Routines emphasising flexibility through regular and gentle stretching are even more appropriate for older persons.
- Exercise can help improve cardiac and respiratory fitness as well as improving balance, strength and endurance.
- This text provides the compelling evidence that some form of exercise is desirable and within the capacity of all but a few severely disabled people. The health sustaining effect of exercise on a variety of our body systems are detailed within. Longevity is not a guaranteed outcome but sensible exercise can enhance the quality of life of all age groups and contributes to a healthier nation.

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Introduction

Increasing age beyond maturity is inevitably linked with a decline in activity and motor performance levels. Motor and sensory skills decline very gradually, although there is evidence that some learning abilities remain intact through the life span of most individuals.

Recent studies have demonstrated that:

- less than 20 per cent of Australians are regularly active at a level sufficient to provide cardiovascular benefits, a figure declining to below 10 per cent of those over 50 years;
- about 45 per cent of the population over the age of 75 have some form of recognised disability;
- perhaps as much as half of the functional decline associated with ageing is the *result of disuse* and can be reversed by exercise aimed at increasing fitness of older persons; and
- more people with tertiary education and higher incomes are regularly active than those of lower education and income.

Older individuals need a level of fitness to enable them to:

- carry out daily activities without undue fatigue;
- develop a reserve of energy for pleasure;
- make a better recovery after debilitating illness; and
- minimise the risks of future ill health.

Changes usually associated with ageing include:

- (a) reductions in
- muscle strength and endurance;
 - lean body mass;
 - coordination, agility, balance and reaction time;
 - joint mobility and flexibility;
 - cardio-respiratory endurance and oxygen intake;
 - bone mass and tendon strength; and
 - the ability to clear glucose from the blood after a meal.

- (b) increases in
- body fat and obesity;
 - blood pressure; and
 - anxiety and depression.

These changes can be improved by habitual exercise.

The amount of improvement will depend upon:

- the extent of the existing condition;
- the type of program provided (eg aerobic or anaerobic);
- the frequency, duration and intensity of exercise;
- the attitude and motivation of the older person toward exercise; and
- the attitude and motivation of health care personnel toward exercise.

Barriers to better levels of fitness in the older person include the negative image of older people as frail and dependent, together with the negative attitude of older persons themselves who:

- believe their need for exercise declines as they grow older;
- greatly exaggerate the risks of exercise for older people; and
- underrate the benefits of light sporadic exercise.

Older persons benefit from exercise just as younger persons do.

Exercise programs need to be tailored to the existing fitness levels of older persons and given the high incidence of disuse, starting programs need to be carefully considered to ensure a steady progression in fitness.

Background

Ageing of the Australian community

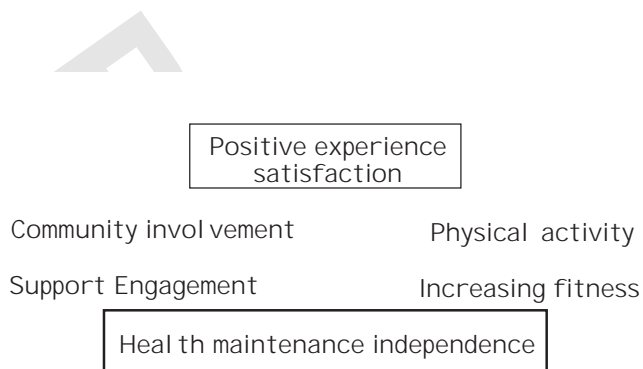
- Life expectancy for both sexes has increased steadily over the past 30 years. In Australia, a female aged 65 years can expect to live a further 19 years; at age 75 years, a further 11.5 years and a further six years at age 85. For males, life expectancy at 65 years is near to 15 years, near to nine years at 75 and five years at age 85.
- The proportion of people surviving to age 85 is four times what it was at the beginning of this century, while the proportion of people surviving to age 75 years is double what it was at the turn of the century.
- Health expenditures by governments are at the limits of tolerability. Our inability to meet the health care demands of older persons will be increasingly apparent. Technology to reduce disability, for instance, joint replacement, will increasingly consume health allocations for the aged. Our ability to provide services to meet the household and personal care needs of older people are under strain.

The increasing relative numbers of older people within Australia and other developed nations raises important quality of life issues related to independence, social interaction, medical care and community involvement. Recent Australian evidence clearly shows for persons aged 60 years and over:

- A decline of time spent at work, but increases of time in passive leisure, social life and home entertainment.
- A decline in the number and range of outdoor and all weather recreational facilities utilised. Age tends to magnify barriers created by cost and distances to such facilities.
- The major reason for the decline in activity levels is given as 'ageing'.
- A belief that older people are excluded and discouraged from participation in both passive and active leisure pursuits.
- A failure of the market to create activities to be demanded by older people. This is evidence of an *underuse syndrome* for older Australians which in itself is a cause of poor health, increasing dependency and declining independence.

Fitness cycles for older people

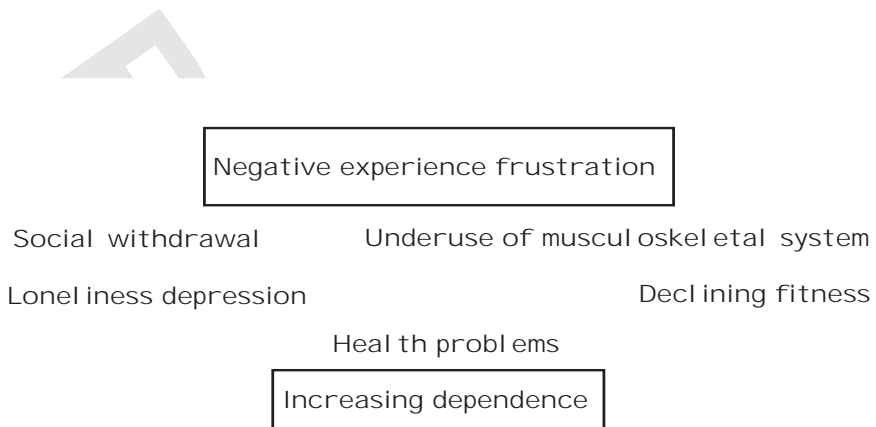
1 Positive cycles



Exercise and resulting physical fitness make important contributions to health and well being at all ages. Positive attitudes towards exercise need to be developed and encouraged from childhood, through adolescence and into later life. An active life style should be everybody's aim. Curtailment of physical education in primary and secondary education compromises these aims.

While the preventive aspects of exercise have been emphasised, regular exercise will only retain a longer-term appeal when it is realised that it gives rise to an enhanced sense of life enjoyment and vigour. Often underestimated, are the benefits of sound mental health by regular social contact with others. Exercise adds life to years and may even add years to life.

2 Negative cycles



A major problem that may confront older persons is a loss of physical independence. Minor episodes of illness can leave an older person dependent for a period until they can meet the moderate physical demands of their daily routine. For some, a protracted period of dependency can lead to premature or inappropriate decisions to relocate into institutional care.

Fitness: exercise and the older person

'Use it or lose it'

Just as the continuation of relatively high levels of intellectual activity are linked to the maintenance of cognitive skills in old age, so it is important that exercise continues and physical fitness levels are maintained. Exercise has a positive effect on cardiorespiratory performance, musculoskeletal activity and neuronal efficiency. There is an abundance of excellent medical and health related literature on these topics.

(a) Cardiorespiratory systems

Regular aerobic exercise, involving the large muscle groups of the body is the foundation of cardiorespiratory efficiency at any age. For optimal improvement, such exercise needs to be performed repetitively and rhythmically so as to increase heart rate for between 15 and 30 minutes, at least three times a week.

- Habitual exercise reduces the age related decline in maximum oxygen consumption and thus aerobic capacity.
- The cardiorespiratory benefits of exercise occur at all ages and the trainability of older people does not depend on their having trained in youth.
- Risks are minimised by an exercise program of moderate intensity, (as low as 30–40 per cent of maximal oxygen uptake) at 70–85 per cent of maximal heart rate. Maximal heart rate declines with age according to the formula $220 \text{ minus age (in years)}$. For some frail individuals over age 70, normal activity levels (eg walking) and self care tasks (eg dressing) *may* require a maximal heart rate response and effort.
- While conditioning as a result of training occurs at a slower rate than in younger persons, it has been shown to still occur at an acceptable rate into extreme old age.
- Evidence for the role of exercise in the treatment of hypertension is now emerging for people of all ages. Exercise for about 30 minutes, three times a week at 60–70 per cent of maximum work capacity produces blood pressure (BP) lowering of about 10mm in both systolic and diastolic BP. The effects are maximal after four weeks and are independent of body weight changes.
- Additional benefits associated with a cardiorespiratory fitness program may be weight loss, probable slowing of arteriosclerosis and the reduction of fatigue.

- The secondary prevention effects of exercise on coronary artery disease are hard to demonstrate because of inadequate sample size in studies undertaken to date. Pooling of data from these studies reveals a 20 per cent reduction in repeat heart attacks in those who exercise after an initial cardiac event.

(b) Muscle and bone

Muscle

There is a general decline in skeletal muscle strength and bulk in old age. This is related to a reduction in both the size and number of muscle fibres, decreased speed of transmission at the myoneural junction and a reduction in mitochondrial activity and enzyme concentration. In addition, an increasing proportion of muscle is replaced by fibrous tissue, although there is only a marginal reduction in fat free mass. The fast-twitch (Type II) motor units are most severely affected, so that movements demanding strength and speed of contraction are more effected than movements requiring endurance.

- These detrimental changes to muscle reflect underuse rather than biological ageing, since they are susceptible to reversal by exercise programs which increase fitness levels.
- Muscle strength can increase markedly with training in older individuals, the amount of increase being of the same relative order as seen in younger people. Similarly, the size and number of fast-twitch muscle fibres increase with exercise in the older person, improving the speed of response and quality of muscle activity.
- Muscle weakness in the legs and increased reaction time are important factors associated with postural instability and falls.
- Through illness, an older person is more likely to encounter enforced periods of rest. Rate of decrease of muscular strength may be as high as 5 per cent per day with leg muscles losing strength twice as fast as arm muscles.

Bone

Bone mass loss begins in men and women from around the age of 35 to 40. Bone loss of 10 per cent per decade after the age of 40 is common. More rapid bone mass loss occurs around age 50, with most women having lost sufficient bone mass by age 80 to be at risk for fracture. About 20–25 per cent of women over 80 are likely to break their hip.

Recent studies strongly support the validity of the role of exercise in the prevention of bone loss and the treatment of osteoporosis. Bone atrophy occurs in the absence of physical activity, while bone hypertrophy follows increased levels of exercise. There is a considerable body of evidence supporting the value of high levels of regular exercise in older persons, in preserving skeletal health. This is particularly the case for females after menopause, when hormonal deprivation adds considerably to involutional bone loss.

- Studies have shown that bone density can be considerably increased in older persons with regular, long-term exercise programs.
- Older athletes have thicker, stronger bones than do sedentary individuals of the same age and gender.
- Regular walking and running significantly increase bone density in the spine as well as the legs.
- Exercises involving both impact and muscle tension produce the greatest gains in bone density. Thus weightbearing exercises have a greater effect on bone density than do exercises in water. However, recent studies show that older person habitual swimmers have greater bone density than sedentary people.
- Exercise has been shown to increase bone density even in osteoporotic females in extreme old age.

There is a strong indication that an inverse relationship exists between muscle mass and osteoporosis in older persons and that a decline in muscle mass is matched by an increasing fragility of bone.

Exercise programs for older persons disabled by osteoporosis and increasing bone fragility must be introduced very carefully and slowly. Ideally this should be a cooperative effort involving the doctor, physiotherapist or physical educator and the older person, with exercise as an essential treatment element. Initially, exercise periods must be brief and take place in an environment where the individual feels secure and comfortable. Thus hydrotherapy is an excellent starting medium, with the rate of progression in the pool and on dry land increasing as strength, mobility and endurance increases.

- Exercise programs must be tailored to suit individual circumstances.

(c) Joints and movement

There is evidence that degenerative joint disease (osteoarthritis) can occur in joints subjected to prolonged extraordinary use, in certain occupations, such as heavy mining. Joints with ligamentous laxity can be aggravated by running. However, there is *no* evidence that normal joints are adversely affected by weight bearing exercise, eg jogging, bike riding etc. Evidence exists to show that patients with arthritis can gain from modified weight bearing activity.

The collagenous elements of the body require movement to facilitate fluid transport and nutrition. Thus, the articular cartilage of synovial joints requires the movement of synovial fluid over its surface, while the alternate compression and relaxation of cartilage during joint movement allows synovial fluid to be expressed and then 'sucked back' into the cartilage as the area of pressure changes over the surface. Similarly, ligaments, tendons and intervertebral discs all require the stresses of exercise and movement to function optimally.

Disuse is associated with a reduction in the amount of joint movement due to adaptive shortening of collagen, thinning of articular cartilage, a reduction in the amount and an increase in the viscosity of synovial fluid, and ligaments and tendons which are thinner and more liable to rupture. Disuse atrophy of joints (including discs), ligaments and tendons are a common part of ageing in Western societies and can be prevented and reversed by regular exercise.

- Movement and exercise are essential for the maintenance of healthy cartilage, for joint lubrication and nutrition, and to maintain the extensibility of the collagenous connective tissues about joints.
- Exercise can significantly increase the range of movement in joints (including the spine) in the older person.
- Exercise and joint movement through a normal range is essential for older persons with stiff arthritic joints.
- Research over recent decades indicates that most people with arthritis can benefit significantly from aerobic exercise without disease exacerbation or joint damage. Unnecessary or prolonged activity may compound disability which has been traditionally attributed to arthritis.
- In each State, the Arthritis Foundation of Australia can provide pamphlets and advice on exercise programs. Such bodies and others can be used to lobby for appropriate, accessible facilities in local communities.

(d) Effects on metabolism

- Resting metabolic rate declines with age and occurs in concert with reductions in lean body mass, bone mass and habitual activity patterns.
- The level of fat in the blood (notably cholesterol), tends to be a little higher in the older person but this rise is less evident among active older persons.
- Physical activity increases high density lipoprotein which counteracts the build-up of cholesterol in the arterial wall.
- Exercise increases the sensitivity of body cells to the effect of insulin thereby reducing the output of this important hormone and improving carbohydrate metabolism.

(e) Psychological changes with age

- Physical activity can be a promising aid for people suffering from depression, anxiety and other emotional disorders as inactivity may be associated with symptoms of depression.
- Exercise has been associated with feelings of improvement in health, general mood, energy level and sleep patterns among older persons.

Sport and the older person

Many individuals now continue regular sport and exercise into old age and clearly show both continuing high levels of athletic performance and the benefits of exercise to their musculoskeletal and cardiorespiratory systems. There are now many examples of major open sporting activities being won by individuals in their thirties, forties and occasionally into their fifties. Similarly, at a lesser competitive levels, many athletes produce personal best times in their middle years. As with athletes of any age, an obsession with exercise can occur and override an individual's judgment when appropriate advice is given to modify activity levels in the face of a new illness.

In comparison with older sedentary individuals, habitual older athletes demonstrate:

- greater aerobic capacity and higher oxygen uptake levels;
- greater lung compliance and cardiac output;
- increased muscle strength and reaction time;
- increased levels of bone density; and
- greater ranges of joint motion and tissue extensibility.

It is estimated that regular exercise may be able to retard such physiologic decline traditionally associated with old age by as much as 50 per cent.

Exercise prescription and the older person

Doctors, physiotherapists and other health care workers should ask about exercise when they see patients. They should have the ability to advise on exercise or a strategy to direct patients to appropriate advice.

The exercise prescription in itself can be unacceptable and of limited value to the individual unless it is accompanied by effective education to encourage and maintain a positive behaviour change.

In more supervised settings (eg day hospital, nursing homes), these principles apply but need to be adapted for the particular group. Coexisting conditions (comorbidity), cognitive state, motivation and existing level of fitness are important considerations.

Exercise may be particularly useful in the frail older person by improving balance, strength and endurance.

Principles of exercise prescription

- Individualised programs are often necessary.
- Take account of the effects of (a) current prescription drugs and (b) pre-existing physical disabilities.
- The effects of different types of exercise on the cardiorespiratory and musculoskeletal systems must be considered eg walking or jogging produces the most effective training stimulus but may be contraindicated for those with significant physical problems in the spine or lower limbs. Enquire about feet, and advise on suitable footwear, possibly involving a podiatrist. Swimming and bike riding are other suitable alternatives. Older people should be encouraged to maintain abilities in these latter areas or to consider swimming tuition.
- It is important to ease steadily into exercise, to begin with low load and low repetition activity and to proceed steadily and slowly dependent on pre-existing conditions. Eventually, this may progress to an exercise program of moderate intensity, at 70–85 per cent of maximal heart rate (ie just exceeding mild fatigue and shortness of breath). An optimal conditioning effect will occur with such a program taking 20–30 minutes a time and for three to five times each week.

- Encourage people to add value to their habitual routines eg walk instead of ride, perhaps keep a garden. Minimum work of walking two times per week at 40–60 per cent of maximum heart rate will give conditioning and increase activity levels.
- Encourage short-term achievable goals and not just long-term aims. Thus increase the length or time of walking, gardening etc.
- Identify pleasurable exercise activities.
- Educate individuals of the continuing need for high levels of exercise through life.
- Encourage people to exercise with a partner or as part of a group.
- Emphasise the psychological and behavioural benefits of exercise as well as the physical.

The following are reasonable recommendations:

- Exercise must not abuse limited physical abilities.
- Muscles must be routinely stretched before and after active exercise programs.
- Older athletes must exercise within the limits of their functional capacity.
- Older women should participate in physical exercise as much as men.
- Sedentary older individuals should consider pre-exercise medical consultation to establish the nature and likely influence of any disease on their proposed program. Fitness programs should be supervised by qualified fitness leaders. Such programs are regularly advertised in local papers.
- Regular exercise, commenced at a low level, and gradually increased is not a hazard to a person who is seen to be free of heart disease on history and examination and on a standard resting ECG. Stress ECGs are not a prerequisite for all middle-aged persons wishing to perform regular moderate exercise.

Barriers to exercise

People of all ages are capable of exercise in some form. The following conditions are not contraindications to an exercise program:

- dementia;
- severe arthritis;
- advanced cardiac or respiratory disease;
- severe osteoporosis;
- unsteady gait;
- wheelchair confined person; and
- general frailty.

However, it is essential to modify the program to take account of these conditions and to choose programs that will improve cardiorespiratory fitness.

Poor motivation and a negative attitude can be barriers to a successful program. Explanation of the relative merits of exercise, and negotiating an acceptable program and supportive follow-up help to improve compliance.

Exercise programs are not usually appropriate during the acute phase of an illness. Once the condition has been stabilised active mobilisation should commence.

Prevention

Exercise, with its effects on muscle bulk and strength, skeletal health and bone mass, the ranges of joint movements, cartilage compliance, soft tissue extensibility and neuronal efficiency, in addition to its better known effects on the cardiorespiratory system is essential for an independent, active life in old age.

The older person must understand that the adage 'Use it or lose it' has direct application to the quality of their life as the years proceed.

Health education should ensure that the relationship between the level of fitness and the maintenance of function (and thus independence) is well understood by the older person.

The preventive role of exercise to the middle aged and the older person has to focus on the continuing need for moderate levels of physical activity throughout life.

An extensive literature attests to the benefits of exercise in human health. For those who are already old, exercise provides no less benefit in minimising some of the limitations of later life, eg reduced mobility, tendency to fall and reduced interaction with one's environment. Greater muscle strength increases the confidence with which an individual can negotiate steps and other barriers, use public transport etc. For many older persons, inactivity renders them particularly prone to the deleterious effects of transient illness. A vicious cycle of inactivity can ensue. Recognition of this cycle and its reversibility can limit avoidable dependency in older persons.

The goal of a reasonable level of physical fitness is to ensure that quality of life is maintained in old age, that older persons have the opportunity to remain mobile and independent with the physical capacity to continue to be able to enjoy life to an optimal level.

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