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Australian and New Zealand Society for Geriatric Medicine
Position Statement – Exercise guidelines for older adults

Overview

1 Regular exercise is essential for healthy ageing, and all older adults should be encouraged to be physically active.
2 Exercise has a role in prevention, treatment and management of cardiovascular disease, congestive heart failure, respiratory disease, osteoporosis, arthritis, and mood and sleep disorders, to name a few.
3 Exercise programs should be multi-component and include aerobic, strength, balance and flexibility training.
4 Exercise programs are safe for older adults. The risk of inactivity poses a greater health risk than exercise. Even frail elderly people are able to safely participate in exercise programs and achieve benefits. Studies have shown that serious adverse effects are uncommon.
5 The evidence suggests that exercise interventions in older adults are cost-effective.
6 Physical activity can increase longevity. Studies have shown this effect occurs in people who commence exercise late in life as well as those who exercise throughout life.
7 Beneficial effects of exercise have been observed with regard to prevention of cognitive decline and reduction in the rate thereof. People with cognitive impairment should be encouraged to exercise. There is a growing body of evidence for the benefits of exercise in people with dementia.
8 Exercise can reduce the risk of falls in older adults. Effective programs target people at risk for falling, are individually tailored, and include balance and strength training.
9 The evidence suggests that exercise can delay or prevent disability in older adults. Identification of older adults with preclinical disability is key, as is the development of intervention strategies to prevent functional decline.
10 Exercise programs can be successfully carried out at home or in group settings and should include some amount of instruction.
11 Older adults are more likely to adhere to an exercise program if they have social support and feel safe to exercise, have mutually agreed-upon goals and are confident in their ability to succeed.
12 Regular physician advice about exercise encourages participation in older adults.
13 Identification of barriers to participation is essential; physical, psychological, cultural and environmental barriers must be addressed.
14 There is a lack of consensus about the type of medical assessment and screening tests required before advising an older person to commence an exercise program. An activity plan that includes a strategy for risk management and prevention of injury should be developed.
15 Research to determine the most effective type, intensity, frequency and duration of exercise programs to optimise physical function in all older adults is needed. Exercise interventions must involve standardised functional assessments and include well-defined disability outcome measures.

This Position Statement represents the views of the Australian and New Zealand Society for Geriatric Medicine. It was written by Dr Michelle Dhanak and Associate Professor Robert Penhall and approved by the Federal Council of ANZSGM on 16 June 2013.

Introduction

> All parts of the body which have a function, if used in moderation and exercised in labors in which each is accustomed, become thereby healthy, well developed and age more slowly; but if unused and left idle they become liable to disease, defective in growth and age quickly.
>
> Hippocrates, 450 BC

The benefits of exercise have been recognised for thousands of years and are well supported by clinical evidence. Promoting physical activity in older people is key to the maintenance of health and function. Physical inactivity is a leading cause of preventable morbidity and mortality. Physical activity guidelines for older adults stress that older people should be as active as possible and that any activity is better than none.

Australian and New Zealand physical activity guidelines for older adults are consistent with global recommendations of 30 minutes or more of moderate-intensity activities at least five days per week as well as two sessions per week of resistance and flexibility activities [1–7]. It is now recommended that the intensity level for older adults be determined relative to fitness level instead of being based on an absolute number of metabolic equivalent of task units as recommended for adults younger than 65 [4,8].

Balance exercises are recommended for those with impaired mobility or at risk for falls [1–7].

Current guidelines recommend exercise of low intensity and duration initially in highly deconditioned individuals. All older adults should have an individually designed activity plan that describes recommended levels of physical activity and how they will achieve this. People with chronic conditions require a plan that integrates prevention and treatment [4,9].

Definition

The terms 'exercise' and 'physical activity' are often used interchangeably; however, they have different meanings. Physical activity is defined as any bodily movement produced by skeletal muscles that results in energy expenditure. Exercise, which is a subset of physical activity, is defined as a bodily movement that is planned, structured and repetitive, performed for the purpose of improving or maintaining physical fitness [10]. While the focus of this statement is on exercise, the evidence supporting these guidelines includes studies of physical activity.

Scope of the problem

The costs of physical inactivity and disability are high, and mobility impairment is one of the primary reasons for entry into residential aged care. Surveys in Australia have identified women, older adults, the financially and educationally disadvantaged, and non-English-speaking individuals as least likely to participate in physical activity [11]. The 2011/12 New Zealand Health Survey found that almost 30% of men and almost 40% of women older than 75 reported less than 30 minutes of daily physical activity [1]. A systematic review by Hill and Brown found wide variation in physical activity levels in older Australians, concluding that it is not possible to accurately estimate the proportion meeting physical activity guidelines. However, their review suggests that between 45 and 75% of older adults are less active than recommended [12].

People with functional dependence or who declined to functional dependence accounted for almost half of total health-care expenditure in a group of community-dwelling older adults over a two-year period [13]. The health-care cost of inactivity in Australia is estimated to be $377 million per annum [14,15]. A study done for the New Zealand Hillary Commission estimated that a 5% increase in the number of adults participating in physical activity would result in $24 million in savings annually from reduced health-care costs, additional years of life gained and reduced disability [16].

Benefits of exercise

Exercise can be an important intervention for the prevention and treatment of many chronic conditions, such as cardiovascular disease, hypertension, diabetes, obesity, chronic obstructive pulmonary disease, osteoporosis, depression and sleep disorder [17–20]. A recent United States report highlights the increased risk for colon, breast and endometrial cancers associated with excess weight and physical inactivity [21].

Aerobic training has been shown to improve cardiovascular fitness, improve lipid profile, reduce blood pressure and improve left ventricular hypertrophy. Both strength and aerobic training improve glucose metabolism, reduce abdominal mass and have a positive effect on bone mineral density [19,22]. A recent randomised controlled trial in patients with New York Heart Association Class II and Class III heart failure with poor physical function suggests that exercise programs combining aerobic and resistance exercise may be more effective in improving performance of activities required for daily living than aerobic exercise alone [23]. Observational and randomised controlled trials have shown that older adults (60–80 years) are able to substantially increase their maximal oxygen uptake with aerobic conditioning [22]. It has been demonstrated that resistance training increases muscle mass and strength and improves neuromuscular performance [24–28].

The benefits of resistance training have been demonstrated in the oldest old. A randomised controlled trial of frail, institutionalised 90-year-old men and women demonstrated increases in muscle mass of ~9% and average increases in strength of 174% after eight weeks of high-intensity resistance training [28].

Cost-effectiveness of exercise

Physical activity interventions in older adults appear to be cost-effective. The Lifestyle Interventions and Independence for Elders Study, a multicenter randomised controlled trial currently underway, is investigating physical activity and prevention of disability. A preliminary cost analysis was conducted for the study and found a lower incidence of major mobility disability for a physical activity program versus an education program after one year of intervention, at an average cost per participant of $1134 compared to $175 for the education program [29]. Economic evaluations of the Otago Exercise Program, a home-based fall prevention program, determined that it cost about NZ$1500 (at 1998 prices) per person per fall prevented. The program was most effective in those more than 80 years of age. When hospital cost savings due to falls prevented were taken into account, the cost was reduced to NZ$576 (at 1998 prices) per fall prevented [30].

A randomised controlled trial that included a cost-utility analysis found resistance training more cost-effective than balance and tone classes. This economic benefit was sustained during the 12-month period following completion of the intervention, due in part to lower fall-related health-care costs. This study was limited by the small number of participants and a wide standard deviation in cost [31].

In Australia, Sherrington and colleagues have recently completed a randomised controlled trial evaluating the effectiveness of a home-based exercise program in reducing mobility-related disabilities and falls in recently hospitalised people

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older than 60. When published, this trial will include a cost analysis [32].

Physical activity, mortality and longevity

The Harvard Alumni Study has demonstrated the causal effect of physical inactivity on mortality. In this observational study, sedentary middle-aged to older men who commenced moderately vigorous physical activity had a 23% lower risk of death during the 11-year follow-up period compared to those who remained inactive. Increased longevity was observed in all age groups, including 75–84-year-olds [33]. Flicker and colleagues found that inactivity in older Australians was associated with a doubling of all-cause mortality in women and a 28% increase in men. Additionally, mortality risk was lower in those who were overweight, defined as those with a body mass index between 25 and 30 [34].

Cardiovascular fitness is associated with reduced mortality rate; this protective effect is evident across age groups. Low levels of cardiovascular fitness are associated with increased relative risk for mortality for men and women [35]. There is an inverse dose–response relationship between amount of physical activity and all-cause mortality. The frequency and duration of activity required to achieve this result have yet to be defined, but energy expenditures of about 1000 kcal/week are associated with a 20–30% reduction in all-cause mortality [36]. Results published in 2012 from the Whitehall II longitudinal cohort study provide additional support for promoting exercise in older adults. This study of middle-aged men and women followed for almost 10 years found a 33% risk reduction in mortality with moderate physical activity, but no mortality risk reduction with mild or vigorous physical activity. They highlighted the importance of evaluating both type and intensity of exercise [37].

Simonsick et al. assessed the risk of inactivity in non-disabled people older than 65 and found a protective effect of increased physical activity with regard to mortality. This supports the hypothesis that regular exercise reduces the risk for development of functional limitations and, by extension, disability [38].

Exercise to delay and prevent disability

Does exercise delay or prevent disability? Utilising data from the Established Populations for Epidemiologic Studies of the Elderly study, a 10-year prospective trial to examine predictors of dying without disability in the last year of life, Leveille and colleagues found a nearly twofold increase in the likelihood of dying without disability in the most active older adults compared to those who were sedentary [39].

The U.S. Department of Health's Physical Activity Guidelines Advisory Committee Report of 2008 concluded that there is strong observational evidence that regular physical activity reduces the risk for moderate or severe functional impairment in middle-aged and older adults. There is modest evidence that regular physical activity improves or maintains function in older adults with existing functional impairments [40].

The evidence does not prove a causal effect of exercise in the prevention or delay of disability, although there are a number of randomised controlled trials showing the benefits of exercise on aerobic capacity, strength and balance, suggesting the plausibility of a causal effect. A trial by Pennix et al. provides some of the strongest evidence of this link. The Fitness, Arthritis and Seniors Trial (FAST), a randomised controlled trial of community-dwelling adults with an average age of 69 with osteoarthritis of the knee, found that individuals who participated in aerobic and resistance exercise programs were less likely to develop incident disability at 18 months compared to those participating in an educational program. Those with the highest compliance with the exercise programs were assessed as having the lowest risk for development of disability [41]. The Lifestyle Interventions and Independence for Elders Study compares a moderate-intensity exercise program with an educational program in sedentary older adults at risk for major mobility disability, defined as the inability to walk 400 m. When completed, this trial may provide evidence that physical activity can prevent mobility disability [42].

Keysor argues that clear definitions of physical activity and exercise are needed, that a framework for disablement outcomes that can be used in exercise interventions needs to be developed and that a mechanism that explains the relationship between physical activity and exercise and disablement should be developed [43].

The relationship of exercise to cognitive impairment and dementia

There are several hypotheses as to how exercise and aerobic fitness might affect cognition. One is the cognitive reserve hypothesis, which proposes that exercise improves cerebral perfusion, thus leading to a larger cognitive reserve that can be beneficial in neurodegenerative disorders such as Alzheimer's disease. Another is the vascular hypothesis, which suggests that aerobic fitness reduces the risk of cardiovascular disease, which is one determinant for dementia. Finally, the stress hypothesis suggests that exercise reduces stress, thereby reducing the risk for dementia [44].

There are a number of studies that provide evidence for the protective effect of physical activity on cognition. A prospective longitudinal cohort study by Laurin et al. found moderate to high levels of physical activity were associated with lower risks for development of cognitive impairment, Alzheimer's disease and other dementias in women [45].

An observational study by Middleton and colleagues of people older than 70 found that higher levels of physical activity were associated with lower incidence of cognitive impairment. This study did not examine intensity of activity but did find a dose–response relationship between physical

activity and development of cognitive impairment [46]. Recent randomised controlled trials suggest that resistance training may also provide cognitive benefits [47,48]. A well-designed randomised controlled trial by Lautenschlager et al. that assessed the effects of physical activity on cognitive function in adults 50 years or older with self-reported memory complaints found a small but significant improvement in objective measures of cognitive function that persisted over the 18-month follow up period in the intervention group [49]. Just as importantly, a 10-year longitudinal study of elderly men aged 70–90 found that men who reduced their physical activity had a higher rate of cognitive decline compared to those who maintained their level of physical activity [50].

A systematic review by van Uffelen and colleagues found a beneficial effect on cognition for aerobic and strength training in one-third of participants without cognitive impairment and in two-thirds of those with cognitive impairment [51]. A Cochrane review that examined the effect of cardiovascular fitness on cognition in healthy older adults found insufficient evidence that observed improvements in cognitive function were attributable to enhanced cardiovascular fitness from exercise [52]. Both reviews concluded that although there appears to be a beneficial effect of exercise on cognition, the current evidence is limited by large variability in exercise protocols and measure of cognitive function, small sample sizes and lack of high-quality studies [51,52]. No negative effects on cognition were observed in any of the studies reviewed.

People with dementia can be included in exercise programs, as demonstrated in an Australian randomised controlled pilot trial evaluating the effectiveness of an exercise program in people with mild to moderate Alzheimer's disease [53]. A recent review of 10 randomised controlled trials evaluating the effects of exercise on people with dementia supports the benefits of exercise in this group. The authors suggest that interventions may be more effective when they are task-specific and of longer duration [54].

Exercise in frail older people

It is important to include frail older people in exercise programs, and in fact, they may achieve the greatest benefits. Fiatarone et al.'s randomised controlled trial of high-intensity strength training in frail, institutionalised 90-year-olds clearly demonstrated that the frail older person can participate in and benefit from strength training programs [28]. A further study by Fiatarone et al. demonstrated functional improvements (defined as stair-climbing ability) with 10 weeks of progressive resistance training in frail nursing home residents [55]. The 1998 American College of Sports Medicine (ACSM) position statement suggests strength and balance training may need to precede aerobic activities in very frail individuals [56].

A recent randomised controlled trail evaluated six months of exercise interventions to prevent decline in highly deconditioned institutionalised elderly persons. While the control group experienced a significant decline, they found that the exercise intervention groups were able to continue performing their activities of daily living (ADL) at six months, although this benefit was lost at 12 months. Interestingly, they found worsening of neuropsychiatric symptoms in the control group but stabilisation or improvement in the intervention groups. This finding should be explored in further research [57].

The evidence suggests that exercise programs are effective in frail elderly people, but diverse outcome measures, lack of a uniform definition of frailty, and significant variation in exercise protocols make it difficult to know whom to target and which interventions will achieve maximum benefit. Additional research is required to determine which interventions impact which specific functional domains [58,59].

Exercise to reduce fall risk

Thirty per cent of all adults older than 65 living in the community fall each year [60]. Current evidence indicates exercise interventions that involve two or more of the exercise categories of strength, aerobic, balance and flexibility exercises reduce both risk and rate of falling in community-dwelling elderly people [60,61].

Australian guidelines recommend balance training for people at risk for falling. The most effective interventions are those that include progressively challenging balance activities, are of sufficient duration and frequency (at least two hours per week for at least six months) and do not include a walking component. Both home- and group-based activities are effective [62]. The successful Otago Exercise Program, a 12-month home-based program of strength and balance exercises to reduce falls, has a reported adherence rate of 74% [63].

A 2010 Cochrane review of exercise interventions found inconsistent evidence that interventions in nursing care facilities reduce falls. However, a post hoc subgroup analysis of these trials suggests that interventions that target multiple risk factors and are provided by a multidisciplinary team may be effective [64].

Identifying preclinical disability

Fried and colleagues [65] hypothesised that there is an identifiable transitional stage between non-disability and disability when impairments impact on an individual's general function but the individual remains able to complete affected tasks and thus does not recognise the change as a disability. This 'preclinical disability' is characterised either by a general reduction in activities requiring a particular physical ability or by modification of the method used to complete a task. Identification of individuals at risk to progress to disability is important, as it will allow for development of targeted preventative strategies. In a prospective observational study, Fried et al. found a threefold to fourfold increase in risk for

progression to disability in women who reported task modification at the onset of the study compared to women who did not report task modification [66].

Observational research has shown that mobility disability leads to threefold to fivefold greater risk for ADL dependency [67]. Guralnik and colleagues demonstrated that objective measures of lower extremity function were predictive of subsequent onset of disability in a prospective cohort study of non-disabled men and women 71 years and older. Participants with the lowest scores on tests of standing balance, an eight-foot timed walk, and a timed sit-to-stand of five repetitions were four to five times more likely to have ADL or mobility disability at four years as compared to participants with the highest performance scores [68].

Settings and adherence

Older adults are more likely to adhere to an exercise program if they have social support to exercise, the program meets their interest and needs, and they feel safe and confident in their ability to succeed.

Interventions that include goal setting with a written contract and provide regular performance feedback and positive reinforcement increase the likelihood that the activity will be maintained [69]. Activities that are convenient, low-cost and of moderate intensity are associated with increased participation in community-dwelling older adults.

Both home- and care centre-based exercise interventions are effective, but few studies have compared these two directly. In healthy middle-aged and older adults, it appears that participation rates are higher in supervised home-based programs [70].

A recent randomised controlled trial demonstrated that video game balance programs are acceptable to older adults, can be performed at home and provide an alternative to standard group-based balance activities [71].

Environmental factors such as good weather, well-maintained sidewalks and provision of places to sit and rest influence participation in physical activities in older adults [69]. Two recent qualitative studies examined factors influencing physical activity. A study in Christchurch, New Zealand, found that leisure-time physical activities in older adults varied according to neighborhood socio-economic status, with lower activity levels associated with 'high neighborhood deprivation', meaning neighborhoods with lower levels of services, income, employment, health, education and housing [72]. An Australian study of older women reported ethnicity-specific differences in barriers to physical activity, highlighting the importance of considering cultural factors when developing programs and making physical activity recommendations [73]. The New Zealand Ministry of Health guidelines on physical activity for older people address this and include culture-specific information [1].

Promoting exercise in older people

Health-care providers play an important role in encouraging incidental activity and should give exercise advice at regular intervals. Studies have found a positive association in older people between receiving exercise advice and subsequent participation in moderate to high levels of physical activity [74,75]. A study of the 'green prescription', introduced in New Zealand in 1998, has shown that advice by general practitioners is effective in promoting physical activity and that written advice can take as little as five minutes to prepare and is more effective than oral advice alone [75]. Morey et al. proposed a paradigm shift from physician as gatekeeper to physician as physical activity advocate [76].

All adults should have a physical activity plan. This plan must meet the person's specific needs and include realistic goal setting. It should describe how, when and where each activity is to be done and should include a gradual approach to increasing physical activity. Recommendations for the older adult must take into account chronic conditions and functional limitations. Older adults commonly have intercurrent illnesses that impact their ability to initiate and maintain an exercise program, highlighting the importance of tailoring the exercise program to the individual, with modifications during periods of ill health.

Medical assessment before commencing exercise

Screening of older adults prior to permitting them to start an exercise program remains controversial. The ACSM has acknowledged that the risks associated with inactivity exceed the risks from participation in regular physical activity [8,9,56]. For healthy asymptomatic adults of any age, cardiac screening is not required before beginning a light-intensity program [8,77]. A strategy for risk management and prevention of injuries is recommended [69]. The presence of common conditions like cardiovascular disease, diabetes, stroke and chronic obstructive pulmonary disease are not specific contra-indications to exercise, and exercise may be therapeutic. Unstable cardiovascular disease and uncontrolled conditions are contra-indications to exercise and require further investigation [8,56].

Adverse events associated with exercise interventions have rarely been reported in the literature and have typically involved minor musculoskeletal injuries that did not necessitate withdrawal from the study; however, the true prevalence is not known [17,25,28,56]. A recent study of adverse events over a 10-year period in people older than 65 participating in high-resistance training found only 448 adverse events over 105 793 training sessions. Seventy-two per cent of these were musculoskeletal, and no more than 0.02% were cardiovascular (10 episodes of angina, equivalent to one episode for every 10 529 hours of training) [78]. The risk of adverse cardiac events associated with exercise is a concern to clinicians giving exercise advice to older adults as well as to older adults themselves [69]. The

actual risk is not well defined, and much of the information comes from cardiac rehabilitation programs, with estimates of occurrence rates of adverse cardiac events ranging between ~1 per 60 000 rehabilitative hours and ~1 per 80 000 rehabilitative hours per participant [76]. Educating participants about risks and helping them to understand how to self-monitor their exercise intensity levels will help reduce their concerns [69].

Gill and colleagues [79] addressed the role of routine exercise stress testing before commencement of an exercise program in adults older than the age of 75. They argue that the guidelines regarding exercise stress testing are not applicable to older adults who would like to use exercise to restore or enhance their physical function. They suggest pre-exercise stress testing is of unproven benefit and expensive and may deter older adults from participating in physical activity. They recommend a history and physical exam directed at identifying potential cardiac contra-indications to exercise, which include myocardial infarction within six months, angina, signs or symptoms of congestive heart failure, and a resting systolic blood pressure of greater than 200 mm Hg or diastolic blood pressure of greater than 100 mm Hg. People with overt cardiovascular disease should undergo risk stratification and be managed appropriately.

Future research

Research to determine the most effective type, intensity, frequency and duration of exercise programs to optimise physical function in older adults is needed. Exercise interventions must include standardised functional assessments and well-defined disability outcome measures. Training of physicians in exercise prescription is important and should be included in both general practice and geriatric medicine training.

Summary

Physical activity is essential for healthy ageing. It can help prevent disability and maintain function in older adults. Avoiding inactivity with regular exercise has significant personal and public health benefit and should be promoted to and for adults of all ages, including the oldest old.

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