Healthy Ageing and Physical Activity

NSW HEALTH

Ageing &
Disability
Department

Healthy Ageing and Physical Activity

For the International Year of Older Persons

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Summary

This special communication complements the previous communication by the NSW Chief Health Officer on physical activity and health. That statement recommended that every adult in New South Wales should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week. This communication emphasises the evidence that participation in regular exercise results in similar health benefits among older adults as well as being effective in slowing the reduction in bodily functioning associated with ageing. For the purposes of this communication older people are those aged 55 or older.

As with younger adults, physical activity needs to be regular and consistently maintained over time, regardless of which physiological, psychological or other health gains are desired. Walking is usually the easiest, most achievable and certainly the most popular way to accumulate the required amount of physical activity. It is a natural part of the daily routine, is a sign of independence and does not require costly outlay to begin. Pre-exercise screening is not necessary for people wanting to commence moderate-intensity physical activity such as walking, swimming or dancing unless there is recently diagnosed or unstable cardiovascular disease or other major health problem. When walking is not a feasible activity people should consider seated or water-based exercises or strength and balance training.

Endurance exercise can maintain and improve cardiovascular function. Importantly, it can lead to reductions in risk factors associated with disease states (for example, heart disease and diabetes) and improve health status. Strength training helps offset the loss in muscle mass and strength associated with normal ageing. Additional benefits include improved bone health and thus reduction in risk for osteoporosis; reduction in the risk of falling; and increased flexibility and range of motion. Compared to sedentary adults those older adults who maintain an active lifestyle may have daily functioning comparable with people aged 15 years younger. Regular physical activity contributes to a healthier, independent lifestyle, greatly improving the functional capacity and quality of life for older people.

Regular physical activity may also contribute to a number of psychological benefits related to cognitive functioning, alleviation of depressive symptoms, and an improved concept of personal control.

Since only 40 to 60% of older people are regularly active, there are considerable health gains to be obtained by encouraging greater participation in physical activity. Current recommendations emphasise that vigorous activity is no longer necessary to obtain health benefits and that moderate-intensity activities such as walking, swimming, dancing and gentle exercise can result in improved health and well-being.

Physical activity and healthy ageing

This special communication complements the previous communication by the NSW Chief Health Officer on physical activity and health. That statement recommended that every adult in New South Wales should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week. Older adults, whether healthy, frail or disabled will all benefit from appropriate amounts and types of physical activity. Regular physical activity has the ability to minimise the typical physiological changes associated with ageing, to improve management of chronic diseases or to reduce the risk of their development and to enhance general psychological well being. For the purposes of this communication older people are those aged 55 or older. However it is emphasised that chronological age need not be the limiting factor in quality of life and daily functioning that may have been assumed in the past.

Consumer research[1] has shown that older adults want to avoid the stereotyping of old age, remaining socially active and that older men in particular are concerned about their health. Being physically active is one way of addressing these issues. Many older people participate in organised sport (eg golf, bowls, swimming, tennis, bushwalking) and dancing is also popular because it has the added significance of social interaction. Walking, whether organised (eg. clubs, shopping centres or cardiac rehabilitation) or free-living (walking the dog, walking to get to or from places), is the most popular physical activity. There is evidence older adults who follow an active lifestyle, have the daily functioning equivalent to less active people aged 15 years younger.[2]

This communication synthesises the recommendations for physical activity and healthy ageing from several sources including a systematic review of the literature[3] commissioned by NSW Health, as well as recent statements from the World Health Organization,[4] American College of Sports Medicine[5] (ACSM) and from the United States Surgeon General (USSG).[6]

Cardiovascular functioning

Older adults develop the same 10%-30% increases in maximal oxygen consumption with prolonged endurance training as do young people, but there are gender differences as to what contributes to the increases found.[7] The maximal oxygen that the body can utilise (VO_2max) decreases with age and is an index of cardiovascular function.[8] While cardiovascular responses to maximal exercise do show differences between older and younger adults, similarities in heart rate responses and cardiac output are found after submaximal exercise.[9] For the same increase in VO_2 max women rely on larger arteriovenous oxygen difference instead of an increase (in men) in left diastolic filling characteristics, stroke volume, cardiac output and left ventricular mass.[7]

Endurance training appears to have similar effects on adult cardiovascular risk factors whether young or old:[10,11,12]

- lowering of blood pressure to the same degree;
- increases in plasma HDL and HDL2 cholesterol;
- reductions in triglycerides and the cholesterol:HDL ratio; and
- body composition changes, the most consistent effect is reduction in the overall percent body fat even if there is no change in bodyweight overall. For men a large decrease has been shown in intra-abdominal fat (the main fat-depot in men).

Older adults with cardiovascular disease have decreased cardiac output after the same absolute exercise intensity compared to healthy peers.[13] Older people with cardiovascular diseases obtain the same benefits from exercise training as do younger people with cardiovascular diseases and they respond with similar cardiovascular adaptations. Other benefits include better sleep and regulation of blood glucose and lipoprotein levels.[14] Long-term training is associated with lower fasting and glucose-stimulated plasma insulin levels and improved glucose tolerance.[15] In general, healthy older adults do not get the same improvements following acute exercise as do young adults.[15]

To achieve maximal beneficial changes in cardiovascular fitness regular exercise of least three extended sessions per week, maintained consistently over time is required. Studies of effective programs for older adults[16-31] have shown that a session usually lasted one hour including warming up and cooling down and that program duration was a minimum of 12 weeks. Most of these programs were supervised and the drop out rate, where reported, ranged from under 10%[21] to 30%.[22,31] Program components included walking[16,18-20,22,24,25,29,30,] treadmill exercise[21,26]; aerobic exercise/movement on land[17-19,27,31] or water[23,27]; supervised resistance training[20,24,25] and cycling.[18,19] The intensity of the exercise undertaken depended on participants' initial fitness level.

Improving cardiovascular fitness can also address cardiovascular disease symptoms. Studies with sedentary people have shown a reduction in blood pressure,[32-34] or heart rate[35] after physical activity. The program followed by sedentary people in Posner's study[33] had a dropout rate of only 6% and involved stationary cycling at 70% VO_2 max for 30 mins, three times per week for 17 weeks. The other programs involved walking or bicycling at 50-70% VO_2 max (that is moderate-intensity exercise) for periods of 6-9 months three times per week. A favourable change in lipid levels (HDLs increased with a concomitant decrease in total cholesterol) in subjects with hypertension was seen in a Japanese study[36] after monitored treadmill exercise for 9 months, 3-6 times per week.

Activities such as walking, running, swimming and cycling should be part of a healthy ageing lifestyle. Regular light-to-moderate activity may reduce age-associated deterioration in physiological function. Moderate-to-vigorous physical activity may be necessary to elicit adaptations to the cardiovascular system and minimise disease risk factors.

Prevention of injury from falls and maintaining functional capacity

Falls prevention

Falls are a common cause of injury in older people and a major public health problem for New South Wales.[37] They result in significant levels of mortality, long term disability, loss of confidence and institutionalisation. Regular physical activity can favourably impact on three of the most important risk factors for falls injuries. These are balance, muscle strength[38,39,40] and osteoporosis.[41] Regular physical activity is associated with a 40% decreased risk of losing mobility for older people.[42] Research findings often derive from broad-based interventions that typically do not include assessment of the individual components. Therefore, it is currently not possible to determine exactly which type of physical activity is most beneficial.

The Frailty and Injuries: Cooperative Studies of Intervention Techniques (FICSIT)[43] meta-analysis involved exercise components that ranged from 10 to 36 weeks in duration. Both general exercise programs and those that included specific balance activities reduced the risk of falls. The Effective Health Care Systematic review[44] suggested that interventions including balancing exercise, strength training and low impact aerobic exercises were the most effective in reducing falls. A number of other studies[18,45,46] have shown major decreases in falls and in falls-related injury. Buchner's study[18] had participants (aged 65-85) follow one of three interventions; (i) endurance training on stationary cycles; (ii) resistance training on stationary weights; and (iii) a combination of the first two interventions. Each group exercised three times per week for 24-26 weeks. In Campbell's study[46] women aged 80 or over, followed a partially supervised home exercise program focussing on the lower limbs. A component combining strength training, balance and walking exercises three times per week was complemented with walking outside at least three times per week. The program was tailored to each participant. Chandler's[45] participants were aged over 64 years and followed a supervised 10 week lower limb resistive training exercise program.

A broad-based exercise program, tailored to the ability and preference of an individual, that includes balance training, resistance exercise, walking and weight transfer can decrease the risk of falls, whether participants have a history of falls or not.

Balance

Postural stability generally means that a person has little risk of losing balance while standing, or of falling while moving. Interventions that have shown convincing improvement in balance/ postural stability consisted of exercise programs, whether on land or water,[24,25,39,47, 48,49] or walking,[18,19,24,25] or a combination of both.[46] These programs were generally conducted over a period of three months, 2-3 times per week. Dropout rates ranged from 14%[48] to 20-25%.[47,49] Computerised balance training[50,51] did not seem to be effective, while Tai Chi programs reduced the fear of falling and improved balance.[50-52]

Flexibility

Flexibility may be defined as the range of motion of single or multiple joints, affected by ageing on bone, muscle, connective tissue. A flexibility training program may be defined as a planned, deliberate, and regular program of exercises intended to progressively increase the useable range of motion of joint/s. Most studies have approached flexibility training with programs that combined a variety of exercises mixed with stretching exercises, not one particular exercise type. No clear dose-response effects of exercise have been shown.

Significant improvements in flexibility have been demonstrated through (i) a yoga and flexibility group[17], (ii) supervised aerobic exercise class[31] and (iii) walking and upper and lower body weight training.[20] These interventions were all conducted over 4-8 months, 2-3 times per week. Importantly the McMurdo study[31] (over 8 months) had a dropout rate of less than 10%. Another study[53] using a range of motion stretching exercises over 8 weeks also reported improvements but those findings are inconclusive due to considerable biases in the study. Flexibility did improve for outpatients of a rheumatology clinic whether or not the home based exercises were supplemented with hydrotherapy.[54]

A range of exercises that include aerobic dance, weight training and stretching offer improvements in flexibility when conducted as part of a long term general exercise program. There is currently insufficient evidence to inform the design of a systematic, cost-effective program to improve flexibility for older people.

Strength and functional capacity

Regular physical activity contributes to a healthier, independent lifestyle, greatly improving the functional capacity and quality of life for older people. Loss of muscle mass is a function of ageing and appears to be more pronounced in women.[55] The decline is more marked in Type II fibres which are associated with speed or power activities and directly related to decreases in muscle strength.[56] Ageing results in a higher percentage of Type I fibres which are associated with endurance activities but this is likely to be the result of the reduction in Type II fibres. Loss of muscle mass has significant effects on functional capacity. One effect is increased risk of falls. Another is reduced walking capacity due to the correlation between muscle strength and preferred walking speed for both sexes.[57] Reduced leg power is associated with walking speed in frail older women. The evidence suggests that walking ability is critically dependent on muscle strength in institutional residents.[57]

Low intensity exercise results in modest increases in muscle strength.[58,59] Older people can achieve substantive gains in muscle strength through progressive resistance training (that is progressively increasing the load against which the person trains) in the same way as their younger counterparts.[60,61] Heavy resistance training confers benefits by improving nitrogen and therefore protein balance which is particularly important for older people with nutritional deficiencies.[62]

Strength training can also play an important role in weight control by increasing the resting metabolic rate, increasing energy requirements and decreasing body fat. However in population terms, heavy resistance exercise is limited as a strategy by its low prevalence (at most 13% of people aged 50-59, 11% of 60-69, 5% of people aged 70 plus reported high levels of energy expenditure).[63] This is defined as 1600 kcal/week including at least one hour of vigorous activity.

As with improving cardiovascular fitness, programs that improved muscle strength were medium-to-long term duration (minimum 12 weeks) of at least three sessions per week. Gains in muscle strength have been found in active,[31,64] moderately active[24,25,39,45,65-70] and sedentary[71-73] participants ranging from 60 to 90 years of age. The type of resistance training exercises varied, with use made of specialised equipment,[24,25,64,66,68,69,72,73] elasticised tubing,[65] home based training[45] and walking.[18,19,70] Six programs succeeded in achieving notably low dropout rates of 10% or less.[31,65,69,45,72,73]

Multiple functional gains for all physical activity subgroups of the elderly population can be achieved by increasing muscle mass through progressive resistance or strength training.

Healthy bones

Easily breakable bones, notably hip, wrist and vertebrae are more common in older people, particularly post-menopausal women. This is usually caused by weakening of their bones due to loss of minerals (osteoporosis). Whilst very few studies have shown a reduction in osteoporosis as a result of an exercise program, people who undertake regular outdoor activity have been shown to have a lower prevalence of hip fracture than those who do not.[74] Active people have been found to have higher bone density than the sedentary[75,76] and a sedentary lifestyle appears to increase the risk of hip fractures.[77,78,79] Positive effects on bone density with progressive resistance training in healthy post-menopausal women, as well as increasing muscle mass, dynamic balance and overall levels of physical activity have been documented.[80] All these factors add to a reduction of risk for osteoporotic fracture.

Chronic disease management

Exercise programs are of benefit in a number of chronic diseases including peripheral vascular disease and chronic lung disease, chronic arthritis and diabetes.[3] Appropriate supervised exercise does not appear to increase joint pain in chronic arthritis.[3]

Diabetes

Epidemiological studies, as reviewed in the USSG [6], strongly support a protective effect of physical activity against developing non-insulin-dependent diabetes mellitus across a range of ages and populations. Diabetes is associated with a two to three fold increase risk of cardiovascular disease in men and a four to five fold increase in women. A decrease in cardiovascular risk factors and plasma insulin levels as benefits from physical activity have been already discussed.[10-12,14,15] Obese diabetic individuals who participated in supervised physical training (bicycling, swimming, treadmill) for 6 weeks and 14 weeks unsupervised training showed improvements in cardiovascular fitness and lipid levels[81] but did not achieve changes to blood glucose control and insulin sensitivity.

Peripheral vascular disease

Treadmill training over 12 to 24 weeks has been shown to improve walking distance, claudication (pain on walking, limping) and biochemical markers.[82-84]

Chronic lung disease

Improvements in the distance walked and quality of life have been reported[85-89] though no strengthening of the respiratory muscles was found after walking, supervised treadmill and exercise reconditioning programs for 2-6 months, three times per week.

Chronic arthritis

While some studies[90-91] found no improvement in symptoms with exercise, neither was there worsening of pre-existing arthritic conditions found in these studies. Walking and home joint mobility exercises were most successful,[92,93] and including hydrotherapy apparently added little value.[92]

Direct benefits to peripheral vascular disease, chronic lung disease and chronic arthritis symptoms from physical activity have been found in addition to the general health improvement gained through physical activity. While for other conditions exercise was not specifically beneficial, older adults still gain health benefit from physical activity participation.

Physical activity for the frail and very old

Being frail and elderly need not exclude a person from participating in physical activity. On the contrary, exercise may be beneficial and evidence from clinical trials found no increase in the risk of injury while exercising. However, some modifications to exercise programs may be necessary to accommodate specific needs. Muscle weakness and atrophy (loss of size or mass of the muscle through underuse) are the most relevant issues to be considered in this group. Muscle mass increases after high intensity training, with little benefit from light regimens, as with younger adults. Gains in muscle strength result in improvements in many functional aspects of daily living. The most difficult prescription for the frail elderly is to respond to aerobic training (training to improve efficiency of aerobic energy-producing systems and which can improve cardiorespiratory endurance). It is emphasised that training to improve strength and balance is a prerequisite for aerobic training among the frail and very elderly.

Lower intensity exercise (eg walking) has been associated with modest improvements in cardiovascular fitness and mobility.[94,95]

Many studies already noted have been conducted in nursing homes or with the frail and very elderly[18-19,36,45,46,49,68-70,94-100] and have covered a wide range of exercise types. For the frail elderly, whether at home or in care, attention should first be given to the ability to get out of a chair (requiring muscle power) and maintaining an erect posture while moving (requiring balance). Exercise to first improve muscle strength, joint stability, and balance may significantly improve the tolerance to weight-bearing activity, such as walking. Therefore, aerobic training should follow strength and balance training; for progress to occur safely, training and supervision of participants (especially of the very frail) is essential.

The ACSM have recently made recommendations about the type and duration of exercise for the frail and very elderly.[5] Higher intensity strength training provides the most benefit for muscle mass through progressive resistance training of the major muscle groups of the upper and lower extremities and trunk. Regimens of two, preferably three days per week with 2-3 sets of each exercise were recommended and, if possible, free standing work with weights to improve balance and muscle coordination. The clinically relevant muscle groups are: hip extensors, knee extensors, ankle plantar flexors and dorsiflexors, biceps, triceps, shoulders, back extensors and abdominal muscles.

ACSM also specified that progressively more difficult postures that gradually reduce the base of support (one-legged stand), require dynamic movements that perturb the centre of gravity (tandem walk, circle turns), stress posturally important muscle groups, such as the dorsiflexors (heel stands), and reduce other sensory input (vision) should be attempted. At that point, moderate intensity aerobic training can begin, first by reaching a target frequency (at least three days per week), then duration (at least 20 min per session), and finally, appropriate intensity (40-60% of heart rate reserve, or 11-13 on the Borg scale [see glossary]). Walking intensity should be increased by adding hills, inclines, steps and stairs, pushing a weighted or occupied wheelchair, or adding arm and dance movements rather than increasing velocity or changing to jogging. Higher intensities are unlikely to be feasible in this population. Although walking is a preferred mode because of its direct functional nature, for some individuals only arm and leg ergometry, seated stepping machines, and water exercises may be possible because of a variety of disabilities, and these are suitable alternatives if available.

Most of the frail elderly live in environments and among caregivers for whom exercise is still an unfamiliar and perhaps frightening concept. There is a need to address the physical surroundings, recreational programming options, and staff training to instil appropriate physical activity in private homes, retirement villages and residential aged care facilities. By eliminating unnecessary barriers to optimal mobility and physical activity among the oldest adults, substantial health benefits may be realised both through the prevention of new disabilities as well as through the rehabilitation of chronic conditions.

Psychological functioning

Most research on physical activity has focused on the areas of cognitive function, depression and perceptions of self-control. These areas of psychological function are age dependent; both cognitive function and perceptions of self control tend to decline with age while depression tends to increase. There are methodological limitations to the current research. However, the general indicators are that physical activity does have beneficial effects on psychological functioning. Given the limitations, no firm conclusions are made here.

Self-efficacy (confidence in ones ability to do exercise) is important as a determinant in the adoption and adherence to cardiovascular rehabilitative exercise programs, for stair-climbing, lifting and carrying and in reducing the risk of falling.[101,102] Cognitive and self-efficacy changes have been investigated in a number of research studies with mixed results. Studies found that there were improvements after a variety of activities: exercise sessions[103], walking[20], bicycling[31,95,104,105] though one bicycling study[105] only showed improvement in perceived as opposed to objective measures. Improved well-being / self-efficacy/ quality of life have also been reported elsewhere.[85,86,92] The people in these studies had chronic arthritis,[85] or respiratory problems[86,92] and reported relief from musculoskeletal pain and the symptoms of dyspnoea (difficulty in breathing) respectively.

The majority of intervention studies on physical activity and depression suggest that exercise can have beneficial effects, even from the first session.[106] Studies have focused primarily on nondepressed individuals and have not addressed the underlying mechanisms or optimal exercise.[107] Two smaller studies have found a reduction in symptoms of depression after exercise.[108-110] One[108,109] used volunteers from the community who were suffering either major unipolar or minor depression and involved high intensity progressive resistance training three times per week over 10 weeks. The study found that sleep quality, strength and quality of life were improved. The other study[110] involved participants who were inpatients in a geriatric rehabilitation and psychogeriatric wards. The exercise program, done mainly while seated, was designed to improve large muscle movements, strength, coordination, balance and flexibility over an eight week period, three times per week.

Research has shown that physical activity and psychological functioning are related. Whether it is physical activity per se or the concomitant social contact that leads to improved psychological function remains unclear. Research to determine the underlying mechanisms, timecourse and physical activity dose-response relationships for psychological functioning in various populations is required to address this question.

Promoting physical activity

Since only 40% to 60% of people aged over 55 are considered adequately active[63] the potential health gains for older people through physical activity are considerable. The proportion of older people in the general population is growing significantly. In 1996,[111] 14.3 per cent of females were aged 65 and over, compared with 11.1 per cent of males. By 2021, the proportion of the population aged 65 years and over is projected to increase to 15.9 per cent for males and 18.7 per cent for females, with the ageing of the current "baby boomers". This is expected to result in a dramatic increase in demand for health and other social services.

Current recommendations have emphasised that vigorous intensity physical activity is no longer considered to be a necessity for health benefits.[6] The important health benefits associated with physical activity can be gained through activity of moderate-intensity - such as walking, swimming or gentle exercise. Recent evidence suggests that the most common physically demanding activities of older people - household work, walking and gardening have a role in maintaining muscle strength at the level required for independent living.[112] Moreover, this activity can be accumulated through bouts as short as 10 minutes (for example, walking to the shops or to get to or from places including public transport), towards the recommended total of 30 minutes or more on most days.[6]

Starting safely

Pre-exercise screening is not usually necessary for people wanting to commence gentle exercise such as walking, swimming or dancing. Pre-exercise screening or a screening questionnaire may be required prior to commencing gentle exercise classes. Screening is required for people with a significant health problem and for people with unstable or recent cardiovascular disease. Some medications can affect people's coordination, blood pressure and alertness while engaging in physical activity (as they do for driving). People should consult a doctor if they are unsure of the effect of their medication on their fitness for physical activity. They should also consult a doctor if they get any symptoms such as dizziness, light headedness or pain when they engage in physical activity. Men over 40 and women over 50 should obtain advice from a doctor before starting any vigorous activity (eg jogging, vigorous dancing, tennis or cycling).

Pre-conditioning exercises should be prescribed for older people wanting to begin or resume sporting activities such as tennis or golf, particularly after a period of non-involvement. In addition, people undertaking vigorous exercise should be shown how to avoid muscle strain. Stretching, warming up and cooling down for older adults should be longer and more gradual allowing double the time of younger adults. Properly initiated (ie gradual increase in duration and intensity) and appropriately supervised physical activity should minimise the chances of injury in the elderly.

For frail and very old participants supervision is essential. The use of assistive devices increases safety as well as the energy costs of an activity, and there is little benefit to attempt to exercise without them.

Environmental factors such as safe footpaths and parks, well-lit public walkways and cycle routes, the provision of road and bicycle safety programs may need to be considered when advising/ encouraging older people to participate in physical activity.

Contraindications

The same contraindications to training apply as for the general adult population[5]:

- absolute contraindications are recent electrocardiograph changes or myocardial infarction, unstable angina, acute congestive heart failure, third degree heart block and uncontrolled arrhythmia;
- relative contraindications are elevated blood pressure, cardiomyopathies, valvular heart disease, complex ventricular ectopy and uncontrolled metabolic diseases.

It is emphasised that both types of contraindications are more prevalent in older people who also are more likely to have comorbidities such as diabetes, hypertension and obesity.

Frailty or advanced age is not per se a contraindication to physical activity participation. However, several conditions warrant investigation before exercise is begun and temporary avoidance of certain types of activity is required, for example during the treatment of hernias, cataracts, retinal bleeding or joint injuries. While serious conditions necessitate permanent exclusion from vigorous exercise, the presence of a number of chronic diseases are not by themselves contraindications to exercise. Some conditions make the usual recommendation of walking for aerobic fitness difficult, or even impossible for the frail elderly; examples include: severe gait disorders, arthritis, dementia, cardiovascular disease, podiatric and orthopaedic problems, visual impairment, and incontinence.

There are several physical activities that inactive older people should avoid to minimise injuries.
These include:

- Exercises that unnecessarily strain the shoulders eg swimming with hand paddles; push-ups and chinups;
- Jogging on hard surfaces;
- High impact sports involving jumping, and
- Sports requiring sudden jerky movements eg squash, basketball, netball.

Conclusion

This special communication complements the previous communication by the NSW Chief Health Officer on physical activity and health. That statement recommended that every adult in New South Wales should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week. This is a general recommendation for all adults but there is emerging evidence that participation in regular exercise among older adults results in similar health benefits. This communication emphasises the more specific effects of prescribed physical activity on particular conditions or its effectiveness in slowing the reduction in bodily functioning associated with ageing.

As with younger adults, physical activity needs to be regular and consistently maintained over time, regardless of which bodily, physiological, psychological or other health gains are desired. Walking is usually the easiest and certainly the most popular way to accumulate the required amount of physical activity. It is a natural part of the daily routine, is a sign of independence and does not require costly outlay to begin. When walking is not a feasible activity people should consider seated exercises or strength and balance training.

Endurance exercise can maintain and improve cardiovascular function. Importantly, it can lead to reductions in risk factors associated with disease states (for example, heart disease and diabetes) and improve health status. Strength training helps offset the loss in muscle mass and strength associated with normal ageing. Additional benefits include improved bone health and, thus, reduction in risk for osteoporosis; reduction in the risk of falling; and increased flexibility and range of motion. Compared to sedentary adults those older adults who maintain an active lifestyle have daily functioning comparable with people aged 15 years younger. Regular physical activity contributes to a healthier, independent lifestyle, greatly improving the functional capacity and quality of life for older people.

Regular exercise may also contribute to a number of psychological benefits related to cognitive function, alleviation of depressive symptoms, and an improved concept of personal control.

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Glossary

AEROBIC TRAINING
Improvement in efficiency of aerobic energy-producing systems and can improve cardiorespiratory endurance

BORG SCALE
A numerical scale (range 6-20) for rating perceived exertion from very, very easy to very, very hard.

CARDIORESPIRATORY FITNESS
Ability of the circulatory and respiratory systems to supply oxygen during sustained physical activity or the proportion of a person's maximal oxygen uptake at which blood lactate level begins to rise.

EXERCISE
Exercise is planned, structured and repetitive bodily movement which is done to improve or maintain one or more components of physical fitness. Exercise is a subset of physical activity.

ENDURANCE ACTIVITY
Repetitive, aerobic use of large muscles (eg walking, bicycling, swimming)

MAXIMAL OXYGEN UPTAKE (VO_2 max)
The maximal capacity for oxygen consumption by the body during maximal exertion. Also known as aerobic power, maximal oxygen consumption, and cardiorespiratory endurance capacity.

PHYSICAL ACTIVITY
Physical activity is any bodily movement produced by skeletal muscles, that results in energy expenditure

POWER
The product of force and velocity

PRESCRIBED PHYSICAL ACTIVITY
Not self-generated physical activity by the participant but initiated as an arm of the intervention

PROGRESSIVE RESISTANCE TRAINING
Progressively increasing the load against which the person exercises.

STRENGTH
The ability of a muscle to exert force.

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